Challenges of PISA:
The PNU Report

The National Center for Teacher Education

In partnership with

Rex Institute for Student Excellence

Challenges of PISA: The PNU Report

Published and exclusively distributed by the
PHILIPPINE NORMAL UNIVERSITY
Taft Avenue, Manila

Printed by the PNU Press

ISBN: 978-971-568-069-1

For citation, please cite the chapter authors, the editors, and the publishers:

Romero, A.D. & Papango. M.C. (2020). PISA Reading Literacy vis-à-vis Kto12 English Curriculum. In M.U. Balagtas & MA. C. Montealegre (Eds), *Challenges of PISA: The PNU Report* (pp.33-56). Philippine Normal University and Rex Institute for Student Excellence, Inc.

Golla, E.F. & Reyes, A.G. (2020). PISA Mathematics Literacy Framework vis-à-vis the Kto12 Mathematics Curriculum. In M.U. Balagtas & MA. C. Montealegre (Eds), *Challenges of PISA: The PNU Report* (pp.57-100). Philippine Normal University and Rex Institute for Student Excellence, Inc.

Belmi, R.M. & Mangali, G.R. (2020). PISA Scientific Literacy Framework vis-à-vis the Kto12 Science Curriculum. In M.U. Balagtas & MA. C. Montealegre (Eds), *Challenges of PISA: The PNU Report* (pp.101-141). Philippine Normal University and Rex Institute for Student Excellence, Inc.

Hibanada, R.R., Dellomos, C.O., & Romero, R.C. (2020). PISA Global Competence Framework vis-à-vis the Kto12 Social Studies and Values Education Curricula. In M.U. Balagtas & MA. C. Montealegre (Eds), *Challenges of PISA: The PNU Report* (pp.142-193). Philippine Normal University and Rex Institute for Student Excellence, Inc.

Rungduin, T.T. & Papango. M.C. (2020). PISA Creative Thinking Framework vis-à-vis the Kto12 Communication Arts English and Arts Curricula. In M.U. Balagtas & MA. C. Montealegre (Eds), *Challenges of PISA: The PNU Report* (pp.194-227). Philippine Normal University and Rex Institute for Student Excellence, Inc.

Yeban, F.I. & Florendo, J.A. (2020). PISA Financial Literacy Framework vis-à-vis the Kto12 Mathematics and Social Studies Curricula. In M.U. Balagtas & MA. C. Montealegre (Eds), *Challenges of PISA: The PNU Report* (pp.228-261). Philippine Normal University and Rex Institute for Student Excellence, Inc.

David, A.P. & Reyes, W.S. (2020). PISA Collaborative Problem Solving Framework vis-à-vis the Kto12 Mathematics, Social Studies and Values Education Curricula. In M.U. Balagtas & MA. C. Montealegre (Eds), *Challenges of PISA: The PNU Report* (pp.262-288). Philippine Normal University and Rex Institute for Student Excellence, Inc.

CHALLENGES OF PISA:

THE PNU REPORT

Marilyn U. Balagtas
Lead Researcher

Ma. Antoinette C. Montealegre
Editor

Published by the Philippine Normal University Press
Taft Avenue, Manila, 1000
Philippines
October 2020

Dedication

This report is dedicated to Filipino learners who are envisioned to be globally competitive and holistically developed citizens possessing 21st century skills. It is hoped that the results of this study on the analysis of the framework of the Program for International Student Assessment (PISA) vis-a-vis the Philippine Kto12 curriculum could help explain the below par performance of our Filipino students in PISA 2018 so that relevant and appropriate adjustments could be made in the basic education curriculum to meet international benchmarks. May this report of the Philippine Normal University, the National Center for Teacher Education (NCTE), with generous support from the Rex Institute for Student Excellence, Inc. (RISE), be of value to the Department of Education as the key agency that leads the reform in improving the quality of basic education in the country.

Preface

To support the call to further improve the Kto12 Curriculum in its goal to make the Filipino learners globally competitive equipped with 21st century skills, this report attempts to offer valuable research data and insights to all stakeholders, specifically to the Department of Education in its efforts to enhance the Basic Education Program in the country. As a strategic move towards this goal, the Philippines has committed to participate in international large-scale assessments to gather indicators to measure the effectiveness of the Enhanced Basic Education Program enacted through Republic Act No. 10533 in 2013. One such large scale assessment is the Trends in International Mathematics and Science Study (TIMSS) where students' knowledge and skills in mathematics and science are assessed. Most recently the Philippines joined for the first time the computer-based triennial Program for International Student Assessment or PISA in 2018 which involved 15-year-old learners randomly selected from those in the public and private schools from across the 17 regions in the Philippines. The major areas included in the assessment are Mathematics Literacy, Scientific Literacy, Reading Literacy, and an innovative area on Global Competence that calls for integration of skills across subject areas, e. g. Social Studies and Values Education.

The PISA results released in December 2019 showed an unimpressive performance of the Philippines vis-a-vis that of the other participating countries. The results have raised concerns from the different sectors of the society on the quality of basic education in the country in the midst of the government's efforts to make it free and accessible to all Filipino learners from kindergarten to tertiary level. As the PISA results call not only for access, but for quality of education as well, DepEd launched its

Sulong Edukalidad Program in 2019 which sets areas for reform to address the need to improve the quality of basic education in the country at the same time calling on its stakeholders to help in achieving a common goal to develop excellent Filipino learners.

As one of the stakeholders, the Philippine Normal University (PNU), whose mandate as the National Center for Teacher Education (NCTE) in the country is to provide evidence-based technical advice on education in crafting policies and programs to DepEd and to Congress, has taken the initiative to contribute to this noteworthy endeavor of DepEd for the improvement of the quality of education in the country.

This PISA study was initiated and spearheaded by the College of Flexible Learning and ePNU under Dr. Marilyn U. Balagtas, former Dean of the College. A number of PNU faculty and retired PNU faculty who are experts in the different subject areas together with some invited faculty from the University of the Philippines and Colegio de San Juan de Letran, and with sponsorship from the Rex Institute for Student Excellence, Inc. (RISE) composed the team tasked to study and analyze the Kto12 curriculum vis-a-vis the PISA framework to provide a more informed advice to DepEd. The present study aimed to examine the alignment of the PISA framework for the three major areas (i.e. Reading Literacy, Mathematics Literacy, and Scientific Literacy) and four innovative assessment areas (i.e. Global Competence, Creative Thinking, Financial Literacy, and Collaborative Problem Solving) with the corresponding subject areas in the Kto12 Curriculum.

The seven different areas in PISA that were examined reveal that there are gaps in the basic education curriculum that need to be looked into if we truly wish to produce Filipino graduates with skills and knowledge that will make them globally prepared and competitive. Hopefully the results of the study will not only be useful to DepEd in its review of the curriculum and enhancement

of education resources, but also to the Commission on Higher Education (CHED) particularly to the Teacher Education Institutions (TEIs) in the country to also examine areas for reform in teacher education.

This report is just an initial response of PNU to the challenges of PISA as it continues to look for more areas needing reform specifically in teacher education and in education in general as the NCTE.

Ma. Antoinette C. Montealegre, D.A.
Editor

Table of Contents

Acknowledgments

This report would not have been possible without the following people who gave their best effort to provide their concrete contributions and showed their commitment to help improve the quality of basic education in the country.

The President of the Philippine Normal University, Dr. Bert J. Tuga, and the former Vice President for Academics and Officer-in-Charge of the Office of the President, Dr. Ma. Antoinette C. Montealegre, for approving the conduct of this study participated in by a group of faculty experts who are current and retired faculty of the Philippine Normal University and some faculty experts from the University of the Philippines and Colegio De San Juan De Letran.

The PNU Vice President for Academics, Dr. Jennie V. Jocson and the PNU Vice President for Planning, Research and Quality Assurance, Dr. Ronald Allan Mabunga for the advice and support that they have extended to the team of researchers.

The officials of Rex Institute for Student Excellence, Inc. (RISE) headed by its President and Chairman, Atty. Dominador D. Buhain; its Chief Executive Officer, Mr. Don Timothy Buhain; its Chief External Affairs Officer, Ms. Danda Crimelda Buhain-Garcia; its Marketing Director, Ms. Jeanne Marie Y. Fontelera-Tordesillas; and its General Manager, Mr. Dexter Cheng Ngo, for their kindness and generosity in providing the faculty researchers accommodation, meals and financial support at the time the project was conceived and started.

The blind referees, for patiently reviewing the work of the writers and gave invaluable input and advice on how to improve their study, namely: Dr. Felicitas Pado, Dr. Heidi Macahilig, Dr. Gladys Nivera, Dr. Bill Atweh, Dr. Merle Tan, Dr. Marie Paz Morales, Dr. Richard Gonzales, Dr. Rita Ruscoe, Dr. Ma. Antoinette C. Montealegre, Dr. Alice Panares, Dr. Flordeliza Anastacio, Atty. Antonio Ferrer, Dr. Violeta Valladolid, and Dr. Ronald Allan Mabunga.

Sincere appreciation is also extended to the following people who generously gave up their Christmas break and weekends to complete the report, namely:

Dr. Angelita Romero, Dr. Mila Arias, and Prof. Marla Papango, from PNU, for analyzing the gaps in the Grades 7 to 10 Communication Arts in English curriculum vis-a-vis the competencies in Reading Literacy, a core area in PISA.

Dr. Evangeline Golla and Dr. Allan Reyes, both from PNU, for their careful analysis of the gaps in the Grades 7 to 10 Mathematics Curriculum vis-à-vis the PISA mathematics literacy, a core area in PISA.

Dr. Rosario Belmi, the former Deputy Dean of the College of Flexible Learning and ePNU, and Dr. Glen Mangali from Colegio de San Juan de Letran, for their careful analysis of the gaps in the Grades 7 to 10 Science Curriculum with reference to the PISA scientific literacy, a core area in PISA.

Dr. Rowena Hibanada, Prof. Carl Dellomos, and Prof. Rene Romero, from PNU, for their analysis of the gaps in the Grades 7 to 10 Araling Panlipunan/Social Studies and EsP/Values Education curricula vis-à-vis the indicators of Global Competence, an innovative assessment area in PISA.

Dr. Teresita Rungduin and Prof. Marla Papango, both from PNU, for their analysis of the gaps in the Grades 7 to 10 Communications Arts English and Art curricula vis-à-vis the competencies in Creative Thinking, another innovative assessment area in PISA.

Dr. Feliece Yeban of PNU and Prof. Joselito Florendo of the University of the Philippines for examining the gaps in the Grades 7 to 10 Mathematics and Araling Panlipunan curricula vis-à-vis the indicators of Financial Literacy, another innovative assessment area in PISA.

Dr. Adonis David and Dr. Wilma Reyes, both from PNU, for examining the gaps in the Mathematics, Values Education and Araling Panlipunan curricula for Grades 7 to 10 vis-à-vis the indicators of Collaborative Problem Solving, also an innovative assessment area in PISA.

All the staff of REX Book Store, Inc. (RBSI), REX Institute for Student Excellence, Inc. (RISE), and the Resource for Educators and Academic Professionals (REAP) Center, for providing the much needed materials, references and accommodation to all the researchers during the writeshops for curriculum mapping and report writing.

The staff of PNU, namely: Mars Majul, Romeo Reginio and Darrel Lariosa who assisted the lead researcher in putting together the manuscripts packed into one report.

Finally, to Dr. Ester B. Ogena, the former President of the Philippine Normal University, for her expert advice, support and guidance during the conceptualization of this project.

Marilyn Ubiña-Balagtas, Ph.D.
Lead Researcher

About the Lead Researcher and the Editor

Dr. Marilyn U. Balagtas, the lead researcher, holds the rank of University Professor at the Philippine Normal University. She is currently the President of the Philippine Educational Measurement and Evaluation Association (PEMEA), Inc. and the former President of the Philippine Association for Teachers of Educational Foundations (PATEF)-United Professionals for the Development and Advancement of Teacher Education (UPDATE). She is a recipient of a Post-Doctoral Fellowship for Research Leadership awarded by the University of New England, Australia, being the Inaugural Director of the Philippine National Research Center for Teacher Quality (RCTQ) that developed the Philippine Professional Standards for Teachers (PPST). She earned her doctorate degree in Educational Research and Evaluation from the University of the Philippines.

Dr. Ma. Antoinette C. Montealegre, the editor, served as the Officer-In-Charge, Office of the President and as Vice President for Academics of the Philippine Normal University. Previously she was the Dean of the College of Teacher Development, Dean of the College of Languages, Linguistics, and Literature, and the Head of the Department of Linguistics, Bilingual Education and Literature. She earned her Doctor of Arts (D.A.) in Language and Literature degree from the De La Salle University (DLSU) graduating with High Distinction. Through a scholarship from the US-RP Faculty Development Program, she finished her Master of Arts in Language and Literature degree also from DLSU. She earned her Bachelor in Secondary Education degree major in English from the Philippine Normal University, graduating as magna cum laude. She is a recipient of the Alice Hollister Marcquardt Professorial Chair in English and the Bonifacio P. Sibayan Professorial Chair in Applied Linguistics awarded by the Linguistic Society of the Philippines (LSP).

Executive Summary

Analysis of the PISA Framework vis-à-vis the Philippine Kto12 Curriculum

Marilyn U. Balagtas
Philippine Normal University, Manila

INTRODUCTION

When the PISA (Program for International Student Assessment) 2018 results came out in December 2019, those in the education sector, if not the whole nation, were in a state of shock upon learning of the disappointing performance of the Philippines as it placed last among 79 participating countries in reading literacy and 2nd from the bottom in mathematics and scientific literacy. The results for the Philippines reveal in broad terms that there is a problem plaguing the basic education program of the country. Our students evidently are not at par with their counterparts in the participating countries. Where lies the missing link in our educational system? What brought about these very telling results about our Filipino learners?

In the first place, the Department of Education (DepEd) must be commended for the brave initiative to join PISA and to take a hard look at the ability and skills of Filipino basic education learners. To participate in PISA means putting under scrutiny the basic education curriculum given that PISA is an international large scale assessment (ILSA) administered to 15-year-old

learners by the Organization for the Economic Co-operation and Development (OECD) every three years (OECD, 2019a,p.11). It assesses the extent to which learners have acquired key knowledge and skills essential for full participation in social and economic life. It examines how well the students can extrapolate from what they have learned and apply their knowledge in unfamiliar settings, both in and outside of school (OECD, 2019a, p.11).

Over the past two decades, PISA has become the world's premier yardstick for evaluating the quality, equity, and efficiency of school systems and an influential force for education reforms (Scheicher, 2019, p.4). It is given in two modalities - paper or computer-based. It started in 2000 with three major areas assessed in every cycle such as mathematics literacy, scientific literacy, and reading literacy. One of these three areas is highlighted every cycle by having 25% more items than the other two areas assessed. Then an innovative assessment area is introduced every cycle to include areas on 21st century themes or skills like creative thinking, collaborative problem solving, financial literacy, and global competence. The assessment also includes administering a survey to students, school principals, teachers and even parents to determine some contextual factors that could possibly explain the results of the assessment.

In 2018, PISA focused on Reading Literacy as its major area and Global Competence as its innovative area, while Financial Literacy is an optional area. For the first time the Philippines participated in PISA 2018 to gather indicators of the effectiveness of the Kto12 reform (DepEd, 2019). It is the first ILSA that the Philippines has participated in after the implementation of the Kto12 Program. In System Assessment Policy of DepEd (i.e. DepEd Order No. 29, s. 2017), PISA has been targeted as one of the ILSAs that the country will participate in to gather indicators

of the effectiveness of the Enhanced Basic Education Program implemented in 2013. It is an assessment given to sampled 15-year old Filipino students who are in junior and senior high school both from the public and private schools across the 17 regions in the country (DepEd, 2019).

According to the DepEd 2019 report, the PISA 2018 Philippine results reveal that the 15-year old senior high school students tested performed significantly better than the junior high school students. Moreover, the students in the private schools performed significantly better than those in the public schools. Those who were tested from the National Capital Region (NCR) performed significantly better than those in the other regions. Since the test administered to the Filipino students was computer-based and in English, it appears that the 15-year old students exposed to more curriculum areas like those in senior high school (SHS) performed better than those in the junior high school. Theoretically, these SHS students sampled were assumed to have been given more content of the Kto12 curriculum and more familiar with Information and Communications Technology (ICT) like those in the private schools and in NCR than their counterparts in the public schools and other regions in the country.

The PISA results concur with the outcome of the National Achievement Tests (NAT) which target students' mastery of what they learned by answering correctly at least 75% of the items in the test. The NAT results reveal that the majority of our students have mastered less than 50% of what they ought to learn in the Kto12 Curriculum (DepEd, 2019).

DepEd has reported as well that the country has made huge gains in improving access to basic education. Twenty-seven million Filipino children and youth are in school from Kindergarten to Grade 12. Since the introduction of the Kto12 program, a

significant number of drop-outs have returned to school (DepEd, 2019). However, while more Filipino children now have access to basic education, their access to quality learning as revealed by the PISA and NAT results is still in question. The global health pandemic even added to the concern for access to quality education.

Hence, on the same day when PISA results were released, DepEd launched its program *Sulong EduKalidad* as its intervention program to raise the quality of basic education in the country. Under this *Sulong EduKalidad Program* are four clusters of intervention programs known as KITE where K stands for the K to 12 Curriculum Review and Update, I is for the Improvement of the Learning Environment, T is for Teacher Upskilling and Re-skilling, and E is for the Engagement of Stakeholders (DepEd, 2019). It is hoped that intervention programs will be developed to improve the quality of basic education in the country as informed by assessment results and hopefully before the Philippines participates again in PISA 2021.

STATEMENT OF PURPOSE

With the desire to understand and explain the possible root of the poor performance of the 15-year old learners in the PISA 2018 and to contribute in informing needed improvement in the Kto12 curriculum, a team of educators was invited to analyze the alignment of the assessment framework of the different components of PISA vis-à-vis selected subject areas in the Philippine Kto12 Curriculum with the generous support and funding from the Rex Institute for Student Excellence, Inc. (RISE). Considering that PISA is given to 15-year old learners (with ages that range from 15 years and three months to 16 years and two months) who are expected to have been exposed to at least 6

years of formal education or are exiting junior high school, this group of educators mapped the content and competencies assessed in PISA with identified subject areas from the Kto12 curriculum for Grades 7 to 10 where the same are assumed to have been strongly developed.

The study intended to determine the extent of the alignment of the PISA content domains and competencies with the curriculum content domains and competencies of the selected subject areas in the Kto12 Curriculum (See Figure 1). It was assumed that identifying gaps between the PISA Framework and the Philippine Kto12 Curriculum could possibly explain the disappointing performance in PISA, and that those gaps should be addressed in updating and/or revising the current basic education curriculum to prepare our Filipino learners to be globally competitive.

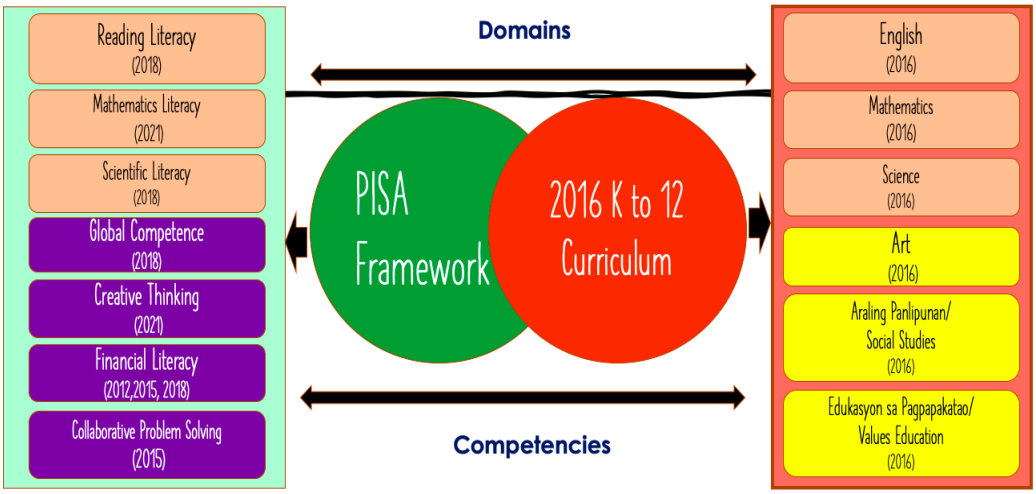
In particular, the study aimed to examine the alignment of the PISA framework in three major literacy areas (reading, mathematics and science) and in four innovative areas (global competence, creative thinking, financial literacy, and collaborative problem solving) with identified appropriate subject areas in the Kto12 Curriculum as possible input to: 1) understanding the preparedness and results of the Philippines' participation in PISA; 2) identifying indicators of the effectiveness of the Kto12 Program in making the Filipino learners globally competitive; 3) updating of the curriculum and learning resources; and 4) reskilling and upskilling of teachers.

METHODOLOGY

In this report, seven areas in PISA were analysed. Three are major assessment areas - reading literacy, mathematics literacy, and scientific literacy; and four are innovative assessment areas - creative thinking, collaborative problem solving, financial literacy, and global competence. The analysis of these areas focused on the PISA Framework in the most recent year available in the OECD website and the 2016 Philippine Kto12 Curriculum documents available in the DepEd website. Figure 1 shows the parameter of the study.

Figure 1

Assessment and Curriculum Review Parameter



As shown in Figure 1, seven literacy areas in PISA were examined to see if the content domains and competencies assessed are covered in the Kto12 Curriculum. Literacy is defined as the students' capacity to apply their knowledge and skills in key areas, and to analyze, reason and communicate effectively as they

identify, interpret and solve problems in a variety of situations (OECD, 2019, p.13). These seven literacy areas in PISA were examined in six subject areas in the Kto12 Curriculum where they are most likely addressed. The three major PISA literacy areas were mapped with individual subject areas in the Kto12 curriculum, while the four innovative areas were mapped in two to three areas to determine the extent of their integration and development across disciplines.

The study made use of document analysis, content analysis, and heat mapping of the latest PISA competencies juxtaposed with the Kto12 Curriculum. Bowen (2009) as cited in Balagtas, Garcia and Ngo (2019, p.4), explains that document analysis examines the functions of documents as a data source. In this study, the latest documents of the PISA Frameworks were examined for the seven areas investigated. The 2021 PISA Framework was examined for Mathematics Literacy and Creative Thinking. The 2018 PISA Framework was examined for Reading Literacy, Scientific Literacy, and Global Competence. The 2012, 2015 and 2018 PISA frameworks were examined for Financial Literacy. The 2015 PISA Framework was examined for Collaborative Problem Solving. Then the 2016 Curriculum Guides in Grades 7 to 10 were examined for the six selected areas in the Kto12 Curriculum. Table 1 shows the summary of the documents examined in this study.

Table 1

Subject Areas in the K to 12 Curriculum Mapped with PISA Areas

PISA Areas	Subject Areas in 2016 Kto12 Curriculum
2018 Reading Literacy	English
2018 Scientific Literacy	Science
2021 Mathematics Literacy	Mathematics
2018 Global Competence	Edukasyon sa Pagpapakatao (ESP) and Araling Panlipunan (AP)
2021 Creative Thinking	English and Art
2012, 2015 and 2018 Financial Literacy	AP and Mathematics
2015 Collaborative Problem Solving	Mathematics, AP, and ESP

Content analysis was done on the documents as the content domains and competencies in each of the seven areas in PISA were identified by the subject area analysts. These subject area analysts were purposively selected based on five criteria set: 1) they are known to be a specialist in the subject area they are analysing; 2) they have done research or publication in the same area they will analyze; 3) they are at least in their dissertation writing at the time of their involvement; 4) they are familiar with the Kto12 Curriculum; and 5) they commit to help in this study and deliver the report within the time set.

The analysts per area in PISA were the ones who identified the content domains and competencies tested with reference to the OECD Framework of the assessment available online. They also did the heat mapping on the documents analyzed. Heat mapping, a process of using colors to visually represent the degree of alignment, was used to analyze the PISA content domains and competencies with their counterparts in the selected areas in the Kto12 Curriculum.

Three colors were used in mapping the content domains and competencies of PISA with those in the Kto12 curriculum. Green

was used to mark the competencies in the Kto12 that were explicitly aligned with PISA content and competencies. A competency in the Kto12 Curriculum for Grades 7 to 10 is deemed explicit if it is reflective of the language of PISA. Yellow for those that were implicitly aligned. In this regard, a competency is considered implicitly aligned if a content or competency in PISA is captured albeit partially by a content or competency in the curriculum based on the professional judgement and inference of the expert. Lastly, Red was used to mark the content or competency in PISA that was not mapped with any content or competency in the curriculum guide of the subject areas examined, and this is regarded as a gap. A gap refers to a PISA content or competency that is neither explicitly nor implicitly aligned with any content or competency in the curriculum. The analysts per PISA area did their independent heat mapping of the content and competencies in the documents they analyzed. Then they met and compared their respective analysis and reconciled their differences. Such process of comparing the independent analyses made by the analysts is called *inter-analyses* in this study.

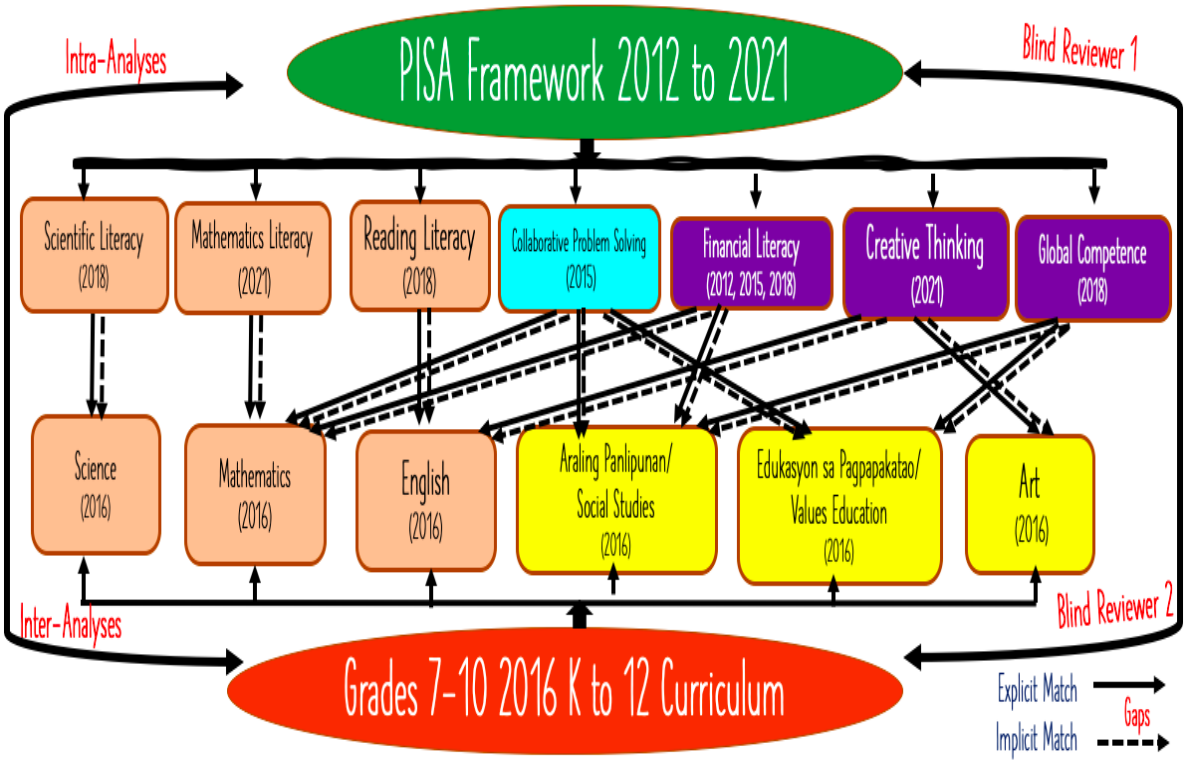
After the heat mapping, the content analysts proceeded to report writing. A report for each area in PISA was written by the subject area analysts. Seven reports were then written for the seven areas in PISA that were analysed (See Chapters 1 to 7). Every report was subjected to a review of two blind referees who were selected based on their national or international exposure and reputation in educational assessment and research. The two referees per PISA area analyzed were invited to do an independent review of the report based on a given set of criteria. After the blind reviews, the referees' comments were forwarded to the report writers. The referees' comments triggered another round of review on the heat mapping done by the analysts. The analysts did another round of individual mapping of the content and

competencies to ensure correct analysis of data for the needed revisions in their paper. This led to an *intra-analyses* as every analyst had done the heat mapping twice in two different periods to ensure the accuracy of the data for analysis.

As shown in *Figure 2*, *intra-analyses* and *inter-analyses* were done to establish the validity and reliability of the data. Recommendations for curriculum updating, learning resource enhancement, teacher upskilling/reskilling, and stakeholders' engagement were provided to address the identified gaps.

Figure 2

Assessment and Curriculum Review Methodology



SUMMARY OF RESULTS

The results of the content analysis of the seven areas in PISA vis-à-vis the Kto12 Curriculum are summarized in this section, but they are discussed in detail in Chapters 1 to 7.

Reading Literacy. The first PISA area presented in this report is the analysis on Reading Literacy (See Chapter 1). In OECD, reading literacy is defined as a student's capacity in understanding, using, evaluating, reflecting on and engaging with texts in order to achieve one's goals, to develop one's knowledge and potential, and to participate in society (OECD, 2019a, p.14). The two authors, Angelita Romero and Marla Papango, who are reading and language specialists, respectively, from the Philippine Normal University (PNU), reported the degree of alignment of the reading competencies in PISA 2018 with those in the Kto12 Curriculum for Communication Arts English in Grades 7 to 10. Based on their report (see Chapter 1), the competencies in reading comprehension in the English Curriculum reflect 100% alignment in terms of text processing skills of *locating, understanding*, *reflecting*, and *evaluating* in PISA. However, literacy behaviors in digital and non-digital environments are not explicitly reflected in the curriculum, but these are considered in PISA when teaching text processing in relation to source of information. PISA emphasizes interaction of reader, text and task in influencing learner's performance, which is not clearly articulated in the curriculum document.

Mathematics Literacy. The second PISA area presented in this report is the analysis on Mathematics Literacy (see Chapter 2). The PISA 2021 Framework defines mathematics literacy as students' capacity to do both deductive and inductive

mathematical reasoning and problem solving by applying mathematical content and 21st century skills in a variety of contexts (OECD, 2019a, p.14). It includes *reasoning mathematically* and *using mathematical concepts, procedures, facts and tools* to describe, explain and predict phenomena. The two authors in Chapter 2, Evangeline Golla and Allan Reyes, mathematics specialists from PNU, reported the degree of alignment of the mathematics competencies in PISA with those in the Kto12 Mathematics Curriculum for Grades 7 to 10. The comparison of the PISA Mathematics Framework with the Kto12 Mathematics Framework showed that both frameworks address many of the same aspects of mathematics indicating that overall there is a high degree of alignment of the two frameworks on content, but the degree of alignment varies across PISA content topics. On mathematical processes of *problem solving and reasoning*, the results show that the Kto12 Mathematics Curriculum has very minimal explicit coverage for the highest level of mathematical processes and mathematical reasoning. This indicates that the Kto12 Mathematics Curriculum does not emphasize well the *contextualization of the mathematical results to real life problems* that require students to reason at a higher level, to interpret, and to evaluate. The *Context* domain was viewed differently in the PISA Mathematics Framework and in the Kto12 Mathematics Curriculum Framework. PISA relates context to aspects of life – personal, occupational, societal, and scientific. These aspects are reflected on the content topics and more specific activities in PISA. In the Kto12 Mathematics Curriculum, *Context* factors include *beliefs*, *environment*, *language*, *culture*, and *learner's prior experience*, but all these were not defined nor embedded in the content and problem solving processes. On observed gaps in the Kto12 Mathematics Curriculum relative to the PISA Mathematics Framework, the widest gap observed was on *Content - Quantity*, followed by *Uncertainty and Data*, and *Space and Shape*. Since PISA considers equal emphasis on

Change and Relationships, Space and Shape, Uncertainty and Data, and Quantity, the results imply that students more likely will experience difficulties on assessment items related to the last three content areas on assessment items related to *growth phenomena*. In the *Process* domain, gaps in the Kto12 Mathematics Curriculum were observed on the *higher level of reasoning processes* and in *Interpreting* and *Evaluating*.

Scientific Literacy. The third PISA area presented in this report is the analysis on Scientific Literacy (see Chapter 3). The two authors, Rosario Belmi of PNU and Glen Mangali of Colegio de San Juan de Letran, who earned their doctorate degree in science education in PNU, reported the extent of alignment of the scientific competencies in PISA with the Kto12 Science Curriculum for Grades 7 to 10. Science literacy is defined as the ability to engage with science-related issues, and with the ideas of science, as a reflective citizen. A scientifically literate person is willing to engage in reasoned discourse about science and technology, which requires the competencies to explain phenomena scientifically, evaluate and design scientific enquiry, and interpret data and evidence scientifically (OECD, 2019a, p.15). The results of the analysis revealed that there is a high degree of alignment of the Kto12 Science Curriculum with the 2018 PISA Scientific Literacy Assessment Framework in terms of the following content domains: content knowledge, procedural knowledge and epistemic knowledge; scientific literacy competencies; and levels of cognitive demand. The gap in the Kto12 Science Curriculum based on the 2018 PISA Scientific Literacy Assessment Framework is its lack of explicit inclusion of topics in *Earth and Space Systems*. The distribution of content topics is not proportionately and appropriately spread across grade levels. Moreover, the learning competencies are not proportionately and appropriately distributed across grade levels in terms of cognitive demand as

there is a high concentration of learning competencies that involve tasks of low-level cognitive demand.

Global Competence. The fourth PISA area presented in this report is the analysis on Global Competence (see Chapter 4). The three authors from PNU, Rowena Hibanada, Carl Dellomos and Rene Romero, recognized advocates of global citizenship, reported the degree of alignment of the global competencies in PISA with the Kto12 Curriculum in Social Studies and Values Education for Grades 7 to 10. Global Competence is defined as the combination of four dimensions - *examining issues*, *understanding perspectives*, *interacting*, and *acting*; each of which necessitates a combination of knowledge, skills, attitudes, and values (OECD, 2019a, p.166). The PISA 2018 Global Competence Framework provides data about education systems around the world in terms of how the youth are prepared to understand their communities and the global realities around them, how they are trained to respond to global issues, how they are guided to interact respectfully with others, and how they are taught to collaborate in taking appropriate and relevant action towards creating a more equitable, conflict-free and sustainable communities. Based on the study of Hibanada, Dellomos and Romero (2020), global competencies are integrated and stated explicitly in the Kto12 Curriculum which can be seen clearly in the articulated mission, goals, outcomes, and framework of the Social Studies and Values Education curricula. However, the content and competencies on global citizenship are minimally provided for in both the Social Studies and Values Education curricula. Moreover, both curricula are lacking in the area/domain of global competence/global awareness when examined for alignment with the PISA Global Competence Framework (GCF).

Creative Thinking. The fifth PISA area presented in this report is the analysis on Creative Thinking (see Chapter 5). The two authors from PNU, Teresita Rungduin and Marla Papango, reported the degree of alignment of the creative thinking skills in PISA vis-a-vis those in the Kto12 Curriculum in Communication Arts English and Arts for Grades 7 to 10. OECD (2019b), defines creative thinking as the competence to be productive in the generating, evaluating and improving ideas that lead to original and effective solutions, advances in knowledge and impactful expressions of imagination (p.7). Based on the report of Rungduin and Papango in Chapter 5, the Grades 7 to 10 Arts Curriculum is more aligned with the PISA indicator of generating creative ideas than with generating diverse ideas and evaluating and improving ideas. The Arts Curriculum focuses more on creative expression than on knowledge creation and problem solving. The Kto12 English Curriculum for Grades 7 to 10 is more aligned with the PISA indicator on *generating creative ideas* than with *generating diverse ideas* and *evaluating and improving ideas*. In other words, the Kto12 English Curriculum for Grades 7 to 10 focuses more on *creative expression* than on *knowledge creation* and *problem solving*.

Financial Literacy. The 6th PISA area presented in this report is the analysis on Financial Literacy (see Chapter 6). The two authors, Feliece Yeban of PNU and Joselito Florendo of the University of the Philippines, who both served as Vice President for Finance and Administration in their respective institution, reported the degree of alignment of Financial Literacy skills in PISA with those in the Kto12 Curriculum in Social Studies and Mathematics for Grades 7 to 10. For OECD (2018, p.128), financial literacy in PISA refers to the competence of knowing and understanding financial concepts and risks, and having the skills, motivation and confidence in applying them when making effective decisions in varied financial contexts to improve

individual and society's financial well-being and participation in economic life. Based on the study of Yeban and Florendo in Chapter 6, the Araling Panlipunan Curriculum particularly that on Economics is about 38% aligned with the competencies set for financial literacy, which is offered as an optional area for assessment in all cycles of PISA. In Mathematics, 18% of the financial literacy competencies are all implicitly targeted. The two curricula combined cover 49% of the PISA Financial Literacy competencies, however, they lack the requisite content on *money and transactions*, *planning and managing finances*, *risk and rewards*, and *financial landscape*.

Collaborative Problem Solving. The 7th PISA area presented in this report is the analysis on Collaborative Problem Solving (see Chapter 7). The two authors, Adonis David and Wilma Reyes of PNU, reported the degree of alignment of Collaborative Problem Solving Skills in PISA with those in the Kto12 Curriculum in Social Studies, Mathematics and Values Education for Grades 7 to 10. OECD (2015, p.134) defines collaborative problem solving, an innovative assessment area in PISA 2015, as the capacity of an individual to effectively engage with two or more individuals who are attempting to solve a problem by pooling their knowledge, skills and efforts to reach a solution. Based on the report of David and Reyes in Chapter 7, about 50% of the PISA collaborative problem solving competencies which are viewed as essential 21st century skills specific to finding solutions to national or global crisis are integrated in the Mathematics, Araling Panlipunan, and Edukasyon sa Pagpapakatao curricula. The lack of integration is evident in the problem solving competencies of *planning and executing* and *monitoring and evaluating.*

CONCLUSIONS AND RECOMMENDATIONS

The following are found to be the gaps in selected areas in the K to 12 Curriculum for Grades 7 to 10 based on the results of the study:

Reading Literacy. The reading comprehension in the English Curriculum reflects the text processing skills of locating, understanding, reflecting, and evaluating in the PISA reading literacy framework, but it does not explicitly reflect literacy behaviors in digital and non-digital environments which PISA considers when teaching text processing in relation to source of information. PISA emphasizes interaction of reader, text and task in influencing learner's performance, which is not clearly articulated in the Kto12 curriculum document.

Mathematics Literacy. The Mathematics Curriculum is aligned with the PISA Mathematics Literacy Framework, except that it does not emphasize contextualization of content in real-life situations that requires processing of information, reasoning at higher level, and interpreting and evaluating personal, occupational, societal, and scientific problems which PISA emphasizes.

Scientific Literacy. The Science Curriculum captures mostly the content requirements in scientific literacy, except that it fails to explicitly include the history of the earth and the universe which is emphasized in PISA. The distribution of content topics and competencies in the curriculum is not proportionately and appropriately spread across grade levels based on the cognitive demand and scientific literacy defined in PISA.

Global Competence. The two subject areas - Araling Panlipunan and Edukasyon sa Pagpapakatao/Values Education - integrate global competencies, but they do not cover some content, skills, attitudes and values emphasized in PISA.

Creative Thinking. The English and Art Curricula integrate PISA creative thinking indicators, but the emphasis is more on generating creative ideas than with generating diverse ideas and evaluating and improving ideas. Both curricula focus more on creative expression than on knowledge creation and problem solving which are emphasized in PISA.

Financial Literacy. The Mathematics and Araling Panlipunan Curricula particularly on Economics integrate only a few of the competencies set for financial literacy, and they lack integration of the requisite content on money and transactions, planning and managing finances, risk and rewards, and financial landscape which are the areas where financial literacy is best integrated.

Collaborative Problem Solving. The Mathematics, Araling Panlipunan and Edukasyon sa Pagpapakatao/Values Education Curricula integrate a few of the collaborative problem solving competencies indicated in PISA, which are viewed as essential 21st century skills specific to finding solutions to national or global crisis. Moreover, they do not cover problem-solving competencies of planning and executing and monitoring and evaluating.

The following are the recommendations based on the findings on the analysis of the Kto12 curriculum vis-à-vis the PISA frameworks as possible input to policy review and development.

English Curriculum for Grades 7 to 10. The English Curriculum, classroom instruction, learning resources, and

assessment should explicitly integrate the demand for reading literacy through interaction of the reader, text and task from multiple sources in digital and non-digital environments. It should also integrate creative thinking skills like generating diverse ideas, evaluating and improving ideas, and knowledge creation and problem solving.

Mathematics Curriculum for Grades 7 to 10. The Mathematics Curriculum, classroom instruction, and learning resources should aim for the development and assessment of mathematical reasoning and high-level individual and collaborative problem solving and critical thinking in personal, occupational, societal, and scientific contexts. It should also explicitly target the development of financial literacy competencies that are emphasized in PISA since Mathematics is the most appropriate area for the development of financial literacy in the Kto12 curriculum.

Science Curriculum for Grades 7 to 10. The Science Curriculum, classroom instruction, learning resources, and assessment should explicitly include the history of the earth and the universe as a content. The curriculum should be unpacked to proportionately distribute the content and competencies across grade levels based on the cognitive demand and scientific literacy as defined in PISA.

Araling Panlipunan Curriculum for Grades 7 to 10. The Araling Panlipunan Curriculum, classroom instruction, learning solutions, and assessment should integrate global competencies (e.g. global language and intercultural relations), cognitive skills and processes (e.g. evaluating information and sources, explaining complex situations); and attitudes and behavioral skills (e.g. sense of interconnectedness, responsibility for others in the world) emphasized in PISA. There should also be competencies

for the development of collaborative problem solving as well as financial literacy integrated particularly in Economics.

Edukasyon sa Pagpapakatao/Values Education Curriculum for Grades 7 to 10. The Edukasyon sa Pagpapakatao Curriculum, classroom instruction, and learning solutions should also explicitly target integration of the global competencies with emphasis on the development and assessment of attitudes and values that promote intercultural relations and understanding as well as the development of collaborative problem solving skills as they are considered in PISA as essential in real life.

Art Curriculum for Grades 7 to 10. The Art Curriculum, classroom instruction, and learning resources should also integrate development and assessment of creative thinking skills among learners like generating diverse ideas, evaluating and improving ideas, and knowledge creation and problem solving as they are valued as essential in PISA.

Teacher Upskilling. The identified gaps in the basic education curriculum based on the PISA framework should be addressed to integrate those competencies in the professional development programs for teachers to deepen their content knowledge and pedagogy including their upskilling in using computer-based assessment and formats used in international student assessment.

REFERENCES

Balagtas, M.U., Garcia, DC.B., & Ngo, D.C. (2019). Looking through Philippine's K to 12 curriculum in Mathematics and Science vis-à-vis TIMSS 2015 Assessment Framework. *EURASIA Journal of Mathematics, Science and Technology Education*, *15*(12), 2-14. https://doi.org/10.29333/ejmste/108494

Department of Education (2017). *DepEd Order No. 29, s. 2017 on Policy Guidelines on System Assessment in the K to 12 Basic Education Program*. https://www.deped.gov.ph

Department of Education (2019). *PISA 2018: The National Report of the Philippines*. https://www.deped.gov.ph/wp-content/uploads/2019/12/PISA-2018-Philippine-National-Report.pdf

OECD (2019). *PISA 2018 Results (Volume I): What students know and can do.* PISA, OECD Publishing, Paris. https://doi.org/10.1787/5f07c754- en.

OECD (2019a). *PISA 2018 Assessment and Analytical Framework*. PISA, OECD Publishing, Paris. https://doi.org/10.1787/b25efab8-en.

OECD (2019b). *PISA 2021 Creative Thinking Framework (Third Draft)*. OECD Publishing, Paris.https://www.oecd.org/pisa/publications/PISA-2021-creative-thinking-framework.pdf

OECD (2018). *PISA 2021 Mathematics Framework (Draft).* https://pisa2021maths.oecd.org/files/PISA%202021%20Mathematics%20Framework%20Draft.pdf

OECD (2017). *PISA 2015 Assessment and Analytical Framework: Science, Reading, Mathematic, Financial Literacy and Collaborative Problem Solving, revised edition*. PISA, OECD Publishing, Paris. http://dx.doi.org/10.1787/9789264281820-en

Scheicher, A. (2019). *PISA 2018: Insights and Interpretations*.OECD.https://www.oecd.org/pisa/PISA%202018%20Insights%20and%20Interpretations%20FINAL%20PDF.pdf

Chapter 1

PISA Reading Literacy Framework vis-a-vis the Philippine Kto12 English Curriculum

Angelita D. Romero and Marla C. Papango
Philippine Normal University, Manila

Abstract

The study aimed to find out if the Kto12 Reading Literacy Curriculum is aligned with the 2018 PISA Reading Literacy Framework. The two documents were examined to look for competencies that are mismatched, and specific gaps were also determined. Mapping of competencies for both documents was done to facilitate comparison of content. Results show a congruence of competencies in both documents. The PISA Reading Literacy Framework and the Kto12 curriculum indicate strong commonality on desired literacy behaviors in general. There is a 100% degree of alignment of competencies. However, a closer look at the PISA reading literacy competencies, though concisely and broadly stated, would reveal that they lend themselves to ease of more specific interpretation after one goes through the core beliefs and theories underlying the competencies. The Kto12 reading literacy competencies, while broken down into smaller chunks of discrete skills, are not spelled out in detail to allow a more specific interpretation for purposes of designing instruction. Focusing on the gaps between the two documents on competencies would help in designing instruction for the Kto12 competencies, though this instructional design may differ from the expected instructional blueprint in the PISA competencies. Restating the Kto12 competencies with qualifying phrases reflecting the overarching beliefs behind them will clarify and highlight commonalities of competencies in both documents. This will facilitate implementing appropriate instructional strategies to help Filipino learners attain similar literacy goals.

Keywords: *Assessment, English Curriculum, Kto12, PISA Reading, Reading Literacy*

INTRODUCTION

The participation of the Philippines in the Programme for International Student Assessment (PISA), an assessment program administered by the Organization for Economic Cooperation and Development (OECD) is a welcome move if only to find out how our students fare in comparison with their counterparts in the international community. The recent results released in December 2019, however, jolted the academe, educators, parents and practically the whole country upon learning that the Philippines ranked the lowest among 79 countries. While not altogether surprising, the report is disturbing let alone embarrassing.

In the area of reading literacy, the PISA 2018 Philippine National Report of the Department of Education mentions that 1) Filipino students obtained an average score of 340 points in Overall Reading Literacy, which was significantly lower than the OECD average of 487 points; and 2) Only 19.4% achieved at least the minimum proficiency level (Level 2) in Overall Literacy.

To have the Philippines ranked among the lowest in reading literacy among 79 countries in the world sends an alarming signal with regard to our youths' capability to survive in a globally competitive world. This is indeed a wake-up call and cannot just be taken lightly by all concerned, especially those in the education sector. Being literate has reached a level of necessity for survival in a knowledge-based society characterized by the incessant and accelerated flow of information in this highly technological world. The Department of Education (DepEd) as the lead and most concerned body involved, took immediate action to address the issue by calling on its stakeholders for feedback, reactions, and action. Moreover, DepEd called on all sectors including academic groups to conduct studies and look into the results to possibly

gather information through research on the factors or circumstances that could explain the PISA 2018 performance results of our Filipino learners. Hence, in support of this well-meaning effort of DepEd, this study on the alignment of the PISA reading literacy framework with the Kto12 literacy curriculum was undertaken.

Reading literacy has generally been considered a major domain in the PISA framework. Revisions have been done through the years to reflect reading literacy skills relevant to the times as PISA embraces the belief that "understanding reading literacy evolves along with changes in society and culture. The reading literacy skills needed for individual growth, educational success, economic participation and citizenship 20 years ago were different from those of today; and it is likely that in 20 years time they will change further still" (OECD, 2018, p. 22).

Undoubtedly reading literacy is one area that PISA appears not to leave to chance. PISA states that "achievement in reading literacy is not only a foundation for achievement in other subject areas within the educational system, but also a prerequisite for successful participation in most areas of adult life" (Cunningham & Stanovich, 1998; OECD, 2013; Smith, Mikulecky, Kilby & Dreher, 2000, quoted in PISA Framework, 2018, p. 22). In support of the need for literacy to achieve academic success, Vaca in Lynch (2019) underscores this when he pointed out the need for teaching literacy across the curriculum as an "every century skill rather than one essential only for modern times."

The foregoing statement justifies PISA's compelling reasons to get involved in literacy assessment. Students' performance needs monitoring on how well they can cope with the literacy demands of the times in a globally competitive knowledge-based society. It is therefore necessary to give the PISA results a serious

study and find relevant information and insights on Filipino students' reading literacy level.

Statement of the Problem

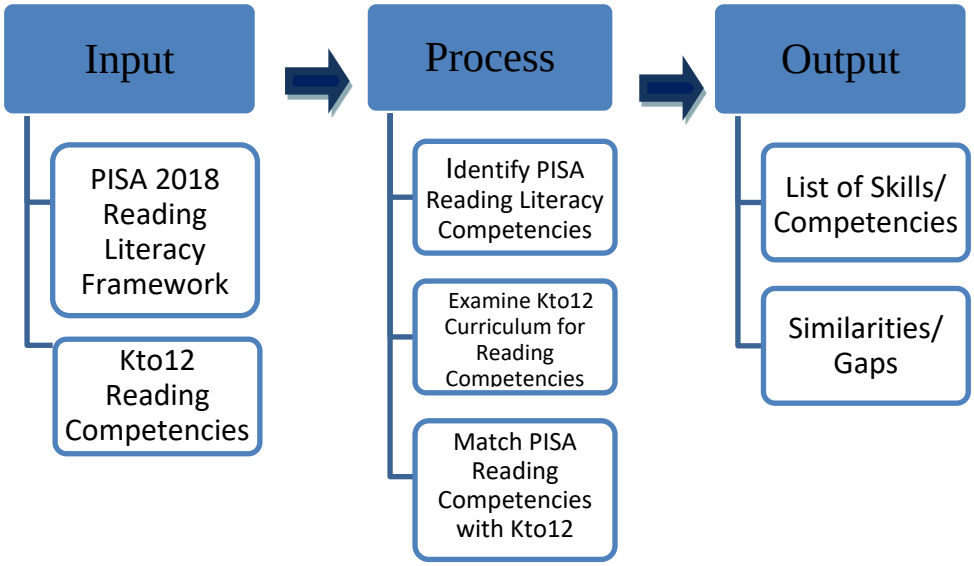
The study aimed to: 1) determine the degree of alignment of the PISA Reading Literacy Framework with the Philippine Kto12 curriculum; and 2) identify gaps in the Kto12 curriculum when matched with the PISA Reading Literacy Framework.

Conceptual Framework

The analysis made use of the PISA Literacy Framework as the source of the literacy competencies assessed in PISA 2018 and the literacy competencies in the Philippine Kto12 curriculum. The analysis model used in the study is the Input-Process-Output (I-P-O) model where the input includes the identified competencies in the PISA Literacy Framework and those in the Kto12 curriculum (See Figure 1.1). A comparison of the two sets of competencies was done to find possible similarities and/or differences in scope/coverage of the two. To do this, mapping and matching of competencies had to be done. Since one of the stated problems is to identify gaps, it was assumed that there are "gaps" in the Kto12 curriculum when mapped with the PISA Literacy Framework. These gaps may provide information on the possible factors that may have contributed to the dismal performance of the Filipino students in the PISA test. The results of the comparison were treated as the output of the process and used as a guide in formulating appropriate recommendations for the different parties concerned.

Figure 1.1

Conceptual Framework



One document subjected to analysis is the PISA Reading Literacy Framework. Revisiting the theories and beliefs underlying its formulation deserves a brief discussion. While theories and/or core beliefs have evolved through the years as findings of research came one after the other, PISA takes cognizance of classic ideas in reading instruction. William Gray, one of the early literacy researchers responsible for many seminal studies in the area, expressed an important point of view in "Classics in Literacy Instruction" (quoted in Robinson, 2002). PISA captures well the idea of Gray:

> The justification of any subject in the curriculum is that it enables pupils to engage effectively in desirable life activities. In keeping with this principle, instruction in reading should take account first of the reading experiences of children and adults in the home, school, and in all social life. Information about these experiences aids in determining

the kinds of reading that people should do and should learn to do better. It may also reveal the reading activities that deserve and need special encouragement.

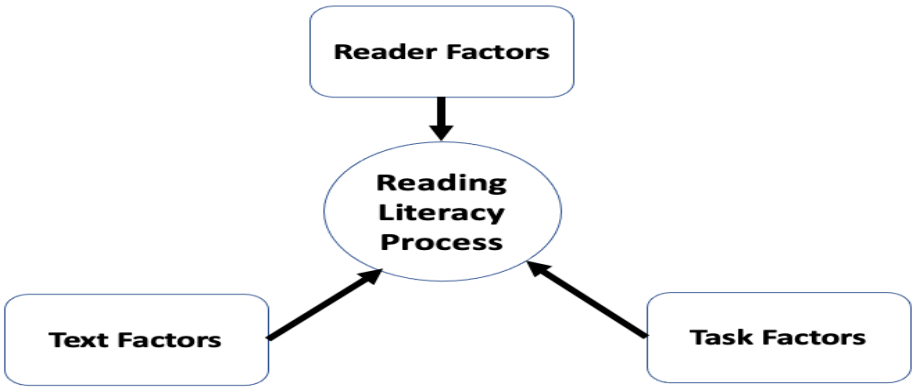
Prominent characteristics that a reader has to cope with include the influx of a large quantity and variety of reading materials presented in different formats and/or genres that have to be accessed through different modalities. Similar to the demands of other survival skills, literacy competencies call for an attitude to "unlearn, relearn, and learn" to fight obsolescence.

The PISA core ideas expressed in its framework reflect enduring past beliefs as well as current ones brought about by recent research findings. It adopts a view that some competencies needed twenty years ago are different from those of today, and in the future these may change further still, and that literacy as a social phenomenon exacts literacy competencies to be responsive to the changing needs of the times.

A product of PISA's exhaustive literature search is the adoption of the RAND Model in explaining the process of reading (see Figure 1.2). The model states that reading literacy development is a joint outcome of three combined sources of influence.

Figure 1.2

The RAND Model



The RAND Framework echoes ideas from Louise Rosenblatt's (Lewis, 2000) Reader-Response Theory that recognizes the reader as an active agent interacting with the text. The reader brings a number of reader factors, e.g. cognitive abilities, linguistic abilities, motivation, and prior knowledge in engaging with a text. The text factors include among others format, language used, text types, genres, and modality of access. The tasks factors/contexts include the potential time and other constraints, the purpose, and even the complexity of the tasks. In other words, the reader's performance is influenced by the text and task factors.

The RAND Model is widely recognized by reading educators in planning effective reading instruction. For effective teachers of reading comprehension, the RAND group has this to say:

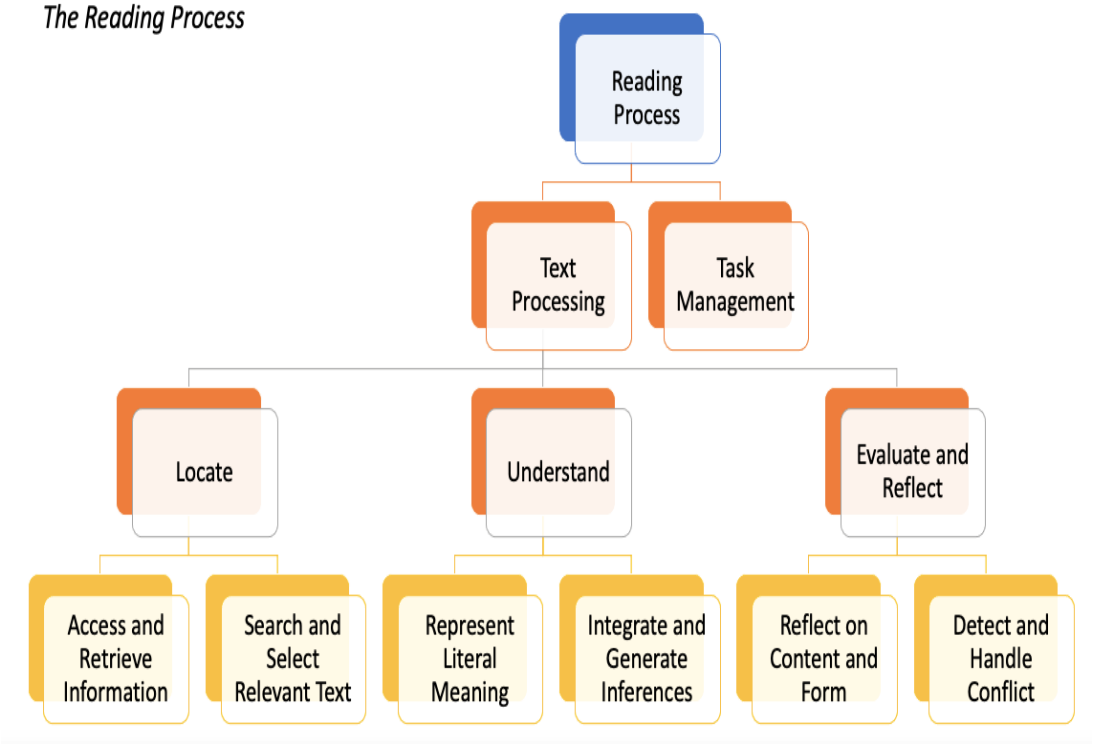
> Effective teachers of comprehension enact practices that reflect the orchestration of knowledge about readers, text, purposeful activity and context for the purposeful activity and contexts for the purpose of advancing students' thoughtful, competent, and motivated reading. However, the characterization of the reader must also take into account the nature of the text that the student is reading and the nature of the task that is motivating the reader' (Rand Study Group, 2002, pp. 29-30).

Adhering to the RAND Model, the PISA Literacy Framework believes that "reader, text and task dimensions interact with a broad socio-cultural context, which can be thought of as the diverse range of situations in which reading occurs."

PISA's cognitive instrument aims to measure a student's mastery of reading processes (see Figure 1.3) through manipulating task and text factors. Reader factors like motivation, disposition and experience were determined via a questionnaire.

Figure 1.3

The Reading Process



Two broad categories of reading processes were designed for PISA 2018: **Text Processing** and **Task Management**. **Text Processing** refers to the various strategies readers employ to decode and make sense of the text. Moreover, text processing strategies require reading fluency, which is an assumed skill cutting across all processes. It is also important to note that in all text processing tasks, readers are expected to monitor their progress, set goals, and select strategies needed to perform a certain literacy task. These are among the important **Task Management** processes that may affect the text processing process.

Text Processing, the first category, includes three sub-skills which are: *Locate*, *Understand*, and *Evaluate and Reflect*. The sub-skills under ***Locate*** include 1) access and retrieve information; and 2) search and select relevant text. While sub-skills for ***Understand*** include: 1) represent literal meaning; and 2) integrate and generate inferences. Lastly, *Evaluate and Reflect* includes three sub-skills: 1) assess quality and credibility; 2) reflect on content and form; and 3) detect and handle conflict. The second category, **Task Management,** includes sub-skills such as 1) set goals and plans; and 2) monitor and regulate. Task Management competencies, though recognized by PISA, were not part of the PISA Assessment.

METHODOLOGY

Initial mapping of literacy competencies in the Kto12 curriculum and those in the PISA Literacy Framework was done first. This was followed by matching the competencies in both lists of literacy competencies to determine their degree of alignment per grade level (Grades 7 to 10). The results of the matching process were expected to shed light on possible existing gaps.

The literacy competencies analyzed in PISA include categories such as ***Locating Information***, ***Understanding***, and ***Evaluating and Reflecting***. A simple coding system was used for the PISA competencies such as **L** for Locate, **U** for Understand, **Ev** for Evaluate and Reflect, and **TM** for Task Management. Similarities and gaps were summarized and analyzed after comparing and matching the competencies in PISA and those in the Kto12 Reading Literacy Curriculum for Grades 7 to 10.

RESULTS AND DISCUSSION

This analysis aimed to determine two things: 1) the degree of alignment of the competencies in the PISA Literacy Framework with those in the Kto12 Reading Literacy curriculum for Grades 7 to 10; and 2) possible gaps in the Kto12 Reading Literacy Curriculum vis-à-vis the PISA Reading Literacy Framework.

The two documents were examined for content similarities. For ease of comparison, the PISA skills were assigned a code. For the Kto12 competencies which show similarities of intent on the desired reading literacy behaviors with those in PISA, a similar coding was used also. Variation lies in the manner they were stated and the degree of explicitness of details that will enable a more accurate and narrowed down interpretation of the competencies. This is specifically true for the Kto12 competencies.

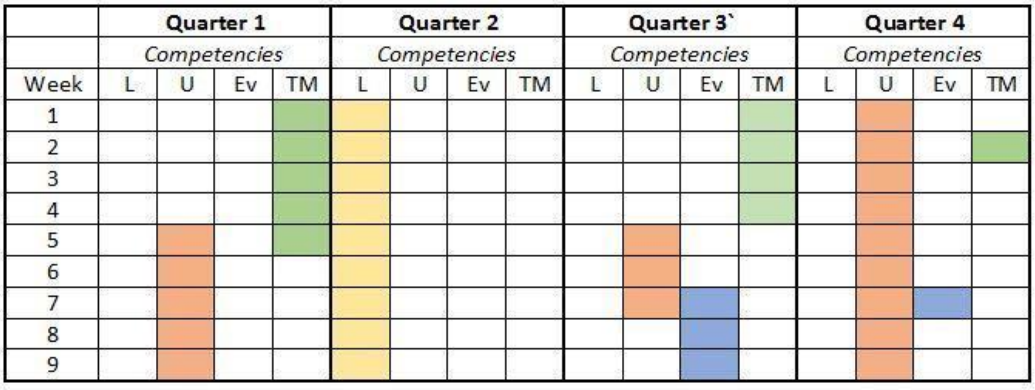
Reading Literacy behaviors refer to the competencies found in the PISA Framework and in the Kto12 Curriculum. Bormuth (1974), in his article in "Reading Literacy: its definition and assessment," refers to these literacy behaviors as a range of behaviors that must be exhibited by learners in order to be called literate. In the context of the present investigation, a literate participant in PISA is one who reaches a certain level of proficiency in the competencies assessed.

As earlier mentioned, the PISA Reading Literacy Framework identifies two major reading processes a learner is expected to be able to do when interacting with a written text or any reading stimulus: 1) **Text Processing** and 2) **Task Management**. The text processing category has sub-categories: ***Locate***, ***Understand***, and ***Evaluate and Reflect***. A second level of sub-categorization for each of the three is likewise presented in Figure 1.3.

In general, all text processing skills mentioned in PISA are reflected in all grade levels in the Kto12 curriculum as seen in Figure 1.4 to 1.7. In describing the competencies for each grade level in the Kto12 curriculum vis-a-vis the PISA Reading Literacy Framework, the following points were considered: 1) The competencies reflected in the particular grade level in the Kto12 curriculum; 2) The distribution of the competencies per grade level in the academic year; 3) The particular focus or emphasis for a particular grading period; and 4) If a discernible pattern exists in the sequencing of competencies as per distribution in the four quarters/grading periods of the academic calendar.

Figure 1.4

Kto12: Grade 7



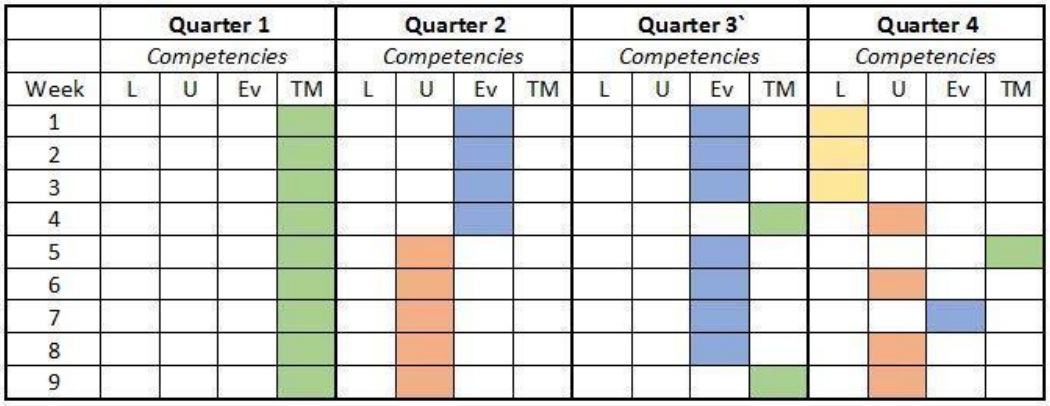
	Quarter 1				Quarter 2				Quarter 3`				Quarter 4			
	Competencies				*Competencies*				*Competencies*				*Competencies*			
Week	L	U	Ev	TM	L	U	Ev	TM	L	U	Ev	TM	L	U	Ev	TM
1																
2																
3																
4																
5																
6																
7																
8																
9																

Based on an examination of the two documents, the Grade 7 reading literacy competencies reflect the PISA competencies (see Figure 1.4). The competencies are stated in "smaller discrete skills," but when clustered they can be classified under each of the **Text Processing** (**TP**) competencies in PISA. **Task Management** (**TM**) skills are also found in the Grade 7 list of competencies. As far as distribution of competencies for the academic year is concerned, it can be claimed that all PISA reading

competencies are reflected in the Kto12 competencies scheduled in the four quarters of the school calendar. The first quarter focuses on two: ***Understanding*** (**U**) and **TM**. The second quarter singles out ***Locating*** **(L**), while ***Understanding*** (**U**), **Evaluating *and Reflecting*** (**Ev**) and **TM** have an almost equal share of emphasis in the third quarter. The emphasis in the fourth quarter shifts to **U,** with one week for **TM** and **Ev**, respectively. Each quarter appears to highlight one or two competencies. For the whole academic year, the Grade 7 list favors **U** followed by **L**, **TM**, and **Ev** in terms of time allotment given. In terms of sequencing of competencies, **Ev** is assigned in the last quarter.

Figure 1.5

Kto12: Grade 8

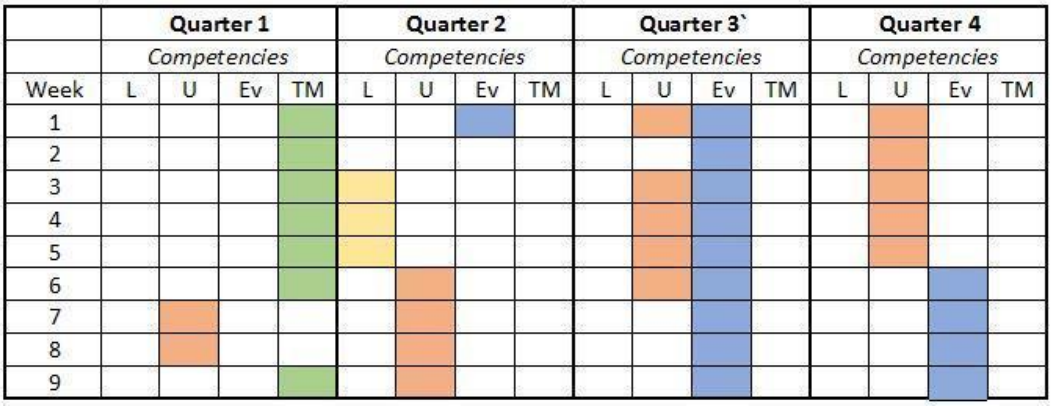


As in Grade 7, Grade 8 reflects PISA reading competencies distributed across quarters for the whole academic school year (see Figure 1.5). The first quarter is focused on **TM** competencies. All the other competencies are set aside for the whole first quarter in favor of **TM**. Quarter 2, on the other hand, highlights **U** and **Ev**. Quarter 3 focuses on **Ev** for seven weeks and provides two weeks for **TM**. Quarter 4 has three weeks for **L** and four weeks for **U,** and a week each for **Ev** and **TM.** For the whole academic

year, Grade 8 takes **TM** seriously as it is the only focus for Quarter 1, with only a week for reinforcement in Quarters 3 and 4. In terms of the amount of time allotted for the whole school year, **TM** is given more time allotment followed by **Ev**, **U**, and **L**. Compared to Grade 7, **Ev** competencies in Grade 8 are not highlighted in Quarter 1, but they are evident in the succeeding quarters.

Figure 1.6

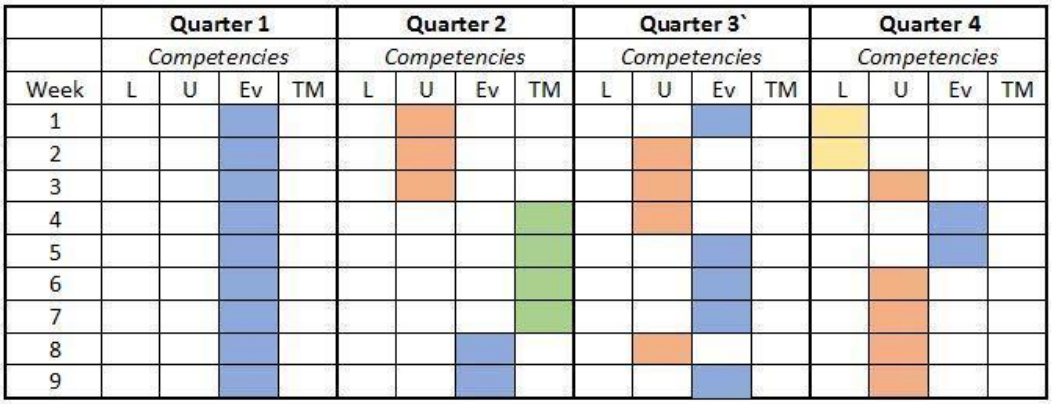
Kto12: Grade 9



All three text processing competencies identified by PISA have their counterparts in the Kto12 Grade 9 list (see Figure 1.6). As in Grade 8, **TM** in Grade 9 is the focus in Quarter 1, with two weeks given to **U**. Quarter 2 attends to **L** and **U,** and devotes a week for **Ev**. Quarter 3 focuses on **U** and **Ev**. Quarter 4 focuses on **U** and **Ev** similar to that in Quarter 3. For the whole year, **U** and **Ev** get the most number of weeks allotted for instruction followed by **TM** and **L**. An emerging pattern in sequencing shows a tendency to take **Ev** competencies usually in the last two quarters. It is quite evident that **U**, **TM** and **Ev** are given more weeks in the Grade 9 curriculum than the other competencies.

Figure 1.7

Kto12: Grade 10



	Quarter 1				Quarter 2				Quarter 3`				Quarter 4			
	Competencies				*Competencies*				*Competencies*				*Competencies*			
Week	L	U	Ev	TM	L	U	Ev	TM	L	U	Ev	TM	L	U	Ev	TM
1																
2																
3																
4																
5																
6																
7																
8																
9																

Similar to the distribution of competencies in the previous three grade levels, Grade 10 has all competencies in PISA reflected across all quarters in the school year (see Figure 1.7). Quarter 1 concentrates on **Ev**, with no other competency for the duration of nine weeks. Quarter 2 allots three weeks for **U** and two weeks for **Ev,** and four weeks for **TM**. Quarter 3 focuses on two competencies: **U** and **Ev,** with five weeks for **Ev** and four weeks for **U**. Three competencies appear in Quarter 4: **L**, **U**, **Ev**. **U** gets five weeks; **L**, two weeks; and **Ev**, two weeks. Each quarter appears to focus on certain competencies. For Quarter 1 the distinct emphasis is **Ev** alone. Quarter 2 focuses on three: **U**, **TM** and **Ev**. Quarter 3 has **U** and **Ev**. Quarter 4 has nine weeks distributed to three competencies: **L**, **U**, and **Ev**. Going over the time allotments for each competency for the whole school year, **Ev** tops the list followed by **U**, **TM**, and **L.** Focus on **Ev** is at its peak in Quarter 1 and gradually wanes giving way to **U** for the rest of the quarters.

A cursory look at the PISA Reading Literacy Framework and Kto12 reading literacy curriculum for Grades 7-10, one can easily discern that there is congruence between the PISA reading

competencies and those in the Kto12 curriculum. Using the broad categorization of PISA as benchmark, the Kto12 specific competencies appropriately fall under the respective broad PISA-identified text processing competencies. Therefore as far as alignment is concerned, in broad terms, it can be claimed that there is 100% degree of alignment between the two documents.

A further examination of the Kto12 reading literacy competencies yields that for Grades 7 to 9, there are 43 competencies in total distributed in the four quarters of the school year. However, in Grade 10, a total of 36 competencies are on the list, and like the rest in the other grade levels, the competencies are similarly distributed in each of the four quarters. It is quite noticeable that there is a reduction in the number of competencies in Grade 10. Whereas there are 43 competencies in total for Grades 7 to 9, in Grade 10, only 36 are on the list. A possible reason for the reduction could be that, at a certain level like in Grade 10, there is already a kind of mastery of certain competencies demonstrated by students as they go from one year level to the next. Maybe duplication or redundancy has to be contained. Or possibly the school calendar for this terminal year in junior high school gives students some entitlements like allowing them 'little freedom' from academic tasks in favor of other concerns.

The number of competencies indicated, however, does not reflect competencies that are distinct from one another. There is a recurrence of the same competencies across weeks, across quarters within a grade level, and across grade levels. The recurrence of competencies within grade level or across grade levels comes naturally since many believe that, on one hand, repeated exposure is a recognized device for mastery. On the other hand, the repeated treatment of some competencies may demand the use of new literacy material or text or any other source of information in varying formats.

The Kto12 curriculum evidently aims to have a learner going through the two major categories of the reading process, i.e. text processing and task management and their respective subcategories spread through Grades 7 to 10.

In a nutshell, the study on the alignment of the Kto12 Curriculum with the PISA Reading Literacy Framework revealed the following:

First, there is generally the desired alignment of the PISA reading literacy competencies and the Kto12 competencies for Grades 7 to 10. However, the Kto12 curriculum has in its list **Text Management** competencies which are not included in the sub-scales assessed by PISA.

If there is alignment of competencies between the two documents, could there be gaps then that need to be addressed in the Kto12 curriculum? Going a bit beyond the inventory of competencies in both documents, for more insights, it is observed that the PISA competencies assessed are nested in a set of theoretical orientation and more beliefs in literacy. To cite, PISA embraces the idea that performance of a reading literacy competency is reader-text-task dependent. As shown in its adherence to the RAND Model which specifies the major sources of influence in reading where the interaction of reader, texts and tasks matter in the reading performance of individuals, the PISA Reading Literacy Framework explains that even if the PISA competencies are concisely stated, one would be aware what factors are to be considered in the assessment.

On the other hand, the Kto12 reading literacy competencies are presented in small skills that when clustered would fall in any of the categories under the PISA text processing competencies. The missing link between the PISA list of reading competencies and the Kto12 competencies would be the absence of the overarching core beliefs or theoretical orientation underlying the

enumerated competencies in Kto12 curriculum. In the absence of an explanation of the underlying theoretical support of the Kto12 competencies, the specific descriptive clauses or phrases to narrow down interpretation of a given competency could have been the alternative to avoid or prevent too much leeway in making interpretations that will in turn result to varied instructional plans.

What follows is an example to illustrate the point. These two competencies are generally similar.: 1) *Locating information* and 2) *Locating information using at least three websites*. The second, however, is more specific thus making teaching and testing plans more predictable. PISA reading considers two subscales in its assessment: *text processing* and *source or the stimulus*. Thus, the two competencies differ in terms of source since the second competency makes use of digital texts in the form of websites.

A second observation on the Kto12 reading competencies is in their distribution for instruction within grade levels and across grade levels. The graphs for each grade level shows that the expected competencies are taken care of with indicated time allotment, e.g. by weeks per quarter. Each quarter consists of nine weeks, and four quarters make one academic or school year. The duration or the length of time allotted to the competencies together with the recurrence within and across levels may be interpreted as indicators for emphasis.

There are some hinted (not-so-discernible) patterns regarding distribution and sequencing of competencies within and across grade levels: 1) Each grade level has an emphasized competency for each quarter and for the entire school year; and 2) A tempting impression is an arbitrariness in the distribution and sequencing of competencies, although there is a slight hint regarding sequencing of competencies reflecting an idea on their hierarchical nature in terms of complexity or sophistication. The

Evaluating and Reflecting competency, for example, is generally placed in the later part of the quarter in each grade level. In Grade 10, **Ev** is the sole focus for Quarter 1 leaving no room for the other competencies. This reflects a priority in the development of higher thinking skills.

It must be noted that **TM** competencies are found in the Kto12 curriculum, but they are not part of the PISA Test. *Task Managing* competencies are metacognitive strategies that readers practice to help them solve problems they encounter while reading. They constitute a range of skills and abilities and represent a range of strategic responses to text difficulties. Since **TM** competencies are in the Kto12 curriculum, one would expect that somehow these competencies could have been of help to Filipino PISA participants in 2018. However, there is no data to support what the effect **TM** instruction had on the Filipino students' performance in PISA 2018. Grabe in Long (2011) says, however, that 'Research on L2 strategic processing is far more limited. There are relatively few studies that demonstrate a relationship between reading strategies and reading comprehension.' In a study on meta-analysis of L2 reading strategy research, Taylor, Stevens, and Asher (2006), who reviewed the existing empirical research in L2 reading strategy training, concluded that a low to moderate effect exists between strategy training and L2 reading comprehension improvement.

CONCLUSIONS

The PISA 2018 results released in December 2019 were disappointing to say the least, definitely not ego-inflating for the country, especially to educators directly involved in instruction as well as to parents who sacrifice their hard earned money for the education of their children. Some sectors single out the teachers

as the ones to blame for the students' dismal performance. Others blame the "classic whipping boy" – poverty, lack of funds to raise teachers' salary, lack of sufficient budget to upgrade school facilities, and many other perennial problems that plague the educational system. Instead of finger pointing as to who is to blame, the Department of Education immediately responded by initiating efforts to obtain information on the nature of the PISA literacy assessment to find how it aligns with the basic education curricular programs in the Philippines. This is a laudable and timely welcome move. This paper is a modest response to that call for participation from stakeholders to help shed light on the PISA 2018 performance of Filipino students.

This analysis endeavored to give pertinent information to explain the Philippine performance in PISA 2018. As a general statement, the PISA reading literacy competencies and the Kto12 reading competencies target the same desired literacy behaviors. In that sense there is an alignment of the competencies in the PISA Reading Literacy Framework and the Kto12 reading literacy curriculum. The Philippines exhibits a strong awareness of universally accepted reading literacy competencies similar to what PISA subscribes to. What is wanting in the Kto12 curriculum list of competencies is the clarity of presentation and the overarching theoretical orientation that will guide instruction appropriate to specific competencies.

While some may be against the Philippine participation in the PISA, it is worth mentioning here that the participation also makes sense in that it helps to find out how our Filipino learners fare in international assessment programs. The exercise is an opportunity for Filipinos to be familiar with international standards because they will eventually be in a workforce or community with people coming from different parts of the world, in a virtual or real-world context in a globally competitive society. In addition, participating in an international assessment program gives

educators a feel of a wider range of education concerns upon which they can situate programs to meet peculiar needs in the local setting. Analyzing the PISA Reading Literacy Framework vis-a-vis the Kto12 reading curriculum is an example of getting a feel of foreign or international assessment programs. The exposure functions as an antidote to stagnation and parochial thinking and discourages the growth of "professional myopics."

While the Filipino students may not have performed well in the assessment program, this does not make the Philippine participation in PISA an exercise in futility. Keeping abreast with developments in education in the international scene, aligning programs with international standards, taking an active role in a global setting, and striving for a peaceful co-existence with the rest of the world in the midst of constructive competition for knowledge generation and other innovations are meaningful to our efforts towards achieving quality education. A wide range of exposure to different ILSAs enables individuals to " flexibly and adaptively apply their knowledge to new cases or situations, situations that are often unlike any they have encountered before" (Spiro, 2000).

RECOMMENDATIONS

The Technical Working Group in charge of the Kto12 curriculum may revisit the Kto12 literacy curriculum for some revisions it may need for ease of interpretation by teachers so that they can design appropriate instruction. Points for consideration in the revision may be the following:

A framework that will include the theoretical orientation in reading literacy and literacy instruction may be designed. The framework must be a product of past tested beliefs in reading and current research findings on reading literacy.

Literacy teachers should be made familiar with the basis of sequencing competencies within and across grade levels so that progression in the development of competencies will be reflected in the lessons.

A competency recurs several times within and across levels so teachers must be familiar with how repeated exposure to the same competency can demonstrate progression from the simple to more sophisticated competencies in terms of sources of influence of reading performance, e.g. text features.

Many teachers who handle literacy classes do not usually have the special training in the teaching of reading. It will be a commendable move by the Department of Education to prioritize training programs in reading and reading instruction for teachers.

With the present MELCs where reduction of competencies is a major concern, the cognitive-linguistic processes need not be reduced. Teachers may be able to use various stimuli sources/ materials/texts that will facilitate simultaneous development of the competencies in a carefully prepared integrated lesson. Needless to say, ample resources then must be provided to the teachers to ensure that they can deliver the lessons effectively.

To improve PISA test results, literacy instruction in the country entails not only alignment of competencies, but also exposure of students to multiple text sources and modality. However, doing so means training teachers in effective literacy instruction using the various text processing and task management strategies presented in the PISA Literacy Framework.

REFERENCES

Alvermann, D.E., Unrau, N.J., & Ruddell, R.B. (Eds.). (2013). *Theoretical models and processes of reading* (6th ed.). Newark, DE: International Reading Association.

Ayfer, S. (2013). *The effect of text types on reading comprehension.* Retrieved from researcgate.net

Bormuth, J. (1973). Reading literacy. its definition. *Reading Research Quarterly*. Vol. IX, Number 9. Delaware: International Reading Association.

Department of Education. (2016). *K to 12 Curriculum Guide in English.*https://www.deped.gov.ph/wp-content/uploads/2019/01/English-CG.pdf

Ellery, V. (2009). *Creating strategic readers* (2ndEd). Delaware: International Reading Association.

Grabe, William. (2011) Teaching and Testing Reading. In Long, Michael H. and Catherine J. Doughty *The handbook of language teaching*. Hoboken, N.J.: Wiley-Blackwell.

Griffe, D. T. (20012). *An introduction to second language research method*. Berkeley.

Lewis, C. (2000). *Limits of identification: The personal, pleasurable and critical in reader response.* Retrieved from journals.sagepub.com.

Lynch, M. (2019). *Teaching reading across the Curriculum* Retrieved from thee.advocate.org

OECD (2019). *PISA 2018 Assessment and analytical framework*. PISA, OECD Publishing, Paris. https://doi.org/10.1787/7fda7869-en

Robinson, R. D. (2002). *Classics in literacy education, historical perspectives*. Delaware: International Reading Association.

Spiro, R. (2004). Principled Pluralism for Adaptive Flexibility in Teaching and Learning to Read in *Theoretical models and processes in reading*. Delaware: International Reading Association.

Taylor, A., Stevens, J., & Asher, J. W. (2006). The effects of explicit reading strategy training on L2 reading comprehension. In J. M. Norris & L. Ortega (Eds.), *Synthesizing research on language learning and teaching* (pp. 213-244). Philadelphia, PA: John Benjamins.

Vacca, J.L et al. (2006). *Reading and learning to Read*. MA: Allyn and Bacon

About the Authors

Dr. Angelita D. Romero is former Vice President for Academics of the Philippine Normal University. She also served as Department Head of the Reading and Literacy Department, Dean of the College of Education and Professor in the Graduate School in the same university , positions backed up by her academic preparation: MA in English Language Teaching, University of the Philippines; Ph.D. in Applied Linguistics, Philippine Normal University; Language Teaching Certificate, RELC-SEAMEO Singapore. She did a year of post graduate studies in Reading and Language Education at Syracuse University in New York. Her involvement with the International Reading Association (now International Literacy Association) includes: membership of an Interest Group that conceptualized the first Professional Standards for Reading Professionals; two-year membership of the Editorial Board of IRA/ILA journal "The Reading Teacher; 3-year country representative to IRA/ILA International Development Committee for Asia; Chapter adviser/ founder, Alpha Upsilon (ILA Honor Society). Her two-term as president of the Reading Association of the Philippines, includes RAP's hosting of the World Congress in Reading. Her interest extends to private publishing houses as a textbook writer, editor, and consultant. She is at present a guest Faculty in the School of Graduate Studies of Angeles University Foundation and Holy Angel University of Angeles City.

Prof. Marla C. Papango currently teaches at the Philippine Normal University handling graduate and undergraduate courses in English and Literature. She holds an MA in Education degree with specialization in Literature and a Graduate Certificate in Campus Writing and Advising from PNU. She has an online certificate in Critical Thinking in the EFL Classroom from the University of Oregon American Institute. A most sought after lecturer and trainer, she conducts teacher training on assessment, mentoring, technology, critical thinking, whole school approach in an English class and Mother-Tongue Based Multilingual Education. She also capped a series of workshops for the Pedagogical Retooling in Mathematics, Languages and Science (PRIMALS) for the Department of Education and the Basic Education Sector Transformation or BEST under Australia Aid. She is presently finishing her PhD degree in English Language and Literature from the Ateneo de Manila University.

Chapter 2

PISA Mathematics Literacy Framework vis-à-vis the Philippine Kto12 Mathematics Curriculum

Evangeline F. Golla and Allan G. Reyes
Philippine Normal University, Manila

Abstract

This paper examined the extent of alignment of the Philippine Kto12 Mathematics Curriculum with the PISA Mathematics Literacy Framework to understand the below par performance of Filipino students in PISA 2018. This is a descriptive study that sought to map the content and competencies of the curriculum and assessment documents. Also, it aimed to find out if the Philippine Kto12 Mathematics Curriculum and the PISA Mathematics Literacy Framework are basically aligned or similar in content although varying in emphasis. Results revealed that the Philippine Kto12 Mathematics curriculum lacks emphasis on the PISA competencies on interpretation, evaluation, and higher level of reasoning. The study recommends a review and improvement of the Mathematics Curriculum in light of the PISA standards, in particular, on the depth of content, the breadth of application of content to practical life situations, the aspect of problem solving processes, and on the curriculum contexts.

Keywords: *content knowledge, curriculum mapping, Kto12 mathematics curriculum, mathematical processes, PISA mathematics literacy*

INTRODUCTION

Mathematics remains an important area of interest in well recognized international large scale assessment studies such as the Trend in International Mathematics and Science (TIMSS) and the Programme for International Student Assessment (PISA). The Philippines has participated in TIMSS 1995, 1999, 2003 and TIMSS-Advanced in 2008. The country has also joined PISA for the first time in 2018 which was viewed as a step towards globalizing the quality of Philippine basic education. Since the start of PISA in 2000, Mathematics Literacy has always been a component of PISA. The Mathematics Literacy domain intends to gauge the ability of students to use curriculum-based mathematical skills and knowledge in a broad range of contexts or situations in which individuals can operate in the real world.

The results of the PISA 2018 National Report of the Philippines released in December 2019 by the Department of Education (DepEd) has earned intense reactions from different sectors of society including Congress and policy makers who raised questions on what we have really gained in implementing the Kto12 Curriculum which aimed to raise the quality of basic education in the country. The reactions stemmed from the dismal performance of Filipino students in the different subject areas assessed by PISA 2018. Particularly in the mathematics domain (Mathematics Literacy), Filipino students attained an average score of only 353 points. This score is significantly lower than the OECD international average of 489 points, and the lowest among the six ASEAN countries and second to the lowest among 79 countries.

More specific performance data appeared disturbing. Majority of Filipino students (80.70%) were classified as having Proficiency Levels below Level 2 and only 19.7% reached at least

Level 2 with Level 6 as the highest proficiency level. On average across OECD countries, 76% of students attained Level 2 or higher. According to the PISA 2018 Results (OECD, 201, p. 107), only 19% of students in the Philippines and Panama attained this baseline line level of mathematics proficiency. In the PISA analysis framework, Level 2 is the minimum proficiency level where students are able to interpret and recognize situations in the contexts that require no more than direct inference, and can extract relevant information from a single source and employ basic algorithms. In addition, 54.4% or more than one in two Filipino students even performed below the minimum proficiency level of the PISA standard. At the other end of the performance spectrum, less than 1% of Filipino students attained high performance level (Level 5) or higher in mathematics, and only 0.01% of students performed within Proficiency Levels 5 to 6. In the same analysis framework, students are considered at Level 5 when they can develop and work with models for complex situations; they can select, compare and evaluate appropriate problem solving strategies; they can work strategically using broad, well-developed thinking and reasoning skills; and they are able to communicate their ideas and reasoning

The PISA 2018 assessment results are consistent with the results in TIMSS, where the Philippines performed also poorly also across the years of its participation in the study. The TIMSS scores of Filipino students' in the mathematics achievement test were also far below those of our neighboring countries like Singapore, Taiwan, and Korea. The results of comparative international assessments can give a better picture of the status of the educational system in a country inasmuch as they provide a larger context within which to interpret national and international performance. It is a reality that countries inevitably want to know how they compare to others, and it is of interest to know how good performing countries achieve such results.

The use of international rankings of student achievement also has become a powerful way to promote policy reforms. In the Philippines, the Department of Education (DepEd) has recognized the importance of national and international system assessment in its effort to improve the quality of basic education. The PISA 2018 results can provide relevant insights on student performance and inform policy decisions of DepEd (DepEd, 2019, p. vii). There is also evidence that some policy-makers have used the PISA assessment frameworks and instrument as a best-practice 'model' or 'guide' in formulating improved national/federal assessment policies and practices (Breakspear, 2012).

We cannot just ignore or take lightly the PISA 2018 results and the implications they have to our basic education program. The PISA Philippine Report calls for a serious study on how mathematics is taught in the country and how the competencies are aligned with national as well as international assessment standards. The present study, on one hand, does not wish to categorically claim that the lack of alignment of the competencies in the Kto12 Mathematics Curriculum with the PISA Mathematics Framework is the reason why the Philippines ranked very low in the PISA 2018 Mathematics Assessment. Instead, this study attempted to provide another possible explanatory variable that could help DepEd better interpret Filipino students' performance in the PISA should we decide to participate again in the future. Any form of curriculum review will open opportunities to educational leaders and policy makers to discuss the needs to be addressed in the newly implemented Kto12 Basic Education Program in light of the mathematics competencies that were assessed by PISA. Any form of discussion on educational policy and program reforms is very timely as nations across the globe

are facing various problems especially in the education front given the many challenges brought about by the COVID-19 pandemic.

Results of an alignment study as intended in this paper can be useful in deciding whether restructuring of curriculum and assessment standards is necessary or not. Alignment analysis results would help identify what changes need to be made in the intended, implemented and assessed curricula. Roach, Niebling, and Kurz (2008) defined alignment "as the extent to which curricular expectations and assessments are in agreement and work together to provide guidance to educators' efforts to facilitate students' progress toward desired academic outcomes" (p. 1). Alignment is also useful when measuring opportunity to learn (OTL) on a large-scale (Vockley & Lang, 2009). According to Shivraj (2017), alignment can be a powerful tool that can be used to provide evidence to support the underlying assumption of opportunity to learn because if two documents (e.g., standards) align well, a student that has had the opportunity to learn the content on one set of standards should theoretically have the opportunity to have learned the content on the other set of standards, if the intended content is implemented with fidelity.

It is hoped that the results of this study will serve as inputs to educational leaders, teachers, and other stakeholders in identifying what changes are needed, if any, on the current Kto12 Mathematics Curriculum vis-à-vis PISA standards for international competitiveness of our graduates.

Statement of the Problem

The objective of this study was to examine the alignment of the PISA Mathematics Literacy Assessment Framework with the competencies in the Philippine Kto12 Mathematics Curriculum with the purpose of identifying what the Kto12 Mathematics Curriculum

needs to address for Filipino students to be more globally competitive. In line with these, we pose these specific questions:

1. To what extent is the Philippine Kto12 Mathematics Curriculum aligned with the PISA Mathematics Literacy Assessment Framework?
2. What are the gaps, if any, in the Philippine Kto12 Mathematics Curriculum when mapped against the PISA Mathematics Literacy Framework?

Conceptual Framework

The PISA 2021 Mathematics Framework provides the theoretical anchor of PISA mathematics assessment. It considers Mathematics Literacy as the defining element of mathematical competence. Problem Solving and Mathematical Reasoning are the very core of mathematical literacy construct. More concretely, PISA 2021 defines:

> Mathematics literacy as the 'individual's capacity to reason mathematically and to formulate, employ, and interpret mathematics to solve problems in a variety of real-world contexts. It includes concepts, procedures, facts, and tools to describe, explain, and predict phenomena. It assists individuals to know the role that mathematics plays in the world and to make the well-founded judgments and decisions needed by constructive, engaged and reflective 21st century citizens' (OECD, 2018, p.7).

The above definition acknowledges three interrelated aspects in developing mathematical literacy: *mathematical content, process, and contexts*. Problem solving requires reasoning, and central to the problem solving cycle are *processes* such as formulating, employing, analyzing and interpreting. To solve a problem, students must have a certain degree of mastery of relevant mathematical content. Also, context is important for

students' understanding of a problem. Contexts refer to the different range of situations in which the individuals may be placed that will require the application of content knowledge as well as problem solving processes to handle a problem situation. More specifically, PISA defines context as the aspect of the learner's world in which problems exist. Contexts on the different aspects of life - personal, occupational, social and scientific - can provide students opportunities for mathematical reasoning and thinking.

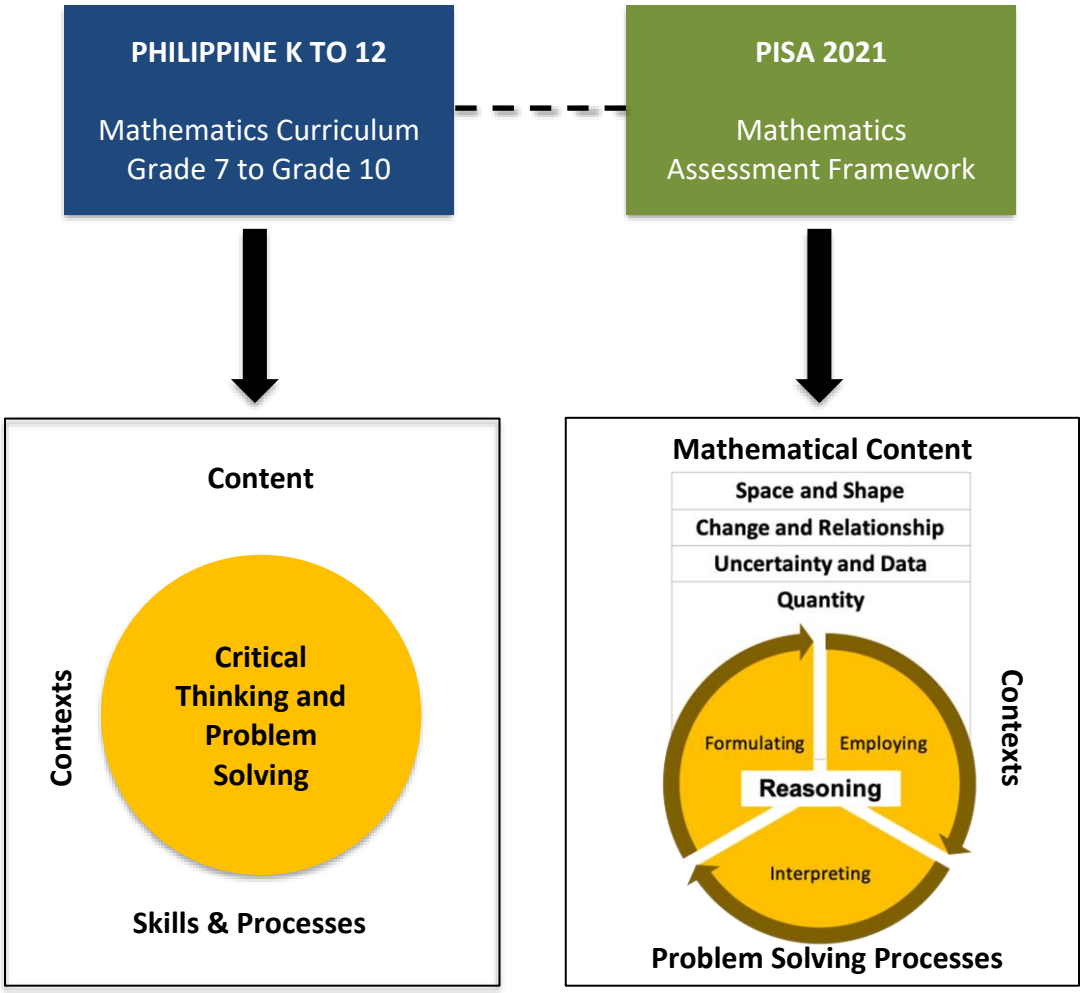
On the other hand, the Philippine Kto12 Mathematics Curriculum *(Ph-MC)* considers critical thinking and problem solving as the twin goals of basic mathematics education for Filipino students. It is viewed that these goals can be achieved with organized and rigorous content, a well-defined high-level skills and processes, values and attitudes and mathematical tools, and these are applied to the different contexts of Filipino learners (DepEd, 2016 p. 3). Its value extends outside the school, as such, students must learn mathematics in breadth and in depth.

Considering the perspectives from the PISA Mathematics Literacy Assessment Framework and the Ph-MC, this study was conducted based on a content-process-context analytic framework. *Content* is the cornerstone of learning, and it is considered the most important component of curriculum assessment and evaluation. In most school curriculum development and evaluation, content is grouped by strands or categories. In this study, *Content* refers to the mathematical knowledge and specific mathematical skills encompassing all the strands. *Process* refers to the cognitive skills that enable students to use and apply the content knowledge in different problem-solving situations. For curriculum development, Process standards are the ways of acquiring and applying content knowledge. *Context* refers to the situations in which a given problem is embedded. It is the "sum total of all factors that can influence what and how content is taught and learned in a program"

(Metzler, 2005, p. 54). With this definition of context, mapping of learning competencies was applied only in the content and process domains. All the elements in the foregoing statements are summed up in Figure 2.1:

Figure 2.1

Mapping of PISA Mathematics Literacy Framework vis-à-vis the Philippine Kto12 Mathematics Curriculum



METHODOLOGY

The study which is descriptive in nature compared and analyzed two documents that both define learning standards in mathematics. The first document is the PISA 2021 Mathematics Literacy Framework that comprehensively defines and describes the competencies required in mathematics. It explains the content knowledge, mathematical processes in problem solving, and contexts that PISA 2021 intends to use to measure mathematics literacy. The other document is the DepEd 2016 Kto12 Mathematics Curriculum Guide. Curriculum guides almost always officially define the curriculum. Even for TIMSS, according to Houang and Schmidt (2008), curriculum guides are considered the primary and purest official, public statement of curriculum and curricular intentions. In like manner, the Kto12 Mathematics Curriculum Guide of DepEd is intended to define the Philippine Kto12 Mathematics Curriculum. However, only the parts covering the Mathematics curriculum for Grades 7-10 were used for analysis. As mentioned earlier, PISA aims to assess the mathematical competence of 15-year-old students. Consequently, only the parts describing the content and learning competency for students aged 12-15, equivalent to Grades 7-10 in the Philippines, were selected from curricular documents. It is also assumed that the mathematical knowledge learned during these four grade levels would cumulatively capture the mathematical knowledge assessed in PISA.

In this study, two experts in mathematics education were involved in examining and analyzing the above mentioned documents. To determine the degree of alignment of the PISA Mathematics Literacy Framework with the Kto12 Mathematics Curriculum, the learning competencies in the Ph-MC were mapped in terms of content, topics, activities and cognitive competencies against the PISA Mathematics Assessment Framework. All the

steps and procedures discussed during the general orientation sessions of the curriculum analysts were followed in order. These involved: 1) color coding procedures; 2) preparation of matrix listing the content and competencies assessed in PISA; 3) individual mapping; 4) preparation of matrix showing the heat map of the PISA items and mathematical competencies in the Grade 7-10 matrix; 5) review and finalization of mapping results; 6) data analysis; and 7) writing of the final report.

A heat map, as used in this study, is a two-dimensional representation of data in which values are represented by colors. It aims to provide the readers a visual summary of information. The two experts worked individually on the curriculum mapping tasks, and consulted each other in areas that needed clarification. The experts were guided by the statement that an '*alignment was said to be present when a sub-construct and a topic each described one or more mathematical skills requiring identical, or nearly identical, cognitive processes'* (UNESCO-IS, 2018, p.4)

In doing a further review of the mapping, the experts agreed to add two content topics to minimize the discrepancy between and among broad content topics. Topics that were added are *Relationship Between & Among Geometrical Objects* and *Numerical Trends and Patterns* which are content topics under **Change and Relationships** and **Quantity**, respectively. The revised mapping then was reviewed and finalized by both experts. The degree of agreement on the mapping of documents is 80+%.

The methodology for alignment also considered some steps commonly applied in alignment studies. The first step is to identify the elements to be examined in the document as reference points for alignment. In line with this, the domains in the PISA Mathematics Literacy Framework were identified, and the competencies under each domain were listed. In the PISA assessment framework, the domains are stated as content

category and content topics. On the mathematical processes, competencies were indicated by expected student action for mathematical reasoning and problem solving processes. The framework does not use "competencies" nor "learning competency" unlike in the Kto12 Mathematics Curriculum. Learning where competency by definition refers to knowledge or skills students are expected to do or to master. The PISA list of expected student actions for reasoning and problem solving processes, in effect, can be taken as learning competencies where learning competencies from the Ph-MC can be mapped. In the Ph-MC, there was a clearer delineation of learning competencies for each content strand such that identifying them for mapping purposes did not pose any difficulty.

Another important consideration in the alignment process was to decide which framework to use as the foundation for comparison. In this study, the learning competencies in the Ph-MC were examined to determine their alignment with the assessment domains in PISA. This means the PISA Mathematics Literacy Framework was used as the basis for comparison, since it is the target framework, to see if the competencies in the Ph-MC meet international standards.

To determine the percentage of alignment of content in the PISA framework covered in Ph-MC, simple frequency was used, and simple percentage score was computed in each content area and content categories per grade level. For a qualitative interpretation of the degree of alignment of the competencies in the Ph-MC with the PISA Mathematics Literacy Framework on content and on mathematical processes, the following respective criteria were set:

On Content

Percent of Coverage	***Description***
More than 50%	High Alignment
25%- 50%	Moderate Alignment
Less than 25%	Low Alignment

On Mathematical Processes

Number of Competencies	***Description***
26 and Above	Mostly covered
11-25	Moderately covered
10 and below	Least covered

RESULTS AND DISCUSSION

Alignment of PISA 2021 Mathematics Assessment Framework vis-à-vis the K to12 Mathematics Curriculum for Grades 7 to 10

Alignment on Mathematics Content Knowledge

In PISA, an understanding of mathematical content and the ability to apply this content knowledge in solving contextualized problems are essential for every learner. Mathematical reasoning and problem solving processes draw upon mathematical knowledge and understanding. On this premise, PISA 2021 Mathematics Literacy Framework emphasizes four content categories for assessing mathematical literacy: 1) *change and relationships*; 2) *space and shape*; 3) *quantity;* and 4) *uncertainty and data.*

In addition, PISA identified specific topics under each of the four broad content categories: 1) **Space and Shapes** has 4 specific topics; 2) **Change and Relationships** has also 4; 3) **Uncertainty and Data** has 7; and 4) **Quantity** has 5 topics. The inclusion of specific topics was also a feature in the previous PISA. However, for PISA 2021, *Geometric Approximations, Growth Phenomena*, *Decision Making* and *Computer Simulation* have been added under their respective content category. The content categories and the corresponding specific topics are shown in Table 2.1.

Table 2.1

PISA 2021 Assessment and Analytical Framework: Content Categories and Topics

PISA Content Category	Content Topic
Space and Shapes	Geometric Approximations
	Spatial Visualization
	Measurement
	Algebra
Change and Relationships	Algebraic Expressions and Functions
	Equations and Inequalities
Uncertainty and Data	Algebra in Growth Phenomena
	Relationship Between & Among Geometrical Objects
	Counting Principles
	Probability in Predicting Events
	Sampling
	Data Collection
	Measures of Central Tendency and Variability
Quantity	Making Sense of Data
	Statistics in Decision Making
	Measurement
	Estimation
	Number and Number Sense
	Numerical Trends and Patterns
	Computer Simulation on Complex Problems

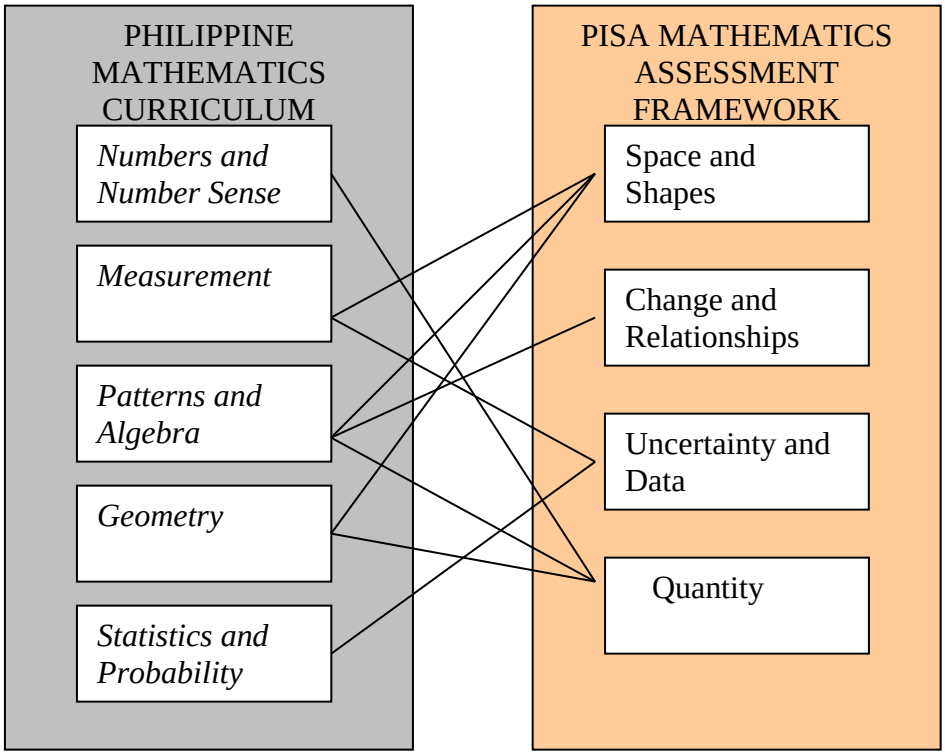
With special topics identified in PISA under each of its content categories, the link between the content standards of the Ph-MC and those in the PISA Mathematics Framework becomes evident. For instance, the **Change and Relationships** category in the PISA framework involves relations between and among geometrical objects such that changes in perimeter relate to changes in area. This means that the **Change and Relationships** strand in PISA comprises aspects of the content found in the **Number and Number Sense** and **Geometry** in the Ph-MC. Further, the two topics **Number and Number Sense** and **Measurement** both under the **Quantity** content category in PISA are exactly the two content strands in the Ph-MC. Even the topic *Number Trends and Patterns* under the **Quantity** content category in PISA is also present in the content in **Patterns** and **Algebra** in the Ph-MC. **Change and Patterns** in PISA is also found in the Ph-MC strand of **Algebra,** and both deal with concepts on variables, functions, algebraic expressions, and solution of equations. Likewise, **Geometry** in the Ph-MC can be matched with *Geometric Approximation* which is the focal point of the **Space and Shapes** content category in the PISA framework. *Geometric Approximation* deals with the attributes and properties of irregular or unfamiliar shapes and objects compared to that in the Ph-MC Geometry that basically deals with axiomatic structure of a mathematical system (defined and undefined terms, postulates and theorems) and familiar shapes. Certainly, **Uncertainty and Data** in the PISA framework is covered in **Statistics and Probability** in the Ph-MC content strand.

The points of similarities between the content standards in the Ph-MC and content categories and special topics in the PISA Mathematics Literacy Framework are presented in Figure 2.2. Clearly, there is no one-to-one correspondence between the PISA content strand categories and the strands in the Kto12 Mathematics Curriculum, however, the content categories are

generally similar in terms of subject areas and knowledge areas. As in the UNESCO Research Methodology Report (p.4), instances of alignment do not necessarily represent a 100% complete, one-to-one correspondence. On this basis, it can be said that all the content strands in the Ph-MC are aligned with the content categories in PISA Assessment Framework as shown in the following figure:

Figure 2.2

Relationship Between the Philippine Kto12 Mathematics Curriculum Content Strands and the PISA Mathematics Assessment Framework Content Categories



To further look at the degree of alignment between the PISA Mathematics Assessment Framework and the Ph-MC, the learning competencies in the Ph-MC that match the PISA content

categories were examined. Table 2.2 presents the number of learning competencies in the Ph-MC content strands in each grade level, and Table 2.3 shows how these competencies were mapped under the content categories in the PISA Mathematics Literacy Framework.

Table 2.2

*Philippines Kto12 Mathematics Framework **Content Strands** and Number of Learning Competencies*

Content Strands	Number of Learning Competencies				Total
	Grade 7	Grade 8	Grade 9	Grade 10	
Numbers and Number Sense	19	0	0	0	19
Measurement	5	0	0	0	5
Patterns and Algebra	17	33	28	21	99
Geometry	11	19	20	11	61
Statistics and Probability	12	5	0	18	35
Total	64	57	48	50	**219**

Table 2.3

Percentage of Kto12 Mathematics Competencies Aligned with PISA Content Categories

PISA Content Categories	*Grade 7*		*Grade 8*		*Grade 9*		*Grade 10*		*Total*
	Explicit	Implicit	Explicit	Implicit	Explicit	Implicit	Explicit	Implicit	
Space and Shapes	20%	3%	44%	12%	6%	0%	0%	0%	23%
Change and Relationship	44%	3%	70%	14%	42%	0%	36%	0%	53%
Uncertainty of Data	14%	0%	9%	0%	0%	0%	34%	2%	15%
Quantity	9%	5%	0%	0%	0%	0%	18%	0%	8%

The percentage of alignment shown in Table 2.3 indicates that mathematical content knowledge included in PISA 2021 is covered in the Ph-MC in varying degrees. Over-all, *Change and Relationships* as a content category in the PISA framework has the most coverage in the Ph-MC. In this study, *Coverage* is measured by the number of learning competencies that appear in the Ph-MC relative to a content category in the PISA assessment framework. As presented above, only *Change and Relationships* has more than 50% coverage in the Ph-MC and with the highest percentages for all grade levels. At the other end, *Quantity* in PISA has the least coverage in the Ph-MC. *Quantity* is the aspect of mathematical literacy that applies knowledge of number and number operations in a wide range of contexts. Further scrutiny of the curriculum guide showed that the content strands for Grades 8 and 9 include *Patterns and Algebra, Geometry, and Statistics and Probability* without *Number and Number Sense* which does not conform with the concept of "spiraling" that DepEd intended in the first place. In the PISA framework, *Algebra, Geometry, Measurement* cut across the different content categories. However, the Ph-MC does not reflect the application of Number and Number Sense in Patterns and Algebra, in Geometry, and Statistics and Probability. It should be noted that PISA does not dictate curricular requirements, nor does it tell how topics should be emphasized according to grade levels.

Space and Shapes is covered in Grades 7, 8, and 9 for a total coverage of a little more than one fifth (23%) of the total number of learning competencies. *Space and Shapes* in the PISA framework is not covered in Grade 10 Ph-MC. In PISA, *Space and Shapes* encompasses a wide range of phenomena in the world that include patterns, properties and representations of objects, interaction with real shapes, movement, displacement and even the ability to predict action in space. *Geometry* for PISA is the very foundation of *Space and Shapes*. The Ph-MC learning

competencies in Grade 10 under the *Geometry* content strand deals with key concepts like circles, coordinate geometry, rectangular coordinate plane, distance formula, proving theorems on secants, tangents, etc. Moreover, PISA sees that Geometry should deal with topics beyond those commonly discussed in a typical school Geometry.

Similarly, there is no learning competency found in Grade 9 Ph-MC for *Uncertainty and Data* as a content category in PISA Framework. It was noted that the Ph-MC does not list Statistics as a content strand in Grade 9 where Uncertainty and Data is supposed to be tackled. The PISA framework considers *Uncertainty and Data* as the heart of statistics and probability, however, it also views that knowledge of number and of aspects of algebra such as graphs and symbolic representation also contributes to solving problems. In other words, in the PISA framework, Uncertainty and Data is not only under Statistics and Probability, but also in Algebra. This view is not reflected in the Ph-MC.

In sum and on the basis of the criterion earlier set for determining the extent of alignment, we can say that the Ph-MC learning competencies have high alignment on Change and Relationships content category with the PISA framework, but with low alignment in the other three content categories: Space and Shapes, Uncertainty and Data, and Quantity.

Alignment with Specific Content Topics in Mathematical Content Knowledge

Space and Shapes

` There are four content topics listed under Space and Shapes in the PISA Mathematics Assessment Framework: *Geometric Approximations*, *Spatial Visualization*, *Measurement*, and *Algebra*. *Geometric Approximations* was not included in the previous PISA

cycles, and this is a new topic under Space and Shapes for PISA 2021.

It can be gleaned from Table 2.4 that *Geometric Approximations* has almost negligible coverage in the Ph-MC with only 0.46% learning competency in Grade 7, and none at all in Grade 8 through Grade 10. PISA sees the relevance of *Geometric Approximations* for students to apply their understanding of their conventional knowledge of space and shapes in a range of typical situations.

Table 2.4

*Coverage of PISA Content Topics under **Space and Shapes** in the Kto12 Mathematics Curriculum*

Space and Shapes	Grade 7		Grade 8		Grade 9		Grade 10		Total
	Explicit	Implicit	Explicit	Implicit	Explicit	Implicit	Explicit	Implicit	
Geometric Approximations	0.46%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.46%
Spatial Visualization	0.00%	0.46%	0.00%	0.00%	0.91%	0.00%	0.00%	0.00%	1.37%
Measurement	5.48%	0.46%	5.02%	0.00%	0.46%	0.00%	0.00%	0.00%	11.42%
Algebra	0.00%	0.00%	6.39%	3.20%	0.00%	0.00%	0.00%	0.00%	9.59%

Spatial Visualization has a very minimal coverage in the Ph-MC. Measurement and Algebra have the most number of competencies covered in the Ph-MC, but they are mostly covered only in Grade 7 and Grade 8. *Algebra* as a topic under Space and Shapes is only covered in Grade 8, and there is no learning competency in this topic in Grade 7, Grade 9, and Grade 10. This does not mean though that there is no *Algebra* in these grade levels, but rather there is no algebra applied under the content topic *Space and Shapes*. For the PISA framework, however, concepts in Algebra are applied in *Space and Shapes*. For instance, when shape changes, a point moves along a locus, therefore, function concepts come in. It cannot be denied that function

concepts are fundamental in the study of Algebra. In the PISA framework, Algebra permeates the different mathematical content and topics. This perspective is not reflected in the Ph-MC, in particular for Grades 7, 9, and 10.

Change and Relationships

The PISA Mathematics Literacy Framework included four content topics under its Change and Relationships category; namely: *Algebraic Expressions and Functions, Equations and Inequalities, Algebra in Growth Phenomena, Relationship Between & Among Geometrical Objects*.

Table 2.5 shows the number of learning competencies on content knowledge under Change and Relationships in the PISA 2021 Mathematics Literacy Assessment Framework covered in the Ph-MC.

Table 2.5

*Coverage of PISA Content Topics under **Change and Relationships** in the Kto12 Mathematics Curriculum*

Change and Relationships	Grade 7		Grade 8		Grade 9		Grade 10		Total
	Explicit	Implicit	Explicit	Implicit	Explicit	Implicit	Explicit	Implicit	
Algebraic Expressions and Functions	5.02%	0.46%	4.57%	1.37%	4.11%	0.00%	2.28%	0.00%	17.81%
Equations and Inequalities	2.74%	0.46%	8.68%	0.00%	5.02%	0.00%	1.37%	0.00%	18.26%
Algebra in Growth Phenomena	0.00%	0.00%	0.00%	2.28%	0.00%	0.00%	0.00%	0.00%	2.28%
Relationship Between & Among Geometrical Objects	5.02%	0.00%	5.02%	0.00%	0.00%	0.00%	4.57%	0.00%	14.61%

Table 2.5 shows for the content category Change and Relationships, the lowest coverage was on *Algebra in Growth Phenomena* with only 2.28% of the competencies. Noticeably,

these competencies were not even explicitly stated or even implied in the list of competencies categorized under Change and Relationships. On the other hand, *Algebraic Expressions and Functions* comprised 17.81%, and *Equations and Inequalities* with 18.26% of the learning competencies in the same content category. The wide difference in coverage may be explained by the fact that *Algebraic Expressions*, *Functions*, and *Equations and Inequalities* are the topics that involve direct knowledge on conventional Algebra as a course. On the other hand, *Algebra in Growth Phenomena* requires application of Algebra in students' understanding of natural phenomena like bacteria outbreak, flu pandemics, or threats to climate change. In such depth of application, students' knowledge of the usual linear relationship leads to better understanding and appreciation of non-linear and exponential relationships which are often seen as theoretical in the current standard curriculum. These are something new for many, but they are included in PISA 2021 Mathematics Assessment Framework. It can be seen that in the Ph-MC, *Algebra in Growth Phenomena* has the lowest coverage of competencies, almost negligible, when compared to all the other topics.

Uncertainty and Data

PISA sees the role of mathematics in explaining the variation that occurs in the world where individuals will be able to understand the presence of uncertainties and occurrence of errors in the real world they live in. This knowledge on *Uncertainty and Data* serves as the learners' anchor in drawing conclusions and making interpretations and decisions in their environment where there is uncertainty. For example, there is uncertainty in weather forecasts, health and safety, economics, gambling, and others. Table 2.6 also shows the learning competencies in PISA that are covered in the Grades 7 to 10 Ph-MC that were mapped in the PISA content topics on *Uncertainty and Data*.

Table 2.6
Coverage of PISA on Content Knowledge: ***Uncertainty and Data*** *in the Kto12 Mathematics Curriculum*

Uncertainty and Data	Grade 7		Grade 8		Grade 9		Grade 10		Total
	Explicit	Implicit	Explicit	Implicit	Explicit	Implicit	Explicit	Implicit	
Counting Principles	0.00%	0.00%	0.91%	0.00%	0.00%	0.00%	3.20%	0.00%	4.11%
Probability in Predicting Events	0.00%	0.00%	1.37%	0.00%	0.00%	0.00%	2.28%	0.00%	3.65%
Sampling	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Data Collection	0.46%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.46%
Measures of Central Tendency and Variability	1.83%	0.00%	0.00%	0.00%	0.00%	0.00%	1.83%	0.00%	3.65%
Making Sense of Data	1.37%	0.00%	0.00%	0.00%	0.00%	0.00%	0.46%	0.00%	1.83%
Statistics in Decision Making	0.46%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.46%	0.91%

It can be gleaned from Table 2.6 that only 4.11% from a total of 219 competencies across Grades 7 to 10 in the Ph-MC are mapped in the PISA content topic on *Counting Principles*. There are no competencies mapped under *Sampling*. Evidently each topic is only covered in at most two grade levels. *Counting Principles* and *Probability in Predicting Events* are only covered in Grades 8 and 10; *Measures of Central Tendency and Variability, Making Sense of Data*, and *Statistics in Decision Making* are covered in Grades 7 and 10; and *Data Collection* is covered by only one competency in Grade 7. *Statistics* is not a content strand in Grade 9 Ph-MC as earlier presented in Table 2.3.

In sum, in 35 Ph-MC learning competencies in *Statistics* that were mapped under Uncertainty and Data in the PISA assessment, 25 (71.43%) of these are mapped on *Counting Principles*, *Probability in Predicting Events*, and *Measures of Central Tendency*. *Decision Making* and *Making Sense of Data* and *Sampling* as content topics in the PISA framework have very low coverage in the Ph-MC.

Quantity

Quantity may be the most fundamental mathematical aspect in our everyday life as viewed by PISA. It is the foremost method used to describe measurements of objects and to describe their attributes. In the PISA framework, the essence of Mathematical Literacy on *Quantity* is quantitative reasoning that requires number sense, number representations, mental calculations, and reasonable estimations.

Table 2.7 shows the percentage of content knowledge under *Quantity* in the PISA 2021 Mathematics Literacy Assessment Framework covered in the Ph-MC.

Table 2.7

Coverage of PISA on Content Knowledge: Quantity in the Kto12 Mathematics Curriculum

Quantity	Grade 7		Grade 8		Grade 9		Grade 10		Total
	Explicit	Implicit	Explicit	Implicit	Explicit	Implicit	Explicit	Implicit	
Measurement	2.28%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	2.28%
Estimation	0.46%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.46%
Number and Number Sense	0.00%	0.91%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.91%
Numerical Trends and Patterns	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	4.11%	0.00%	4.11%
Computer Simulation on Complex Problems	0.00%	0.46%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.46%

It can be viewed from Table 2.7 that only a little more than 8% of Content Knowledge on *Quantity* was covered in the Ph-MC. Topics on *Measurement and Estimation* were minimally covered and in Grade 7 only, but it is explicitly included. *Numerical Trends and Patterns* were explicitly covered but in Grade 9 only. It seems quite surprising that while Quantity is fundamental and deemed essential not only by PISA, but also by other large international

assessment studies, no competencies in any topic identified under Quantity were addressed in Grades 8 and 9. A closer examination of the Ph-MC showed that learning competencies in Grades 8 and 9 focused on *Patterns and Algebra* that deal more with functions, solving equations and graphs, and Geometry on defined terms, postulates, axioms, theorems, proving statements of congruence, and proving theorems. It does not take into account how *Measurement*, *Estimation* and all others under content Quantity are applied to Algebra and Geometry. The absence of competencies for *Number and Number Sense* for Grades 8, 9, and Grade 10 in the Ph-MC is expected since this topic is only a content strand in Grade 7.

The application of computer tools in complex problems as a content topic in the PISA framework has negligible coverage in the Ph-MC. It is also noted that, upon a closer look at the Ph-MC, mathematical tools are a domain in its conceptual framework. However, this element was not reflected, explicitly or implicitly, in the list of Ph-MC learning competencies.

To summarize, on Content Strands, out of the 219 listed competencies in the Ph-MC from Grade 7 through Grade 10, there are 216 competencies that are mapped with the PISA assessment content topics. More specifically, 53% concur with assessment competencies of PISA on the category Change and Relationships; 23% concurrence related to Space and Shapes; 15% on Uncertainty and Data; and a low 8% on Quantity, indicating that the degree of alignment of the Ph-MC with the PISA Mathematics Literacy Assessment Framework varies according to content category. PISA clearly established a balance between mathematics content, processes and application. There is an equal distribution of score points in the four content categories (25 percentage per content category) with the view that all of these content domains are all important. Ph-MC revealed a high degree of imbalance of emphasis on content relative to the PISA

standards where percentage of coverage as seen above ranged from 53% to 8%.

Alignment on Mathematical Processes

For learners to be mathematically literate, they should be able to use the different Mathematical Content Knowledge to solve problems in real life situations through mathematical models. For PISA, the process of coming up with an accurate representation of real word problems requires Mathematical Reasoning which is central to the problem solving processes. These processes include: 1) Formulating; 2) Employing; and 3) Interpreting and Evaluating. As defined by PISA (OECD, 2019), the *formulating* process indicates how effectively students are able to recognize and identify opportunities to use mathematics in problem situations and then provide the necessary mathematical structure needed to formulate that contextualized problem into a mathematical form; the *employing* process indicates how well students are able to perform computations and manipulations and apply the concepts and facts that they know to arrive at a mathematical solution to a problem formulated mathematically; and the *interpreting* process indicates how effectively students are able to reflect upon mathematical solutions or conclusions, interpret them in the context of a real-world problem, and determine whether the results or conclusions are reasonable.

Table 2.8 shows the extent of coverage of the PISA 2021 in the Ph-MC in the domain of Mathematical Process in the Problem Solving Cycle.

Table 2.8

*PISA Mathematical Processes in the **Problem Solving** Cycle vis-à-vis the Kto12 Mathematics Curriculum*

PISA Competencies	Grade 7		Grade 8		Grade 9		Grade 10		Total
	Explicit	Implicit	Explicit	Implicit	Explicit	Implicit	Explicit	Implicit	
Reasoning	46	19	82	22	17	20	70	10	286
Formulating	24	18	19	4	11	6	28	20	130
Employing	53	9	50	5	16	3	51	9	196
Interpreting and Evaluating	1	7	4	5	3	10	18	10	58

Since *Reasoning* is central to Problem Solving, it is expected to have the most number of competencies covered in the Ph-MC, and this is because *Reasoning* is fundamental to *Formulating*, *Employing*, and *Interpreting and Evaluating*. There are more learning competencies on *Employing* than on *Formulating* across grade levels because may be in *Employing,* the learners are expected to use established procedures and algorithms. Given this, more learning competencies in the Ph-MC are linked to *Employing* in the PISA assessment framework. For instance, *"Solve quadratic inequalities"*, "*Graph a quadratic function*", and "*Simplify expressions with rational exponents"* are mapped in *Employing* because all these involve implied computation and applying rules and procedures. There are less learning competencies mapped under *Formulating,* and much less on *Interpreting and Evaluating*, with *Interpreting and Evaluating* having the least competencies covered in the Ph-MC.

It can be further gleaned from Table 2.8 that the numbers in the cells are high compared to those in the previous frequency tables. This could be because one learning competency stated in the Ph-MC was mapped to two or more competencies in the PISA

Framework. It is interesting to note that while the PISA Framework is expected to contain broader and more general domains and constructs, in this particular case, it was the other way around. This may be explained by the fact that central to the PISA framework is *Mathematical Reasoning* and *Problem Solving,* and being faithful to its goal, it gave attention to the specific cognitive processes in problem solving and mathematical reasoning. Thus, a learning competency in the Ph-MC can cover multiple competencies or a range of process skills when mapped against the PISA Framework. As an example, the learning competency "*Solve verbal problems, involving..."* is very common in the Ph-MC and stated in too general terms, while PISA statements are more explicit and specific to mathematical problem solving processes like: " *identify the key variables in the problem*", "*select a representation appropriate to the problem*", "*identify the mathematical aspects of the problem*", "*translate a problem to a mathematical representation or algorithm*", among others. With that, it was assumed that a learning competency in the Ph-MC written as "*solve verbal problems involving*…." in specific content also includes competency on formulating, employing, and reasoning, and these were added to the counts. In other words, one learning competency in the Ph-MC is entered in three PISA categories. Therefore, caution should be observed in the interpretation of cell entries in Table 2.8.

The PISA Mathematics Literacy Framework also identified more specific mathematical processes learners should be able to perform and manifest when they do problem solving. Table 2.9. to 2.12 present how these important processes are covered in the Ph-MC.

Reasoning

PISA views that for learners to be mathematically literate, they should be able to utilize their Mathematical Content

Knowledge to transform real life problems into a well-defined mathematical model to solve problems, and Mathematical Reasoning is central to the problem solving processes.

Table 2.9 shows 18 competencies under Reasoning in the PISA mathematics assessment framework that are covered in the Ph-MC. The rows that are shaded darkest are those competencies that are most covered in the Ph-MC, followed by those with lighter shading signifying moderate to minimal coverage, and then the unshaded rows are those learning competencies with the least coverage.

Formulating

In the PISA Mathematical Literacy Framework, *Formulate* refers to learners' ability to use content knowledge in defining the mathematical structure of a problem presented in a contextualized situation. In *Formulating*, students extract the essential mathematics in a given contextualized problem, analyze, set the mathematical model, and solve the problem.

Table 2.10 shows the matrix of competencies related to *Formulating* listed in the PISA Mathematics Literacy Framework and the extent of coverage in the Ph -MC. The same color coding used earlier is applied. As presented in Table 2.10, *Recognizing mathematical structure* (including regularities, relationships, and patterns) *in problems or situations* and *Translating a problem into a standard mathematical representation or algorithm* are the competencies in PISA mostly covered in the Ph-MC. On the other hand, *Simplifying or decomposing a situation or problem for further analysis* and *Identifying the constraints, assumptions, simplifications in a mathematical model* are the two least covered competencies in the Ph-MC. Again, these least covered competencies in the Ph-MC are higher order thinking processes in *formulating* as defined by PISA.

Table 2.9

*Competencies Under **Reasoning** in the PISA Mathematics Framework vis-à-vis the Kto12 Mathematics Curriculum*

Expected Student actions for Mathematical Reasoning (PISA Mathematics Assessment Framework)	Number of Competencies in Ph-MC	Description
Utilize definitions, rules and formal systems as well as employing algorithms and computational thinking	66	mostly covered
Understand definitions, rules and formal systems as well as employing algorithms and computational reasoning	64	mostly covered
Select an appropriate justification	26	mostly covered
Draw a simple conclusion	23	moderately covered
Provide a justification for the processes and procedures used to determine a mathematical result or solution	21	moderately covered
Explain why a mathematical result or conclusion does, or does not, make sense given the context of a problem	18	moderately covered
Reflect on mathematical arguments, explaining and justifying the mathematical result	17	moderately covered
Explain or defend a justification for the processes and procedures or simulations used to determine a mathematical result or solution	10	least covered
Reflect on mathematical solutions and create explanations and arguments that support, refute or qualify a mathematical solution to a contextualized problem	10	least covered
Analyze similarities and differences between a computational model and the mathematical problem that it is modeling	5	least covered
Explain how a simple algorithm works and to detect and correct errors in algorithms and programs	5	least covered
Explain and defend a justification for the identified or devised representation of a real-world situation	4	least covered
Interpret a mathematical result back into the real-world context in order to explain the meaning of the results	4	least covered
Represent a problem in a different way, including organizing it according to mathematical concepts and making appropriate assumptions	3	least covered
Identify the limits of the model used to solve a problem	3	least covered
Provide a justification for the identified or devised representation of a real-world situation	3	least covered
Critique the limits of the model used to solve a problem	2	least covered
Explain the relationships between the context-specific language of a problem and the symbolic and formal language needed to represent it mathematically.	2	least covered

Table 2.10

*Competencies Under **Formulating** in the PISA Mathematics Framework vis-à-vis the Kto12 Mathematics Curriculum*

Expected Student actions for Formulating (PISA Mathematics Assessment Framework)	Number of Competencies in Ph-MC
Recognize mathematical structure (including regularities, relationships, and patterns) in problems or situations	26
Read, decode and make sense of statements, questions, tasks, objects or images to create a model of the situation	14
Translate a problem into a standard mathematical representation or algorithm	14
Recognize aspects of a problem that correspond with known problems or mathematical concepts, facts or procedures	13
Select a mathematical description or a representation that describes a problem	12
Select a representation appropriate to the problem context	12
Use mathematical tools (using appropriate variables, symbols, diagrams) to describe the mathematical structures and/or relationships in a problem	9
Identify the key variables in a model	8
Identify and describe the mathematical aspects of a real-world problem situation including identifying the significant variables	7
Apply mathematical tools and computing tool to portray mathematical relationships	7
Simplify or decompose a situation or problem in order to make it amenable to mathematical analysis	4
Identify the constraints, assumptions, simplifications in a mathematical model	4

Employing

In Mathematical Literacy, *Employing* refers to the application of mathematical concepts, reasoning, and procedures to real life problems by formulating or modeling to solve problems and consequently draw conclusions. This involves performing symbolic manipulations, arithmetic computations, and algorithms. More specific actions in employing are listed in Table 2.11 which shows the number of competencies in *Employing* as a Mathematical

Process as defined in PISA 2021 and the extent of their coverage in the Ph-MC. Again, the rows that are highlighted green and orange are the most and least covered in the Kto12 Mathematics curriculum, respectively.

Table 2.11

*Competencies Under **Employing** in PISA Mathematics Framework vis-à-vis the Kto12 Mathematics Curriculum*

Expected Student actions for Employing (PISA Mathematics Assessment Framework)	Number of Competencies in Ph-MC	Description
Perform a simple calculation	79	Mostly covered
Understand and utilize constructs based on definitions, rules and formal systems including employing familiar algorithms	18	Moderately covered
Implement a given strategy to determine a mathematical solution	16	Moderately covered
Make generalizations based on the results of applying mathematical procedures to find solutions	14	Moderately covered
Make mathematical diagrams, graphs, constructions or computing artifacts	12	Moderately covered
Select an appropriate strategy from a list	10	Least covered
Develop mathematical diagrams, graphs, constructions or computing artifacts and extracting mathematical information from them	9	Least covered
Use a multi-step procedure leading to a mathematical solution, conclusion or generalization	9	Least covered
Manipulate numbers, graphical and statistical data and information, algebraic expressions and equations, and geometric representations	8	Least covered
Make sense of, relate and use a variety of representations when interacting with a problem	8	Least covered
Articulate a solution, showing and/or summarizing and presenting intermediate mathematical results	6	Least covered
Use mathematical tools, including technology, simulations and computational thinking, to help find exact or approximate solutions	3	Least covered
Switch between different representations in the process of finding solutions	2	Least covered
Use an understanding of the context to guide or expedite the mathematical solving process, e.g. working to a context-appropriate level of accuracy	2	Least covered

Table 2.11 shows the competency in Performing *a simple calculation* under the Mathematical Process *Employing* in the PISA framework, and this shows a wide margin as the most addressed

competency in the Ph-MC. This means that relative to other competencies listed in PISA, *Performing simple computation* is given much more focus in the Ph-MC. This is not surprising since performing simple computations is a given in mathematics. Furthermore, in the Ph-MC document, learning competency that entails computation like *determine*, *find*, *compute*, *solve* are all mapped under *Performing simple computation*. Ph-MC did not include many more specific actions for *Employing* processes which are clearly specified in the PISA Mathematics Framework such as "*make sense of*", "*articulate*" "*identify constraints*", and others reflected in the above table. Learning competencies that deal with the use of mathematical tools, switching in different representations and use of context to solve problems are hardly visible in the Ph-MC document.

Interpreting and Evaluating

In Mathematical Literacy, the process of *Interpreting and Evaluating* refers to the ability of learners to reflect on the answers derived from word problems. It involves interpreting results in the context of real life problems, and being able to justify these results within real life constraints. This mathematical process also involves communicating explanations and arguments related to the outcomes of the problems solved.

Table 2.12 shows the number of competencies under the Mathematical Process *Interpreting and Evaluating* in the PISA Mathematics Literacy Framework covered in the Ph-MC. As shown in Table 2.12, *Interpreting and Evaluating* is not sufficiently covered in the Ph-MC. Interpreting and Evaluating are higher level processes in the problem solving cycle and yet, the figures reveal that thinking processes that should develop students' ability to interpret and evaluate are the least covered competencies in the Ph-MC indicating that development of higher order thinking skills is not given more importance and emphasis in the curriculum.

Table 2.12

*Competencies Under **Interpreting and Evaluating** in the PISA Mathematics Framework vis-à-vis the Kto12 Mathematics Curriculum*

Expected Student actions for Interpreting (PISA Mathematics Assessment Framework)	Number of Competencies in Ph-MC	Description
Construct and communicate explanations and arguments in the context of the problem	18	Moderately covered
Identify whether a mathematical result or conclusion does, or does not, make sense given the context of a problem	10	Least covered
Understand the relationship between the context of the problem and representation of the mathematical solution. Use this understanding to help interpret the solution in context and gauge the feasibility and possible limitations of the solution	9	Least covered
Interpret a mathematical result back into the real world context	6	Least covered
Identify the limits of the model used to solve a problem	6	Least covered
Recognize [demonstrate, interpret, explain] the extent and limits of mathematical concepts and mathematical solutions	5	Least covered
Interpret mathematical outcomes in a variety of formats in relation to a situation or use; compare or evaluate two or more representations in relation to a situation	3	Least covered
Use knowledge of how the real world impacts the outcomes and calculations of a mathematical procedure or model in order to make contextual judgements about how the results should be adjusted or applied	1	Least covered
Use mathematical tools or computer simulations to ascertain the reasonableness of a mathematical solution and any limits and constraints on that solution, given the context of the problem	0	Least covered

From Tables 2.9 to 2.12, it is evident that the PISA Mathematics Assessment Framework gives emphasis on mathematical processes in problem solving and reasoning, and each phase of the problem solving cycle is of equal importance as reflected in the approximate equal weighting of 25 percentage score points in each process.

In sum, similar to the results in the Content category, there appears an imbalance in the emphasis given to the different mathematical processes which are important in PISA. In the Ph-MC the least emphasis is given to higher order thinking skills. The results showed that *Reasoning* has 18 competencies, with a frequency ranging from 2-66; *Formulating* with 12 competencies and a frequency from 4-26; *Employing* with 14 competencies and a frequency from 2-79; and *Interpreting and Evaluating* with 9 competencies and a frequency from 0-18.

Alignment on Contexts

An important domain in both the PISA Mathematics Literacy Framework and the Ph-MC documents is Context. PISA recognizes the importance of context, and gives it a major role in the assessment of mathematical literacy. From the perspective of PISA, seeing the context in which a problem arises is the key for learners to develop a model in solving a given problem. Contexts are wide and varied to cover different situations in which individuals operate in this global world.

PISA 2021 Mathematics Literacy Framework identified four context categories: 1*) Personal*- those problems dealing with situations related to one self, one's family or one's peer group. Some examples are food preparation, shopping, health, recreation and games and sports, travel, finance, all on a personal level; 2) *Occupational* – situations that individuals may encounter in their world of work from unskilled work to the highest professional level of occupation, e.g. measuring, costing on construction materials, accounting and payroll, scheduling and inventory, architectural designing - situations that entail job-related decision making; 3) *Societal*- problem situations in community where the learners belong—local, national or global. Some cited examples in PISA include public transport, voting

systems, demographics, health, government policies, economics, entertainment and national statistics; 4) *Scientific*- problems that relate to the application of mathematics to the natural world and the issues linked to science and technology. PISA listed the problems that deal with weather, climate, ecology, medicine, space science, genetics, measurement and others in the world of mathematics.

The Ph-MC conceptual framework has this statement about Context:

> We define context as a locale, situation, or set of conditions of Filipino learners that may influence their study and use of mathematics to develop critical thinking and problem solving skills. Contexts refer to beliefs, environment, language and culture that include traditions and practices, as well as the learner's prior knowledge and experiences (Department of Education, 2016 p. 3).

Given this, the Ph-MC document apparently failed to define beliefs, environment, language and culture, and prior knowledge and experiences as the sub-domains of Context.

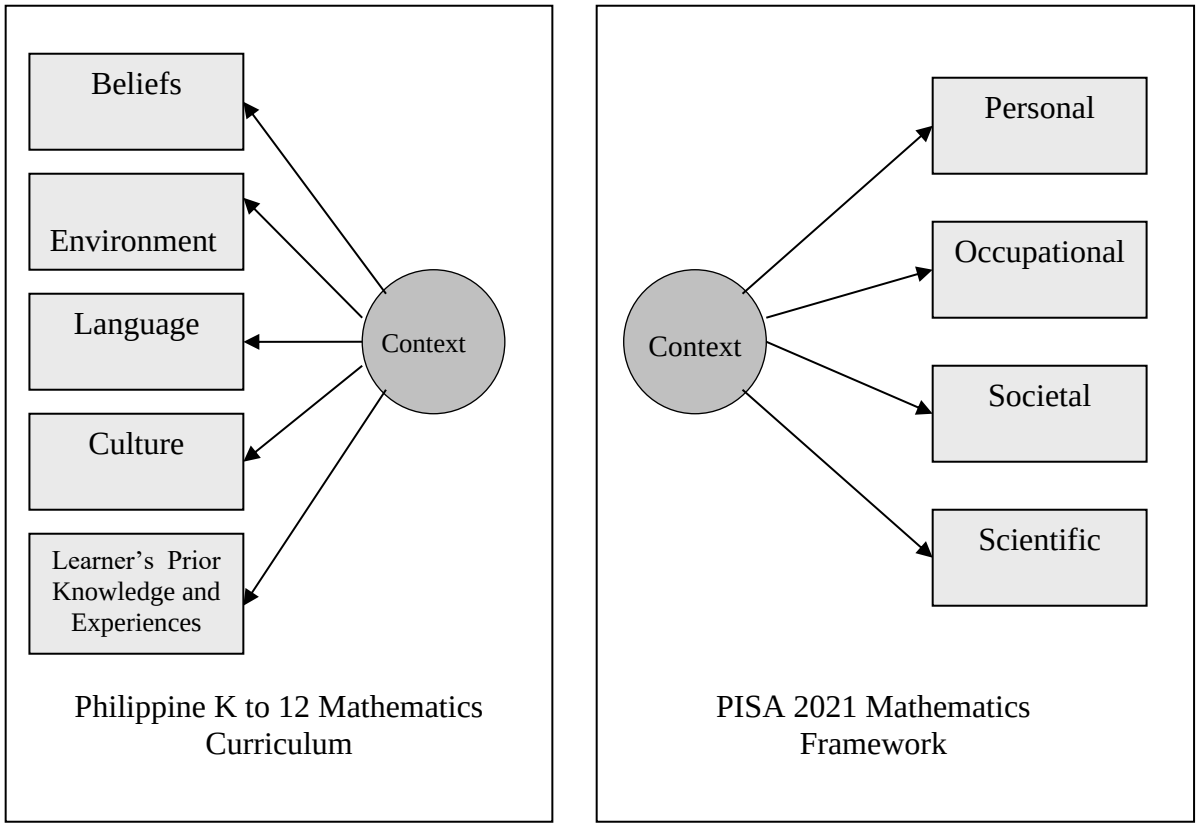
Figure 2.3 presents the comparison of the PISA Mathematics Literacy Framework and the Kto12 Mathematics Curriculum on the Context domain. It is evident that the two frameworks differ in the Context domain. This does not seem surprising as problem contexts in the two frameworks may have been conceptualized according to different perspectives, purpose, and principles.

A very important aspect of the mathematics literacy construct is on developing learners' ability to *use* and *do* mathematics in different situations. For PISA, the closest situation is the students' personal life, work life, community and social life, and scientific situations in that order. The PISA document mentions about dealing with problem situations like flu pandemics

and bacterial outbreaks, climate change on topics under *Growth Phenomena*, perspectives in painting, creating and reading maps under *Space and Shapes*, finding the right amount of carpeting in a building under *Geometric Approximation*, making economic predictions, analyzing poll results and weather forecasting under *Uncertainty and Data.* In addition, the PISA document illustrates sample assessment items that are embedded in situations like savings, navigation, tilings, smartphone use, and purchasing decisions. These real life situations may be mapped in at least one of these context factors - personal, occupational, societal, or scientific.

Figure 2.3

Comparison of Philippine K to 12 Mathematics Curriculum and PISA 2021 Mathematics Framework on Context Domain



On the other hand, the Ph-MC document does not show clear evidence on how contexts are written in the conceptual framework diagram. The most common statement where one can draw that element of context is on a learning competency like: "*Solve problems involving [e.g. equations and inequalities, variation, quadratic equations, quadratic inequalities, quadratic functions, parallelograms, trapezoids and kites, triangle similarities* and other general content topic]. Even then, the "*solve problem*" competency does not explicitly define the specific problem situations to mirror the contexts where a mathematical problem is embedded.

Overall, the PISA Mathematics Framework and the Ph-MC have very different Context factors. The PISA framework considers that mathematics problems should be contextualized in the different aspects of life - personal, occupational, societal, and scientific or life situations should be embedded in the Content domain. In the Ph-MC, context was not seen explicitly embedded neither in content knowledge nor in mathematical processes.

CONCLUSIONS AND RECOMMENDATIONS

In light of the above findings, the following conclusions are made:

1. The comparison of the PISA Mathematics Literacy Framework with the Philippine Kto12 Mathematics Framework showed that both frameworks address many of the same aspects of mathematics indicating that, on the whole, there is a high degree of alignment between the two frameworks on content, but the degree of alignment varies across the PISA content topics.

2. On problem solving and reasoning, the results showed that the Kto12 Mathematics Curriculum has very minimal explicit

coverage for higher mathematical processes and mathematical reasoning. In other words, the curriculum does not emphasize contextualization of mathematical results to real life problems that will require students to reason, interpret and evaluate at a higher level.

3. The Context domain was viewed differently in the PISA Mathematics Literacy Framework and in the Philippine Kto12 Mathematics Curriculum Framework. The curriculum, for its part, does not clearly define context factors such as beliefs, environment, language and culture, and learners' prior experience.

4. On the observed gaps between the Kto12 Mathematics Curriculum and the PISA Mathematics Literacy Framework, the widest gap noted was on **Content -** *Quantity*, followed by *Uncertainty and Data,* and *Space and Shapes.* Since PISA considers giving equal emphasis on *Change and Relationships*, *Space and Shapes*, *Uncertainty and Data*, and *Quantity*, the results seem to imply that students will more likely experience difficulty in dealing with assessment items related to the last three content areas and with those assessment items applying algebra in growth phenomena. In the Process domain, the Ph-MC gap was observed in the higher level reasoning processes and in *Interpreting and Evaluating*.

Based on the results of the study, some implications are drawn to offer the following recommendations:

1. PISA has presented a different perspective on how mathematical content knowledge is structured and organized to understand mathematical content that is evidently different from the typical content strands used in school mathematics curriculum. This study recommends a curriculum review to be conducted by teachers, curriculum

developers and designers, and school administrators to improve the content of the Kto12 Mathematics Curriculum in terms of its purpose, relevance and functionality to address present and future challenges in Mathematics education and international assessment standards. Since DepEd has adopted in the Kto12 framework for Mathematics the "spiral curriculum," the need to reexamine the continuum of mathematics content across strands and grade levels becomes imperative to emphasize those competencies that are mapped with the content categories in the PISA Mathematics Literacy Framework.

2. The review of the two documents revealed that the majority of the learning competencies in the Kto12 Mathematics Curriculum Guide do not articulate the important mathematical processes that can define Critical Thinking and Problem Solving which are the core of PISA Mathematics Literacy Framework**.** The PISA Mathematics Literacy Framework indicates competencies on more specific cognitive processes for problem solving and mathematical reasoning. If we consider PISA to be our benchmark, there is a need then to review the Kto12 learning competencies in Mathematics for Grades 7 to 10 and be explicit on the specific level of cognitive processes students need to develop critical thinking and problem solving skills.

3. PISA 2021 has strongly articulated that its focus is on problems that are beyond the situations typically encountered in the school classroom, and it has translated this view in its four context categories - personal, occupational, societal, and scientific. For its part, the Kto12 Mathematics Curriculum identified *beliefs,* l*anguage*, *culture, environment,* and *students' previous learning experiences* as contexts in developing Critical Thinking and Problem Solving skills, but failed to embed these constructs

in content and processes. For curriculum developers and curriculum writers, there is a need to revisit the conceptual framework of the Ph-MC to clearly define the context factors and see how these factors can be embedded in the Ph-MC competencies as this may help in enhancing the present curriculum in terms of depth of content and breadth of application of mathematical content in local and global life settings.

4. PISA has listed new topics that are not typical in school mathematics - pandemics, bacterial outbreaks, climate change, weather forecasting, financial predictions, poll results, use of GPS, and even machine learning software in mathematics. If the Philippine Mathematics education recognizes that these are important content topics in and equally relevant to the mathematics curriculum, there is a need to implement a continuing development program to upgrade teachers' content knowledge and to develop textbooks, modules, and other forms of learning material to deepen teachers' pedagogical content knowledge and assessment practices to improve quality of outcomes in basic Mathematics education. All these efforts entail collaborative work with *training providers* (e.g. teacher-training institutions), *textbook publishers, and other stakeholders* to support the needed intervention programs.

5. Curriculum reforms, that stem from large-scale international assessment like PISA, need to be supported, needless to say spearheaded, by DepEd and policy makers so the needed reforms can be appropriately and promptly implemented.

6. There maybe a need to seriously revisit the new Teacher Education Curriculum in Mathematics to see how more specific content areas and topics in the PISA Mathematics

Framework are covered in the pre-service teacher education curriculum.

REFERENCES

Breakspear, S. (2012). *The policy impact of PISA: An exploration of the normative effects of international benchmarking in school system performance*. (OECD Education Working Papers, No. 71). OECD Publishing. Retrieved from http://dx.doi.org/10.1787/5k9fdfqffr28-en.
Department of Education (2019). *PISA 2018 National Report of the Philippines*.

Department of Education (2016). *K to 12 Curriculum Guide in Mathematics*. deped.gov.ph.

Gal, I. & Tout, D. (2014). *Comparison of PIAAC and PISA Frameworks for Numeracy and Mathematical Literacy*. OECD Education Working Papers, No. 102, OECD Publishing. http://dx.doi.org/10.1787/5jz3wl63cs6f-en

Houang, R.; Schmidth, W. (2008). TIMSS International Curriculum Analysis and Measuring Educational Opportunities. https://www.researchgate.net/publication/268395948

Ludvigsen, S. (2016). Comparative studies of the Nordic countries: implications for education policy, *Northern Lights on PISA and TALIS*. Nordic Council of Ministers. Rosendahls Schultz-Grafisk.Denmark

Metzler, M. (2005). *Instructional models for physical education* (2nd ed.). Scottsdale, AZ: Holcomb Hathway.

Nortvedth, G., Ludvigsen, S. et al (2016). *Northern Lights on PISA and TALIS*. Nordic Council of Ministers. Rosendahls Schultz-Grafisk.Denmark

OECD (2014), *Lessons from PISA for Korea*, Strong Performers and Successful Reformers in Education, OECD Publishing. *http://dx.doi.org/10.1787/9789264190672-en*

OECD. (2014a). PISA tri-fold brochure. Retrieved from http://www.oecd.org/pisa/aboutpisa/PISA-trifold-brochure-2014.pdf.

OECD (2019). PISA 2018 Results (Volume I): What Students Know and Can Do, PISA, OECD Publishing, Paris. https://doi.org/10.1787/5f07c754-en.

OECD (2019). *PISA 2018 Assessment and Analytical Framework*. PISA, OECD Publishing, Paris, https://doi.org/10.1787/b25efab8-en.

OECD (2018). *PISA 2021 Mathematics Framework (Draft).* https://pisa2021maths.oecd.org/files/PISA%202021%20Mathematics%20Framework%20Draft.pdf

Roach, A. T., Niebling, B. C., & Kurz, A. (2008*). Evaluating the alignment among curriculum, Instruction, and assessments: Implications and applications for research and practice, Psychology in the Schools,* 45, 158-176

UIS-PISA Framework Alignment: Methodology and Results: UNESCO Research Report http://gaml.uis.unesco.org/wp-content/uploads/sites/2/2018/10/4.1.1_17_MATH_GCF

Seitz, P. (2017). Curriculum Alignment Among the Intended, Enacted and Assessed Curricula for Grade 9 Mathematics Journal of the Canadian Association for Curriculum Studies (JCACS) 15(1)

Shivraj, P. (2017). Evaluating the (mis)alignment of the intended to the assessed curriculum for the U.S.: Implications for the common core state standards for mathematics. International Journal of Education in Mathematics, Science and Technology, 5(4), 333-347. DOI:10.18404/ijemst.18375

Vockley, M., & Lang, V. (2009). Alignment and the states: Three approaches to aligning the National Assessment of Educational Progress with state assessments, other assessments, and standards. Reston, VA: Council of Chief State School Officers.

About the Authors

Dr. Evangeline F. Golla is a professor in mathematics education, statistics, and research and evaluation. She served the Philippine Normal University in various capacities such as Vice President for Planning, Research and Extension, Dean of the College of Science, Head of the Graduate School Science and Mathematics Education Department, and Research Coordinator, College of Graduate Studies. She has led research projects in science and mathematics education, information and technology education, and assessment at the institutional, national and international level including the Teacher Education and Development Study in Mathematics (TEDS-M) of the International Association for Evaluation of Educational Achievement (IEA). She has earned her doctorate degree in Educational Research and Evaluation at the University of the Philippines and a recipient of DAAD University Staff Development Training Program in Germany.

Dr. Allan G. Reyes has been a Senior Program Manager at the Research Center for Teacher Quality (RCTQ) at the Philippine Normal University (PNU) for 3 years. As SPM, he worked closely with the Department of Education in improving teacher quality in the country. He is a Mathematics teacher in PNU for more than 13 years. He graduated top of his class from Mapua Institute of Technology with a degree of Bachelor of Science in Civil Engineering. He earned his Doctor of Philosophy in Mathematics at De La Salle University.

Chapter 3

PISA 2018 Science Framework vis-a-vis the Philippine Kto12 Science Curriculum

Rosario M. Belmi[1] and Glen R. Mangali[2]
[1]Philippine Normal University, Manila
[2]Colegio De San Juan De Letran, Manila

Abstract

The research focused on the analysis of the Kto12 Science Curriculum for Grades 7 to 10 vis-a-vis the PISA 2018 Science Framework to examine the degree of alignment and identify possible gaps on the knowledge domains (content, procedural and epistemic), scientific literacy competencies, and levels of cognitive demand. Descriptive Research Design was used employing qualitative and quantitative methods. Statistical tools used include mean average, frequency and percentages. The mapping process involved analysis of the content and performance standards and the learning competencies in the Kto12 Science Curriculum vis-a-vis the components of PISA 2018 Science framework which are knowledge domain, scientific literacy competencies and level of cognitive demand. Collaborative validation of the results of the mapping was done to confirm initial analysis. Findings revealed that PISA 2018 Scientific Literacy Assessment Framework is closely similar to the Kto12 Science Curriculum in terms of content and knowledge domains, scientific learning competencies and levels of cognitive demand. The identified gaps were limited to a few topics in Earth and Space Systems that were not explicitly included in the curriculum content. Finally, the content topics and learning competencies were not proportionately and appropriately distributed across grade levels and in consideration of the cognitive demand expected of a learner. The unpacking of the curriculum to consider the findings of this study is recommended.

Keywords: *alignment, curriculum mapping, competencies, gaps, PISA results*

INTRODUCTION

The World Bank's Strategy 2020 (World Bank, 2011) aims to promote country-level reforms of education systems to achieve "learning for all." This emphasis on education quality and learning outcomes has led to increased interest in and demand for national, regional and international large-scale learning assessment (OECD, 2015). One such large-scale learning assessment is the Programme for International Student Assessment (PISA) participated in by both developed and developing countries. PISA provides baseline data to these participating countries who wish to know how they performed in the assessment including their rank using global standards. Many countries use PISA and other comparative international assessment to see the bigger picture and understand the context of national performance. In this way, stakeholders such as parents, students, teachers, government and the general public can be informed of the state of education in the country with respect to its quality, educational outcomes and learning opportunities (Roser & Ortiz-Ospina, 2020).

The Philippines, for the first time, participated in PISA 2018 with the primary goal of gauging the quality of education in the country to support its efforts towards globalization of educational standards (DepEd, 2019). PISA 2018 also known as the seventh PISA cycle was participated in by 600,000 students from 79 countries and was delivered through a two-hour computer assessment test. It covers three fundamental domains: Reading Literacy, Mathematics Literacy, and Scientific Literacy. As PISA adds one innovative domain in every test cycle, in 2018 the innovative domain was global competence. Learners aged 15 years old from different participating countries were sampled in this test. In the Philippines, the 15-year old learners from Grades 9 and 10, some in junior and senior high school, were randomly selected to take part in the test.

On its first attempt to participate in PISA, the Philippines scored 357 in Science Literacy, which placed the country second from the bottom similar to that in mathematics literacy (with 353 points), and in Reading Literacy (with 340 points), the country ranked last among 79 participating countries. As referred to in the PISA 2018 National Report of the Philippines (DepEd, 2019), one possible attribution of the result of the Philippine ranking in PISA 2018 is the low expenditure allocated per student and the students' lack of readiness to answer computer-based tests. The expenditure per student in the Philippines is 90% lower than that of the OECD average and the lowest among all PISA participating countries (OECD, 2019b). According to Tienken (2017), test results decrease when poverty increases. In addition, it was also noted in the PISA 2018 results that socio-economic status was a strong predictor of performance in mathematics and science in all PISA participating countries. Particularly in the Philippines, the socio-economic status of the student takers in PISA 2018 could be a factor in the 14% variation of their science performance which is 1% higher than that of the OECD average variation. Data from the Philippine Statistics Authority in 2018 (Full Year Poverty Statistics) showed that the coefficient of variation of 2018 provincial poverty incidence among families is greater than 20%.

Another factor that may be attributed to the low PISA ranking of the Philippines is the mode of test administration. The PISA 2018 assessment was facilitated through a computer-based test to be accomplished in two hours. Science examinations requiring decomposition or partitioning are apparently difficult to answer via the computer. Still another study on the implication of computer-based assessment in large-scale testing revealed that anxiety levels of students increase when they know that they are being monitored while using computers in answering tests. As explained by Scheuermann and Bjornsson (2009), if unmotivated students are told that they are underperforming based on the

monitoring done and are encouraged to improve, they turn out to show better performance. Comparatively, students who are motivated from the very start and are informed not performing based on the monitoring done show poor performance instead.

Apart from the above-mentioned attributions, this present study assumes that the implemented Kto12 Curriculum, specifically for Grades 7 to 10, when examined vis-a-vis the PISA 2018 Science Framework, could explain the below par performance of Filipino learners in PISA 2018. To carry out this purpose, this study proposed a mapping of the content, competencies and standards of the Kto12 Curriculum against the content, knowledge domains, competencies and cognitive demand of PISA 2018 Science Framework. This research hopes that by using the pertinent data on cross-national assessment in scientific literacy, quality information may be provided to inform the Philippine government and private funding institutions to work together in improving the education system in the country and science education in particular. Specifically, the results of this mapping will hopefully provide baseline data to guide the Department of Education (DepEd) and the Commission on Higher Education (CHED) in addressing issues on curriculum alignment and the quality of teacher education in the country.

This research focuses on one of the domains of assessment - **scientific literacy**. Within the concept of scientific literacy, both broad and applied knowledge in science are covered (Berman & Kuden, 2017). In PISA, scientific literacy articulates the use of real-life context which may highlight conceptual understanding comprising common procedures and practices in science and how these enable science to advance. Hence, a person who is scientifically literate is able to understand major science concepts and ideas, derive scientific and technological knowledge and justify various evidences and its theoretical foundation (OECD,

2019). This is the reason why many researchers believed that scientific literacy should be one of the key competencies that an individual must have (National Research Council [NRC], 2012; National Academy of Engineering [NAE], 2014; and Pearson, Moje, & Greenleaf, 2010). It is in this light that the present study focused on analyzing the Kto12 Science Curriculum in the Philippines vis-à-vis the PISA 2018 Science Framework.

Research Objectives

The study was conducted to analyze the Kto12 Science Curriculum for Grades 7 to 10 vis-a-vis the PISA 2018 Science Framework. Specifically, it aimed to accomplish the following objectives:

1. determine the degree of alignment of the Philippine Kto12 Science curriculum for Grades 7 to 10 with the PISA 2018 Science Framework in terms of the following: knowledge domains (content, procedural and epistemic); scientific literacy competencies; and levels of cognitive demand.

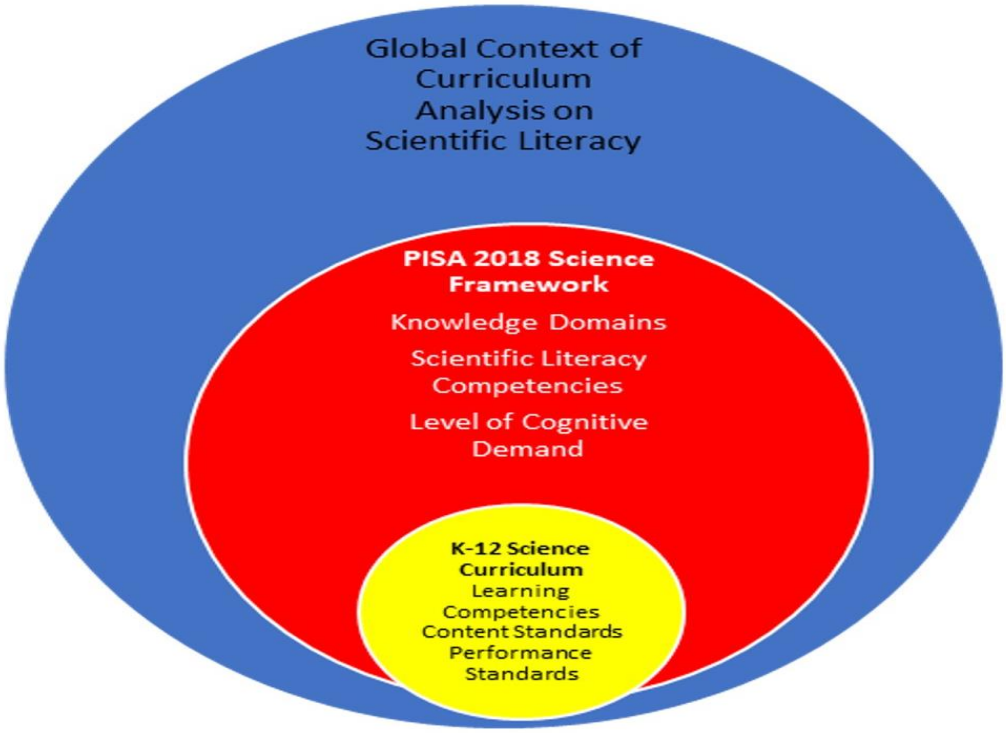
2. identify the gaps in the Kto12 Science Curriculum for Grades 7-10 vis-a-vis the PISA 2018 Science Framework.

Conceptual Framework

Curriculum evaluation is an inevitable part of a continuous cycle in curriculum development. It usually comes last after planning, designing and implementing, considering a four-step process. Evaluating the implemented curriculum is aimed at providing substantial feedback on how well the framework addresses its intended goals of scientific, technological and environmental literacy over and above the main objective of affecting student learning. This study, with the view of providing inputs to curriculum evaluation, made use of the PISA 2018

Science Framework as a basis to map the existing Philippine Kto12 Science Curriculum for Grades 7 to 10. Figure 3.1 presents the conceptual model of the study as an overview of the frameworks and concepts used in this research.

Figure 3.1
Conceptual Model of the Study



The PISA 2018 Science Framework spells out the competencies and knowledge in specific contexts in terms of their relevance to the interests and lives of a 15-year old learner in which scientific literacy has a particular value and that which can inform development of public policy. Since the framework concerns this age group of learners, only the Kto12 Science curriculum for Grades 7 to 10 was considered for mapping, but at the same time taking into account the spiral approach of the curriculum. The framework presents three domains of knowledge

- **content**, **procedural**, and **epistemic**. Table 3.1 presents how these three domains of knowledge coincide with the levels of cognitive demand and major groups of scientific literacy competencies in the PISA 2018 Science Framework.

Table 3.1

Matrix of the Major Components of the PISA 2018 Science Framework

Domains of Knowledge	Levels of Cognitive Demand	Scientific Literacy Competencies
Content knowledge of facts, concepts, ideas and theories of the physical, the living and the earth and space systems (Duschl, 2008)	1) Low-Level include tasks that involve: - simple recall - one-step procedure -locating a single information from a graph or table. 2) Medium-Level include tasks that involve: - use and application of conceptual knowledge to describe or explain phenomena - selecting procedures or performing them with two or more steps involved - organizing, presenting and interpreting data 3) High-level include tasks that involve: - analyzing, synthesizing, evaluating and justifying complex data - designing a plan to solve a problem.	1) explaining phenomena scientifically involves: -explaining a certain scientific truth using data and facts; -understanding the procedures and processes that were used to arrive at such truth; - justifying the knowledge produced by science (OECD, 2019a). 2) evaluating and designing scientific enquiry involves: - appraising presented scientific enquiry using the content, procedural and epistemic knowledge; - seeing the congruences and incongruences of the presented procedures and concepts /theories vis-a-vis the standards of a scientific research; - proposing a revision of the model, if not design a different one (OECD, 2019a). 3) interpreting data and evidence scientifically involve: - analyzing data presentations; - arriving at certain patterns and interpretations that can be compared to existing and established research studies (OECD, 2019a).
Procedural requires a knowhow of the standard procedures employed in every scientific investigation along with the application of diverse methods and procedures in order to establish a scientific knowledge (Duschl, 2008)		
Epistemic - refers to the knowledge of the constructs and defining features that are important in the knowledge-building process (Duschl, 2008)		

PISA explains that learners must be able to acquire all these three domains of knowledge. Further, it is presumed that these three domains of knowledge are inherent to each major competency of scientific literacy promoted in the PISA 2018 Science Framework. Therefore, for every scientific literacy competence, the learner must be able to make use and apply the three domains of knowledge to ensure attainment of competency.

Finally, the PISA 2018 Science Framework discusses three levels of cognitive demand based on the depth of knowledge required from a learner in order to accomplish a task or perform a certain competency. The three levels of low, medium and high categories were adapted from Webb's Depth of Knowledge grid which is determined by the complexity of both the content and the task required. The model is originally captured in four levels; namely: 1) Level 1 - Recall; 2) Level 2 - Using skills and/or conceptual knowledge; 3) Level 3 - Strategic Thinking; and 4) Level 4 - Extended Thinking (Webb, 1997; 2006). Referring back to Table 1, the scientific literacy competencies are graduated based on depth of knowledge and complexity of task being considered. Similarly, for every indicator of the major scientific literacy of concern, a set of low, medium and high levels of cognitive demand competencies are categorized.

The Philippine Kto12 Science Curriculum envisions the development of scientifically, technologically, and environmentally literate and productive citizens of the country. The curricular framework is organized around three interlocking components; namely: (1) inquiry skills, (2) scientific attitudes, and (3) content and connections (DepEd, 2016). Being interrelated, these components are woven together and presented in the content standards, performance standards and learning competencies of every science discipline in order to support the holistic

development of a scientifically literate individual with metacognitive skills.

The content standards describe the specific knowledge or topic that should be taught or learned. This can be considered parallel to the content topics in the PISA Science Framework. The four major science content disciplines; namely: *Earth and Space*; *Living Things and their Environment*; *Matter*; and *Force Motion and Energy* are taught per grade level standards starting from simple to increasing complexity in spiral progression.

The performance standards in the curriculum guide, on the other hand, provides clear expectations of instruction, assessment or student task. It specifically points out the level of work required to demonstrate achievement of standard. This can also be considered parallel to the content, procedural, and epistemic knowledge in the PISA framework which determines the extent of how knowledge in the content disciplines were effectively applied and used.

Finally, the Kto12 Science curriculum is composed of learning competencies designed around the three domains of learning science: understanding and applying scientific knowledge in a local setting as well as in a global context; performing scientific processes and skills; and developing and demonstrating scientific attitudes and values (DepEd, 2016).

Given the PISA science framework discussed above, the domains of knowledge, competencies required, and level of cognitive demand were used in mapping / evaluating the learning competencies in the Kto12 Science Curriculum for Grades 7 to 10. In the curriculum guide, the topics in science covered per grade level are explicitly stated in the content standard, thus they can be easily compared with the content domain included in the PISA 2018 Science Framework. However, the procedural and

epistemic domains of knowledge can only be drawn from the performance standards and learning competencies reflected in the guide. This was done by using verbal cues in the specified performance standards / learning competencies. For instance, the verbal cues like recall, justify, relate, describe (using one variable), compare, and differentiate were regarded to be similar in depth and complexity with the indicators in the PISA content knowledge domain and low-level scientific literacy competence of "explaining phenomena scientifically." The verbal cues like investigate, describe (using two variables), determine using formula, demonstrate, and apply the principles, were regarded to be similar in depth and complexity with the indicators of procedural knowledge domain and the medium level of scientific literacy competence of "evaluating and designing scientific enquiry". Finally, the verbal cues like create and interpret; collect, record and report data; trace and predict; and investigate relationships were regarded to be similar in depth and complexity with some of the indicators of epistemic knowledge domain and the high level of scientific literacy competence of "interpreting data and evidence scientifically."

The same bases were used in identifying the level of cognitive demand that a particular learning competency and content standard calls for. As previously mentioned, the three levels of low, medium and high cognitive demand were adapted from Webb's Depth of Knowledge grid which is determined by the complexity of both the content and the task required (OECD, 2019a). To reiterate, the model is originally captured in four levels; namely: 1) Level 1 - Recall; 2) Level 2 - Using skills and/or conceptual knowledge; 3) Level 3 - Strategic Thinking; and 4) Level 4 - Extended Thinking (Webb, 1997; 2006). Hence, some verbal cues may be identified across domains of knowledge, major types of scientific literacy, and levels of cognitive demand

depending on their contextualized depth and complexity of use in the stated learning competency.

With the use of curriculum mapping process, this research aimed to analyze the extent to which the content and learning competencies of the Philippine Kto12 Curriculum is aligned with the PISA 2018 Science Framework. Results of the evaluation will hopefully provide meaningful inputs to study how the Kto12 Curriculum for Grades 7 to 10 addresses the global expectations on scientific literacy that every 21st century learner should possess.

METHODOLOGY

The study employed a descriptive research design using the qualitative method. Simple presentations of statistical data in the form of average mean, frequencies and percentages were used. Procedures employed in the study were only confined to comparing, presenting and explaining the results of the mapping done. There was no attempt to do correlations or identify relationships in any form, thus the choice of the research design and method.

The data gathering procedure was anchored on curriculum evaluation, one of the four steps in the curriculum development process. The present study attempted to employ curriculum mapping procedures to examine the alignment of certain elements between two frameworks - the PISA 2018 Science Framework and the Philippine Kto12 Science Curriculum for Grades 7 to 10. The process involves two major phases.

Phase 1 involved mapping of the Grades 7 to 10 Science curriculum components such as content standards, performance standards, and learning competencies vis-a-vis the following

components in the PISA 2018 Science framework: 1) content and knowledge domains; 2) learning competencies; and 3) levels of cognitive demands as the standard. Initially, the mapping was independently done by two different curriculum analysts. After the mapping, alignments and gaps in the content domain were identified. In terms of alignment, the coherence of the Grades 7 to 10 Kto12 Science Curriculum (content standards considered and depth and complexity of the learning competencies) with the PISA 2018 Science framework was looked into. Part of the mapping involved the assessment of the explicitness and implicitness of the content topics covered.

Explicit content topics were regarded as either mentioned in the content or performance standards and/or stated in the learning competencies of the Kto12 Science Curriculum as specified in topics such as Earth Science, Biology, Chemistry and Physics in the PISA 2018 Science framework. The number entries of how many learning competencies represent each content topic based on the PISA 2018 Science Framework is reflected in Table 3.1. On the other hand, implicit content topics were regarded as those topics in the PISA 2018 Science Framework which were identified to be wanting or not explicitly mentioned in the Kto12 Science Curriculum. Specifically, for implied content topics, the number of competencies was categorized into the number range of implied competencies per grade level (See "+" categorization in the Legend below Table 3.1).

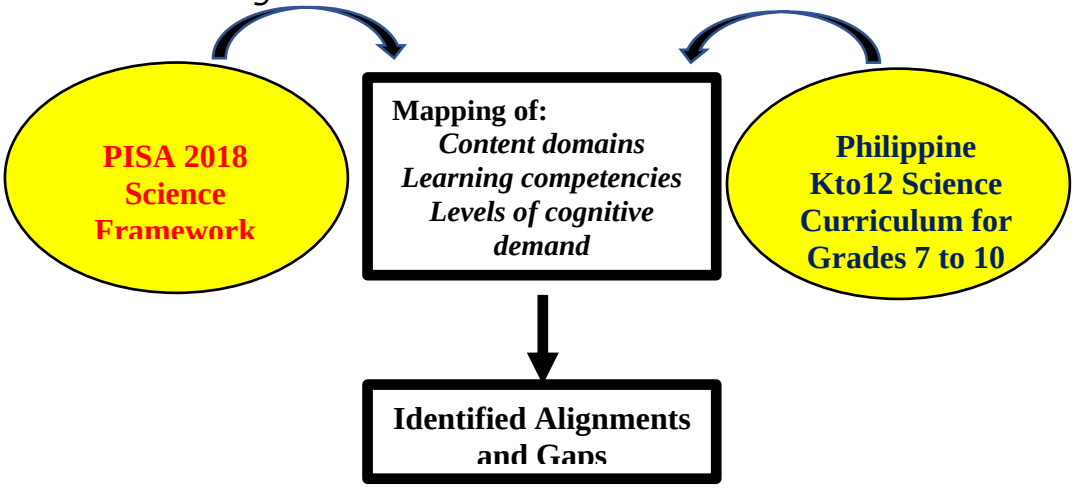
Coherence of the learning competencies in the Grades 7 to 10 Science Curriculum vis-a-vis the PISA scientific literacy competency and the levels of cognitive demand were also analyzed. Verbal cues of cognitive behavior used in the learning competencies in the Kto12 science curriculum served as basis for mapping coherence since there is no specific categorization of scientific literacies and levels of cognitive demand found in the

curriculum. In the course of examining the alignment, gaps were identified, i.e. those missing and/or implicitly represented topics in the Grades 7 to 10 Kto12 Science Curriculum after comparing them with the content topics in the PISA 2018 Science Framework.

Phase 2 involved an inter-analyst deliberation of the results of the mapping done after determining the identified gaps/alignments and the coherence of the components. It was followed by a resolution of the observations into common findings for further examination and final reporting. Figure 3.2 summarizes the procedure using a research paradigm.

Figure 3.2

Research Paradigm



RESULTS AND DISCUSSION

This section presents the results, findings and discussion of the study. The first part analyzes the alignment of content topics, while the second part discusses the identification of the gaps as well as the coherence of the learning competencies in the Kto12 Science Curriculum for Grades 7-10 with respect to the content domains (content knowledge, procedural knowledge and

epistemic knowledge) and the scientific literacy competencies in the PISA 2018 Science framework

1. Alignment of the Learning Competencies in the Kto12 Science Curriculum with the PISA 2018 Scientific Literacy Framework

1.1 Knowledge Domain

1.1.1 Content Knowledge

In the PISA framework, three areas were covered under content knowledge: **physical systems**, **living systems**, and **earth and space systems**. Results of the mapping showed that all subtopics under *physical systems* and *living systems* are covered in the Grades 7 to 10 Kto12 Science Curriculum. However, for the *earth and space systems*, two subtopics are not found.

Table 3.2 presents the detailed results of the mapping done. Topics on *interactions between energy and matter* covered the highest (N=20) number of competencies in the *physical systems* category of the PISA 2018 Science framework, while the least covered is on *chemical changes of matter* (N=8). When taken per grade level, the Grade 8 Science Curriculum covered the highest number (N=26) of topics in *physical systems*, but in Grade 7 only two topics were covered. Evidently, many of these topics are explicitly mentioned in the curriculum, and only a few topics are implicitly represented. For instance, the topic on the excretory system in Biology was mentioned in the more general content and content standard in Grade 8, and in the performance standard for Grades 6 and 10. For the rest of the identified implied topics, the same was observed except for some which are not mentioned at all. But since such implied topics are mentioned in the content topic, although not represented by a specific learning competency, a discipline-based science teacher would be able to consider

discussing them either as a recall of prior knowledge or a review topic to serve as a springboard for a more in-depth or integrated content discussion.

Table 3.2

Explicit and Implicit Learning Competencies across the Grades 7 to 10 Kto12 Science Curriculum vis-a-vis Content Knowledge Covered in the PISA 2018 Science Framework

PISA 2018 Science Framework	K to 12 Science Curriculum								
Content Domains	Grade 7		Grade 8		Grade 9		Grade 10		
	E	I	E	I	E	I	E	I	Total
1. CONTENT KNOWLEDGE									
A. Physical systems, including:									
1. structure of matter	0	0	2	0	6	0	2	0	10
2. properties of matter	0	+	6	0	3	0	2	0	11
3. chemical changes of matter	2	0	0	0	0	0	6	0	8
4. motion and forces	0	0	5	0	5	0	0	0	10
5. energy and its transformation	0	0	4	0	10	+	0	+	14
6. interactions between energy and matter	0	0	9	0	0	0	11	0	20
Total	2	+	26	0	24	+	21	+	73
B. Living systems, including:									
1. Cells	2	0	0	0	0	0	2	0	4
2. The concepts of an organisms	1	0	0	0	0	0	0	0	1
3. Humans	0	+	3	0	3	0	4	0	10
4. Populations	2	0	7	0	4	0	4	0	17
5. Ecosystems	4	0	4	0	4	0	0	0	12
6. Biosphere	0	0	0	0	0	0	3	0	3
Total	9	+	14	0	11	0	13	0	47
C. Earth and space systems, including:									
1. structures of the Earth	2	+++	0	0	1	0	0	0	3
2. Energy in the earth	0	+	0	++	2	0	0	0	2
3. Change in the earth	0	0	4	0	4	0	10	0	18
4. Earth's history	0	0	0	0	0	0	0	0	0
5. Earth in space	0	+++ +	3	0	4	0	0	0	7
6. The history and scale of the Universe and its history	0	0	0	0	0	0	0	0	0
Total	2	++++ +	7	+ +	11	0	10	0	30

Legends: E – explicit; I – Implicit; (+)less than three competencies are implied; (++) four to six competencies are implied; (+++) seven to ten competencies are implied; (++++) more than ten competencies are implied

For the *physical systems* category, the *concept of conductivity* was mentioned in a specific experiment on *thermal*

conductivity in the science equipment column of the curriculum guide, but not as an explicit learning competence. Nevertheless, the same topic is dealt with explicitly much later in Grade 9. The topic *physical changes of matter* is initially given in Grade 3, and then reinforced in Grade 8 only with additional topics on *chemical changes*. The competencies on chemical reaction were treated more as an application to biological and industrial food processes affecting the environment and covered in Grade 10. This topic may also be implicitly discussed under the concepts of *chemical bonding of elements* (ionic and covalent), but beyond that, there are no specific competencies to address different types of chemical reactions anywhere from Grades 3-10. There are few competencies covering the f*ormation of a new substance when exposed to heat or oxygen*, but these are included in Grade 5 and an in-depth discussion of the topic may be limited. If this is so, the said topics may only be covered with depth based on the teacher discretion. Discussion on *chemical bonding* in Grade 9 Chemistry may be extended to discussing types of chemical reactions by science teachers who are specialists/purists in Chemistry. However, science teachers who are not actually Chemistry majors may not necessarily elaborate on those topics because they (the topics) are not actually specified in the curriculum. In addition, these teachers may not find them significant enough to be one of the expected outcomes of the subject. A study showed that there is limitation in content knowledge, comfort level, and preparation time when teachers discuss topics not aligned with their field of expertise (Attia, 2017). The same claim is supported by a report of the Organization for Economic Co-operation and Development (OECD) which states that expert teachers have extensive pedagogical content knowledge and problem-solving strategies (Guerriero, 2013). A study supports this which said that expert teachers have better perception, sensitivity to context, and can incorporate knowledge in various experiences and practical practices inside

and outside the classroom (Guerriero, 2013). More so, while these findings may not be considered a gap, it might be important to take into consideration that it is more advantageous for students to learn these concepts early on so that in Grades 9 and 10 in depth discussion and integration of related topics may be offered instead and use such in strengthening students' epistemic skills.

For the topics under living systems, it is good to note that all concepts based on the PISA Science framework were covered in Grades 7 to 10. Across grade levels, the topic on *population* covered the highest number of competencies (N=17) in the Kto12 curriculum, and the least covered is the topic on *concepts of an organism* (N=1). Percentage wise, Grade 8 covered the greater distribution of content knowledge at 29.16%, Grades 9 and 10 got the same percentage distribution with 22.92%, and Grade 7 with 18.75%. Also it was observed that content knowledge in Grade 7 particularly about *cells* (e.g. *structures and function*, *DNA, differences between plants and animal cells*) was minimally covered with only two competencies out of the 48 identified. The said topics on cells, however, are distinctly specified in the PISA Science framework.

It was also observed that topics on *sustainability*, *population growth* and *carrying capacity,* topics specified in the PISA Science framework, are not discussed along with the topic on *ecosystem* in Grades 7 and 8 and, thus may not guarantee that a 15-year old PISA assessment taker would have learned these just before the test. The concept of *sustainability* was also not given much emphasis, but this may be implicitly discussed in topics like *environmental stability*, *pollution*, and *human activities affecting the environment*. *Sustainability* is one topic that should be dealt with in depth if the Kto12 Science Curriculum framework advocates environmental literacy among the learners.

The *earth and space systems* category on the topic *change in the earth* covered 18 competencies across Grades 7 to 10, which has the most number of covered competencies, while *structures of the earth* (N=1) covered the least number. Two topics were not covered in the Kto12 Curriculum: *the earth's history* and *the history and scale of the universe*. Given that there are spiral topics on the solar system for Grades 6 and 8, discussion on the history may be done as an introduction to the solar system (*history of the universe*) and *introduction to planet Earth* as part of the solar system (*history of the earth including fossils*). But since there is no single competency stated in the curriculum to deal with the topic then most likely there is a remote chance that they will be dealt with at all. This is a clear gap to take note of since the said concepts are specified in the PISA Science Framework.

In addition to this noted gap, there are topics on *earth and space system*s that are implicitly covered in the Kto12 Science Curriculum. As seen in Table 3.2, these topics are observed in Grade 7 with the most number (N=10) of implied content topics, but there are also several observed implied topics in Grade 8 such as *structures of the earth* and *earth in space* and *energy in the earth.* There are competencies that cover topics on *internal structure of the earth*, but there was no specific competency to cover *spheres of the earth* (i.e. *lithosphere* and *hydrosphere)*. When discussing *plate tectonics* and *land formation*, *lithosphere* may be mentioned. There are considerable discussions across grade levels which involve water (i.e. *water in the environment*, *bodies of water*, *water as a resource*, *water in the oceans contributing to weather disturbances*) and assumingly the *concept of hydrosphere* will somehow be mentioned. On the other hand, the concept of *atmosphere* covered several topics across grade levels. The possibility of these concepts to be taught in class highly

rests on the discretion of the teachers again especially if they are not experts in the discipline.

1.1.2 Procedural Knowledge

Procedural knowledge is more than knowing the content. It requires understanding on how scientific knowledge is established to students that makes them confident in what they know. Students who possess procedural knowledge employ standard procedures using diverse methods and practices. It prepares students to demonstrate empirical inquiry to generate explanations about the world. They must understand independent and dependent variables and their relationships; control variables, measurement of errors; and recognize patterns in the data collected; and recognize ways in presenting data correctly (OECD, 2019a). Table 3.3 shows that all PISA topics under procedural knowledge are covered in Grades 7 to 10 in the Kto12 Science Curriculum.

Among the seven procedural knowledge topics, the concept of variables is mostly reflected in the Kto12 Curriculum with 57 competencies identified across Grades 7 to 10. On the other hand, two topics of procedural knowledge have minimal consideration in the Kto12 curriculum with only one competency identified for each. These include the following topics: mechanisms to ensure the replicability; accuracy of measurement; use of randomized controlled trials to avoid confounded findings; and to identify possible causal mechanisms.

When taken per grade level, Grade 8 covered 33 explicit procedural knowledge, while Grade 10 has the least coverage of only 14 learning competencies. There are more competencies measuring procedural knowledge in Grade 8, and the least in Grade 10. The spiral progression structure of the curriculum pre-supposes that the level of complexity and depth of knowledge

goes with increasing grade level. While all these three domains of knowledge are equally important to be developed in any level of learning progression, the application of procedural and epistemic knowledge will prove to be useful for learners as they move to higher grade levels where they are expected to perform more complicated tasks.

Table 3.3

Procedural Knowledge Domain across the Grades 7 to 10 Kto12 Science Curriculum

PISA Framework	K to 12 Curriculum (Code)				
	Grade 7	Grade 8	Grade 9	Grade 10	Total
2. PROCEDURAL KNOWLEDGE					
1. The concept of variables, including dependent, independent and control variable	7	24	17	9	57
2. Concepts of measurement	7	6	1	1	15
3. Ways of assessing and minimizing uncertainty such as repeating and averaging measurements	0	1	2	0	3
4. Mechanisms to ensure the replicability and accuracy	0	0	1	0	1
5. Common ways of abstracting and representing data using tables, graphs and charts and their appropriate use; the control variables and its role in experiment design	2	1	1	0	4
6. The use of randomized controlled trials to avoid confounded findings and to identify possible causal mechanisms	0	0	1	0	1
7. The nature of an appropriate design for a given scientific questions, e.g. experimental, field-based or pattern-seeking	1	1	0	4	6
Total	17	33	23	14	87

Following this contention, Grade 7 is expected to be allotted with more knowledge-based competencies, and Grades 9 and 10 with more challenging and complex procedural and epistemic knowledge-based competencies. In this way Grade 8 will not be overwhelmingly packed with many competencies. However, there seems to be an imbalance in the distribution of content,

procedural and epistemic knowledge domains in the curriculum. Another support to this observed concern of appropriation is the fact that the procedural knowledge items in the PISA 2018 Science Literacy Framework is only given about 19-31% allotment, while about 54-66% allotment is given to content knowledge items (OECD, 2019a). Given that there are 87 procedural knowledge-based competencies identified out of the 162 competencies mapped in the Kto12 curriculum, it is evident that more than half of the total competencies in the curriculum are procedural knowledge-based which is more than what are appropriated in the PISA 2018 Science Framework.

1.1.3 Epistemic Knowledge

The epistemic knowledge provides students the ability to define constructs and processes in building new knowledge. It prepares them to know their role, and it justifies the science in the process of knowledge building. Epistemic knowledge includes understanding and constructing models in direct representation or abstraction. An individual with epistemic knowledge distinguishes theory from guess and theory from law based on facts (OECD, 2019a). Table 3.4 presents the mapping of the Kto12 Curriculum in this knowledge domain.

When the learning competencies in the Kto12 Science Curriculum were analyzed and compared to the PISA Science Framework, it was noticeable that there are lesser competencies in the curriculum representing epistemic knowledge. There were also constructs that are not covered in any of the grade levels; namely: the *nature of reasoning used in science, such as deductive, inductive, interference to the best explanation (abductive), analogical and model-based; role of scientific knowledge, along with other forms of knowledge in identifying and addressing societal and technological issues; and role of*

collaboration and critique and how peer review helps to establish confidence in scientific claim. While it is expected that all three domains of knowledge - content, procedural and epistemic - are represented in every grade level and in every science discipline, the weight of representation of each domain will correspondingly vary across grade levels as each domain becomes more complex.

Table 3.4

Mapping of PISA Epistemic Knowledge Domain with the Learning Competencies in the Grades 7 to 10 Kto12 Science Curriculum

PISA Framework	K to 12 Curriculum (Code)				
Content Domains	**Grade 7**	**Grade 8**	**Grade 9**	**Grade 10**	**Total**
3. EPISTEMIC KNOWLEDGE					
The constructs and defining features of science, that is:					
1. The nature of scientific observations, facts, hypotheses, models and theories	3	0	0	0	3
2. The purpose and goals of science (to produce explanations of the world) as distinguished from technology (to produce an optimal solution to human need), what constitutes a scientific or technological questions, and what constitutes appropriate data	0	1	0	0	1
3. The values of science, such as commitment to publication, objectivity and the elimination of bias;	0	4	2	0	6
4. The nature of reasoning used in science, such as deductive, inductive, interference to the best explanation (abductive), analogical and model-based	0	0	0	0	0
The role of these constructs and features in justifying the knowledge produced by science, that is:					
a. How scientific claims are supported by data and reasoning in science:	0	4	2	0	6
b. The function of different forms of empirical enquiry in establishing knowledge, including both their goal and their design	0	4	2	0	6
c. How measurement error affects the degree of confidence in scientific knowledge	0	4	2	0	6
d. The use of role physical, system and abstract model and their limit	0	4	2	0	6
5. The role of collaboration and critique and how peer review helps to establish confidence in scientific claims	0	0	0	0	0
6 The role of scientific knowledge, along with other forms of knowledge in identifying and addressing societal and technological issues	0	0	0	0	0
Total	3	21	10	0	34

Another observation is that when epistemic knowledge representation is examined per grade level, the majority of the constructs are covered in Grades 7, 8, and 9 only as shown in Table 3.4. There are no constructs identified in Grade 10.

The kind of knowledge called for in the epistemic domain is useful to students when they conduct research. Among the students from the different grade levels, those in the higher levels are the ones expected to do more in-depth research (over and above the usual laboratory experiments) that requires skills in evaluating, rationalizing and assessing other research studies in the field. It is expected that students can justify their actions and decisions based on scientific inquiry. Grade 10 students are expected to understand how scientists collect, draw data, and write claims based on gathered data. They should learn the skill of being able to review published research studies and be critical about the scientific practices employed by researchers in their attempt to establish new claims.

Based on the item appropriations found in PISA, epistemic knowledge is allotted 10-22% representation. From the curriculum mapping, 34/162 (21%) competencies were identified as epistemic knowledge-based. Given this data, it can be said that the Kto12 Curriculum has incorporated enough epistemic knowledge, but they are not necessarily distributed appropriately and accordingly across grade levels. Again, while this knowledge domain is expected to be present in all grade levels, the ability to be critical about the research work of the scientific community is a skill that a Grade 7 Filipino student may not be fully prepared for yet. The development of the said skill will require, among other factors, length of exposure, training and even experience which science students can learn through the years as they progress from one grade level to the next.

1.2. Scientific Literacy

1.2.1 Competency 1: Explaining phenomena scientifically

The mapping process done in this study resulted in the identification of 162 explicitly represented competencies in the Grades 7-10 Kto12 science curriculum using the PISA 2018 Science Curriculum as the basis. The distribution of which, however, was found to favor the lowest category of scientific literacy cluster of skills. Table 3.5 presents the number of times a PISA competency is presented in the different topics across grade levels in the Kto12 Science curriculum.

The first cluster of competencies is categorized under the "explaining phenomena scientifically" indicator. The data suggests that the majority of the learning competencies in the Kto12 Curriculum is focused on the low-level sub-skills of identifying, using, and generating explanatory models and representations. However, skills that elicit higher levels of cognitive demand, as they belong to the highest end of the continuum of the cognitive process (Davis & Buckendahl, 2011), were represented with the lower number of competencies if not the least. This observation is important to note since the Science Curriculum Framework was designed to be learner-centered and inquiry-based, emphasizing the use of evidence in constructing explanations more than just simply knowing facts or reading about them.

Table 3.5

No. of Competencies in Kto12 Curriculum Covered in the PISA 2018 Scientific Literacy Framework

PISA Competencies	Grade 7	Grade 8	Grade 9	Grade 10	Total Competencies Covered = 162
Explaining phenomena scientifically	31	44	35	27	137
Percentage from Total Kto12 Competencies	67%	92%	88%	93%	85%
Evaluating and designing scientific Enquiry	12	2	2	2	18
Percentage from Total Kto12 Competencies	27%	4%	5%	7%	11%
Interpreting data and evidence scientifically	2	2	3	0	7
Percentage from Total K to 12 Competencies	4%	4%	7%	0	4%

Another observation based on these results is the fact that among the four grade levels (Grades 7-10), it is in Grade 7 where the distribution of the lower competencies are the lowest (67%), and the higher percentages are allotted in the higher grades (93% for Grade 10 as the highest). If this category of scientific literacies represents the low level of cognitive demand among the three clusters of competencies in the PISA 2018 Science Framework, then it is expected that these competencies should be mastered in the lower grades, and the more complex set of scientific literacies in the higher grades.

1.2.2 Competency 2: Evaluating and designing scientific enquiry

In contrast, the set of skills in the second cluster of scientific literacy competencies presented are concentrated in Grade 7 and

much less in Grades 8 to 10. In terms of the number of competencies covered, the Kto12 Curriculum reflected a greater number of competencies in the sub-skill *evaluating ways of exploring a given question scientifically*. In terms of level of cognitive demand, this is of a higher level. However, in comparison with the first set of skills, this second set of scientific literacies represents higher cognitive demand (medium level) and therefore should be offered more in the higher grade levels than in the lower grades. These sets of skills are believed to be useful for non-scientists in appraising scientific findings (National Academies of Sciences [NAS], 2016) and are expected to be acquired in Grade 10 more than in the lower grades, but still the trend is the same, more of these competencies are reflected in Grade 7. In both observations, the concern lies in the distribution of the competencies vis-a-vis its level of cognitive demand or complexity, and not on the issue of whether to have them or not in a certain grade level. This is because the Kto12 Science Curriculum is designed to promote scientific literacy as early as the formative years of kindergarten.

1.2.3 Competency 3: Interpreting data and evidence scientifically

The last set of PISA competencies is grouped under the skill of "interpreting data and evidence scientifically." Out of the seven-mapped explicit competencies, four (4) are focused on the sub-skill of transforming data from one representation to another – a high level cognitive demand skill, but the lowest among the sets of skills in consideration. Although the number of covered competencies increases with the grade level, the overall representation is quite low and the two competencies with the highest levels of cognitive demand are not represented. Interpreting data is a core activity of all scientists and is therefore

essential in scientific literacy (OECD, 2018), and yet the Kto12 Science Curriculum barely reflected these competencies.

1.3. Level of Cognitive Demand

The above findings are further confirmed by the specific data revealed in Table 3.6 this time considering the level of cognitive demand.

Table 3.6

Level of Cognitive Demand based on PISA 2018 Science Framework vis-a-vis the Identified Learning Competencies in the Kto12 Science Curriculum

Level of Cognitive Demand	No of Competencies/ Percentage per Grade level			
	Grade 7	Grade 8	Grade 9	Grade 10
Low	21	31	27	23
	47%	65%	67.5%	79.3%
Medium	11	13	5	3
	24%	27%	12.5%	10.35%
High	13	4	8	3
	29%	8%	20%	10.35%
Total	45	48	48	29

Table 3.6 shows that competencies with low level cognitive demand increases in number of representations as the grade level increases. On the other hand, higher levels of cognitive demand (medium and high levels) based on the PISA 2018 Science Framework decreases as the grade level increases. Again, this result runs contrary to the more logical learning goal which is to increasingly develop among students more complex and deeper thinking skills as they age and go up one grade level each year.

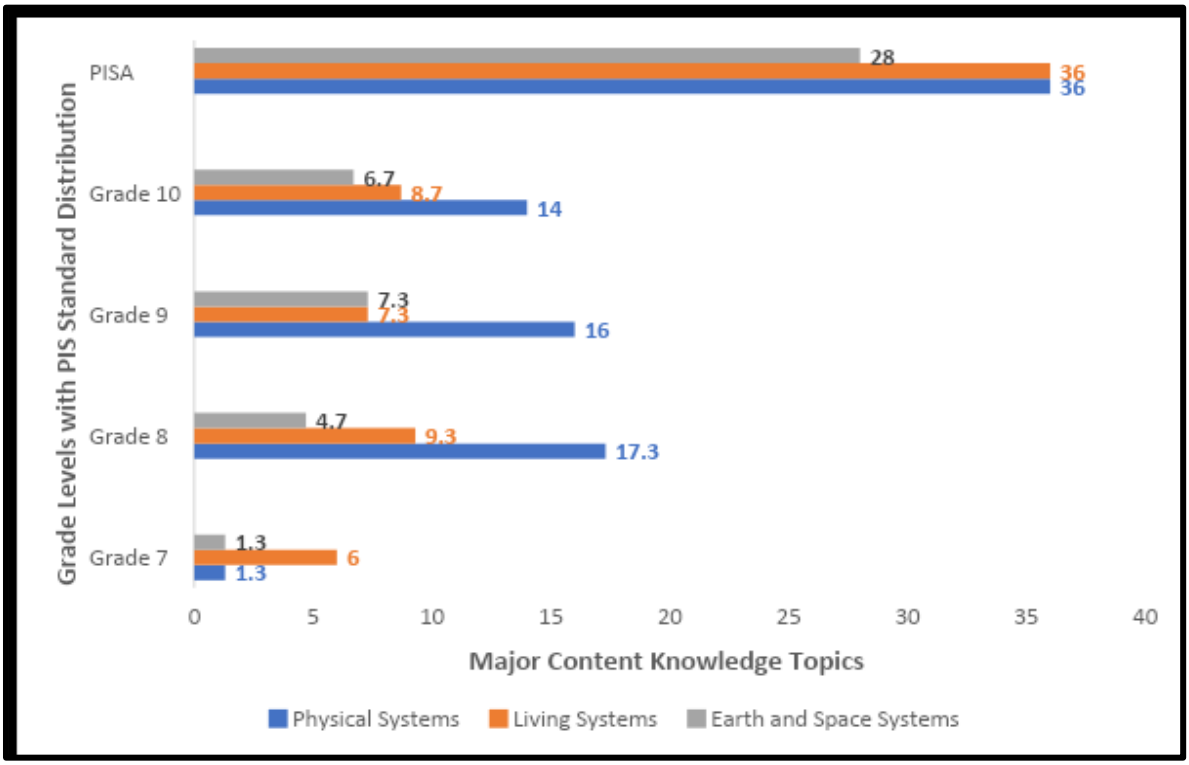
2. Identified Gaps in the Kto12 Science Curriculum vis-a-vis the PISA 2018 Scientific Literacy Framework

2.1 Content Knowledge

Figure 3.3 provides an overview of the percentage representation of all the topics covered across grade levels and science disciplines.

Figure 3.3

Percent Coverage of the PISA Topics in the Grades 7 to 10 Kto12 Science Curriculum



Results of the mapping yielded interesting data that would need serious consideration in curriculum evaluation. One is that

certain topics are lacking in *earth science*, i.e. *history of the earth* and *history of the universe*. Another is that there are more topics in *physical systems* covered in Grades 7 to 10 (about 49% of the total competencies identified), but are mostly discussed in Grades 8 to 10. Next are the topics under the living systems which cover about 24% of the total competencies. The disparity in the distribution of learning competencies in the *living systems* versus *physical systems* per grade level ranges from 5-9%. In PISA both the *living and physical systems* are equally distributed at 36%. In the Kto12 Science Curriculum, for *the earth and space systems* and the *physical and living systems* the percentage difference of representation is about 0-13%, while PISA allotted only about an 8% difference. It was also noted that the bulk of discussion of all the topics in the Kto12 Science Curriculum is concentrated in Grades 8 to 10 (from 29 -31% coverage), leaving Grade 7 with only about 9% coverage.

There is really nothing wrong with discussing the topics in any grade level as the curriculum planners deem fit. However, since PISA is given to 15-year old learners (approximately those in Grades 9 and 10), and that the Philippines has decided to join this international assessment, then it maybe it would be more beneficial to learners to introduce the science topics provided in the PISA Science framework early on rather have them later in Grades 9 or 10. With many class interruptions due to natural calamities and weather disturbances (and now because of the COVID-19 pandemic), and other regular and incidental holidays, classes are often suspended or cancelled. As a result, the curriculum is less likely to be fully implemented and the expected learning outcomes are not achieved.

Given the analysis made in this study where topics in the *physical systems, for example,* have more coverage compared to those in the *living systems* and *earth and space systems*, then students who will be selected to participate in PISA will most likely

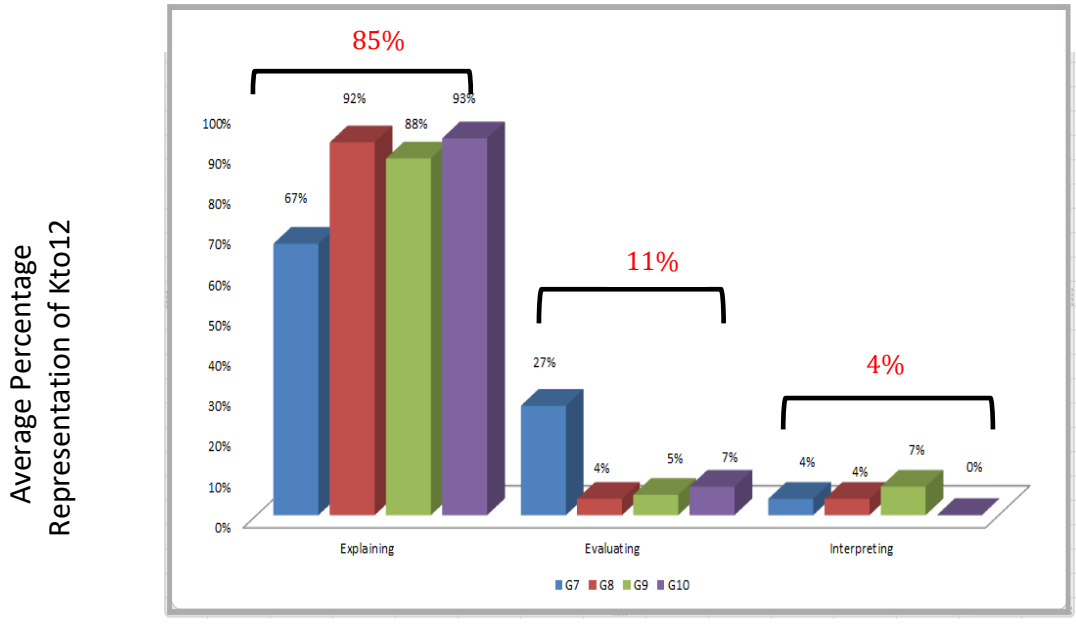
be lacking in a number of areas under content knowledge. These findings of imbalance in the distribution of topics may not necessarily be considered a gap, but maybe it can be a point of reflection for curriculum designers to revisit the distribution of topics per grade level.

2.2 Scientific Literacy Competencies

In summary, it is good to note that the mapping of the learning competencies in the Kto12 Science Curriculum for Grades 7 to - 10 vis-a-vis the domains in the PISA 2018 Science Framework revealed a comparatively close alignment in terms of the required competencies in scientific literacy. Figure 3.4 presents this finding.

Figure 3.4

Average Percentage Representation of the Kto12 Learning Competencies vis-a-vis the PISA 2018 Scientific Literacy Competencies



Major Grouping of Scientific Literacy Competencies based on PISA

With a total of 162 competencies in the Kto12 Science Curriculum that were identified as explicitly covered, the majority (85%) of those are reflected in *explaining phenomena scientifically* cluster of skills. This is followed by *evaluating and designing scientific enquiry* cluster with 11% representation, and the least represented cluster is *interpreting data and evidence scientifically* with 4% of the total. Considering the distribution of score points set in the PISA 2018 Scientific Literacy Framework, majority of the items (40-50%) assessed included lower-level of cognitive demand set (explaining skills) of competencies. On the other hand, 30-40% of those are included under the *interpreting* cluster of skills, while 20-30% for *evaluating* set of skills (OECD, 2019a).

Comparatively, both frameworks put greater weight on the lower set of competencies, but there is not much disparity noted in the Kto12 Curriculum appropriation. The PISA 2018 Science Framework made a 50:50 distribution of weights between the low and high level sets of competencies, while in the Kto12 Science Curriculum there is an 85:15 distribution, with greater weight given to the low-level competencies (OECD, 2019a). Moreover, the number of competencies with low-level of cognitive demand which are expected to be given in Grade 7, more than in Grade 10, for the first set of competencies runs contrary to what cognitive development theory presupposes that cognitive development increasingly involves higher-order thinking skills as children grow older (Galotti, 2011; Albert & Steinberg, 2011; Piaget, 1969). The same is true with the second and third sets of scientific literacy skills where medium to a high level of cognitive demand is generally found wanting in the higher grade levels in the Kto12 Curriculum. Again, these observations may not necessarily be considered a gap, but this study would like to reiterate the need to seriously pay attention to the issue on

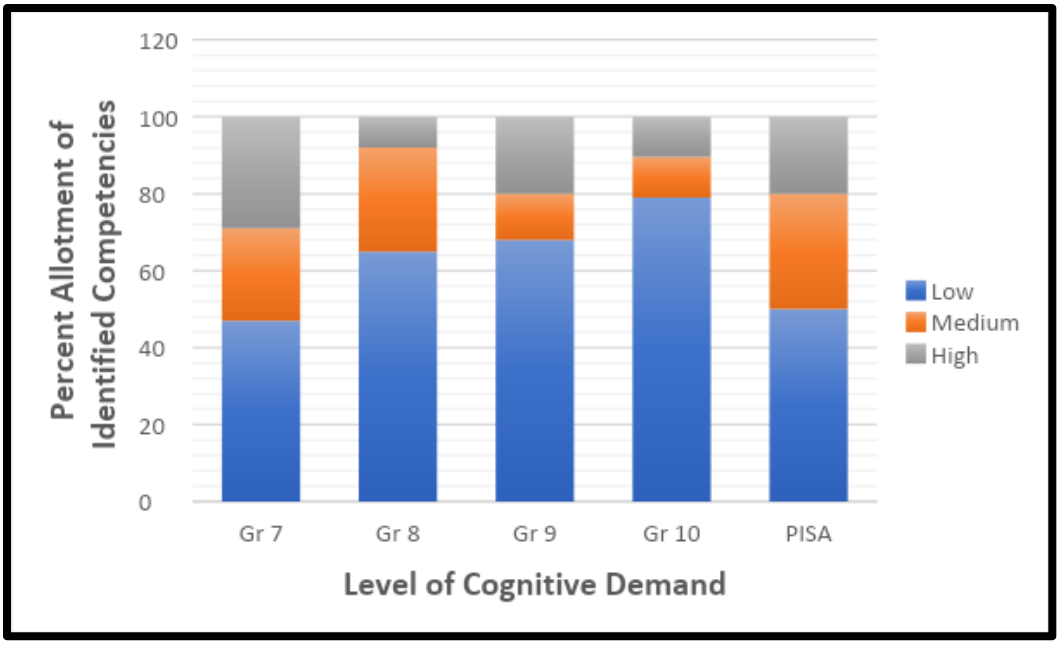
appropriation and distribution of the learning competencies across grade levels in conducting curriculum revision or evaluation.

2.3 Level of Cognitive Demand

At a glance in Figure 3.5, the obvious disparity in the number of low-level vs. high-level cognitive demand competencies and the observed diminishing representations of competencies from Grades 7 to 10 are shown in Figure 3.5.

Figure 3.5

Level of Cognitive Demand based on the PISA 2018 Science Framework vis-a-vis the Identified Competencies in the Grades 7 to 10 Kto12 Science Curriculum



Compared to the percentage allotment in PISA, there is a notable relatively higher percentage of competencies in the low level of cognitive demand across grade levels (47%-79% average

range) in the Kto12 Science Curriculum. Comparing the percentage allotment of competencies across grade levels, it can be viewed that Grade 7 is allotted with the highest percentage of competencies with high level of cognitive demand when those competencies should have been placed in the higher grades. These findings can somehow explain the recent results presented by OECD (2019a). Compared to the OECD coverage index of 88%, the Philippines posted 32% coverage of proficiency in science which is above level 2. This goes to show that the greater 68% percent covered levels 1a, 1b, and below level 1b which involve tasks that require a low level of cognitive demand, and learners in these levels are considered low achievers in science. Among the three low levels, it was observed that more than 1 in 20 students in the Philippines performed below level 1b (OECD, 2019a). The concentration of learning competencies in the low-level category in the curriculum will most likely produce students who are low achievers in science.

CONCLUSIONS AND RECOMMENDATIONS

With the pressing need to shed light on the PISA 2018 results of the Philippines, this study was conducted to analyze the alignment of the learning competencies in the Kto12 Science Curriculum for Grades 7-10 with respect to the PISA 2018 Science Framework. After a careful process of mapping the content, competencies and standards of the curriculum and a thorough discussion of the results, the following conclusions were drawn:

1. There is a high degree of alignment of the Philippine Kto12 Science Curriculum with the PISA 2018 Scientific Literacy Assessment Framework in terms of the content domains: content knowledge, procedural knowledge and epistemic knowledge; scientific literacy competencies; and levels of cognitive demand.

2. The major gap in the Kto12 Science Curriculum based on the 2018 PISA Scientific Literacy Assessment Framework is its lack of explicit inclusion of two topics in *Earth and Space Systems*.

3. The learning competencies in the Kto12 Science Curriculum are not proportionately and appropriately distributed across grade levels in terms of cognitive demand as there is a high concentration of learning competencies that involve tasks of low-level cognitive demand.

Based on the foregoing findings and conclusions of this study and guided by the four key reform areas (KITE) of Sulong Edukalidad Program of the Department of Education, the following recommendations are offered:

1. ***Kto12 Science Curriculum Review and Update***. The science curriculum should be unpacked and the content topics and learning competencies across grade levels should be proportionately distributed based on the level of cognitive demand and proficiency that a progressive learner should acquire. It should likewise consider the explicit inclusion of content topics (i.e. *history of the Earth and universe*) that are specified in the PISA 2018 Science Framework and other international large-scale assessments should the Philippines continue to participate in this global activity. Essential competencies should be highlighted in each grade level in the Kto12 Science Curriculum to guide stakeholders on the expected outcomes of the learners. These may include *performing investigation with focus on the problems encountered in the community, appropriate use of laboratory techniques*, *mitigation and disaster risk reduction preparedness*, *participation in activities that lessen the risk of various disasters*, *community engagement in protecting and conserving endangered and economically important species*, *importance of adaptation as mechanisms*

of species, and *proposing ways to enhance sports related to projectile motion*.

2. ***Improvement of the Learning Environment.*** DepEd schools and other stakeholders (e.g. publishing companies, teacher education institutions) should take the lead to develop accessible learning and assessment materials that are similar or responsive to the PISA assessment structure on scientific literacy. This may be done both in print and technology-aided forms. Schools should be provided with sophisticated and working science laboratory facilities where students can conduct meaningful experiments and research to develop content, procedural, and epistemic knowledge. Students should also be exposed to research problems that deal with real-life situations and challenges like discovering a vaccine against COVID 19 or finding solutions to various emerging problems today by using their science knowledge and skills as an exercise in developing scientific literacy. Teachers and students should take advantage of the varied education-based applications, online instructional tools and materials, and scientific research resources that can help improve not only their scientific competencies, but also their ICT competencies.

3. ***Teachers' Upskilling and Re-skilling.*** A wide-scale information dissemination on the results of the curriculum review and evaluation needs to be done to make the teachers understand and find ways to address the gaps in the curriculum they are implementing considering the global standards for scientific literacy emphasized in PISA. A needs-assessment for teachers could be conducted to gauge their capability in mastering all the content domains and developing scientific literacy competencies and higher-level cognitive thinking skills. Professional development programs can be tailored-fit to what is actually needed when

developing the same among their learners. Seminars, trainings, and workshops must be provided for science teachers to leverage their skills in demonstrating appropriate laboratory techniques in gathering data; analyzing the advantage of the Philippine climate, weather and seasons for example to improve farming, fishing and the like; and demonstrating readiness in disaster preparedness during calamities to equip and support the needs of their students. All science teachers must be actively engaged in scientific research so they can share with their students the knowledge, skills and practices of what a true scientist /researcher should be.

4. ***Engagement of Stakeholders for Support and Collaboration***. A stakeholders' forum may be initiated by DepEd to disseminate the overall results of the curriculum evaluation done and share the possible initiatives that can be implemented by any sector of the society to support the advocacies of *Sulong Edukalidad* (e.g. publishing companies hosting and funding meaningful trainings/workshops/seminars; international agencies or NGOs to finance the upgrading of science laboratory facilities of schools or put up a sophisticated regional science laboratory center; and local officials to create city/municipal ordinances to provide funds for internet accessibility in every public school within their domain. Moreover, city/municipal level officials and school heads may come up with working plans per school year on how students can be actively involved in community engagements as an extension of their learning. This may include adopting and maintaining cleanliness of a canal or river; inventing a useful gadget (research component and mass production may be sponsored by the local government) that can be used by the people of the barangay to sustain a livelihood activity; or

establish perhaps a "micro-teaching school" where students can do peer tutoring or teachers can conduct mini-lectures that are relevant to the needs of the community.

REFERENCES

Attia, N. (2017). Teachers' Perception on the Relationship Between Subject-Specialized Teaching and Students' Achievement in Elementary Classrooms By. (April).

Albert, D., & Steinberg, L. (2011). Judgment and decision making in adolescence. Journal of Research on Adolescence, 21(1), 211-224.

Berman, E. A., & Kuden, J. L. (2017). Scientific Literacy. In Agriculture to Zoology: Information Literacy in the Life Sciences. https://doi.org/10.1016/B978-0-08-100664-1.00002-8

Bybee, R., McCrae, B., & Laurie, R. (2009). PISA 2006: An assessment of scientific literacy. Journal of Research in Science Teaching. https://doi.org/10.1002/tea.20333

Davis, S.L. & Buckendahl, C.W. (2011). 'Incorporating cognitive demand in credentialing examinations.' In G. Schraw & D.R. Robinson (Eds), Assessment of Higher Order Thinking Skills (pp. 327-359). North California: IAP

DepEd (August, 2016). K to 12 science curriculum guide. https://www.deped.gov.ph/wp-content/uploads/2019/01/Science-CG_with-tagged-sci-equipment_revised.pdf

DepEd (December, 2019). PISA 2018 National Report of the Philippines. deped.gov.ph/wp-content/uploads2019/12/PISA-2018-Philippines-National-Report.pdf

Dillon, J. (2009). On scientific literacy and curriculum reform. International Journal of Environmental and Science Education.

Duschl, R. (2008), "Science Education in Three-Part Harmony: Balancing Conceptual, Epistemic, and Social Learning Goals", Review of Research in Education, Vol. 32/1, pp. 268- 291, http://dx.doi.org/10.3102/0091732x07309371.

Dweck. C. S. (2012). Mindset: The New Psychology of Success. Constable & Robinson Limited.

Galotti K. M. (2011). Cognitive Development. Thousand Oaks, CA: SAGE. [Google Scholar]

Gormally, C., Brickman, P., & Lut, M. (2012). Developing a test of scientific literacy skills (TOSLS): Measuring undergraduates' evaluation of scientific information and arguments. CBE Life Sciences Education. https://doi.org/10.1187/cbe.12-03-0026

Guerriero, S. (2013). Teachers' Pedagogical Knowledge and the Teaching Profession: Background Report and Project Objectives.

Hurd, P. D. (1998). Scientific literacy: New minds for a changing world. Science Education. https://doi.org/10.1002/(sici)1098-237x(199806)82:3<407::aid-sce6>3.3.co;2-q

Gormally, C., Brickman, P., & Lutz, M. (2012). Developing a test of scientific literacy skills (TOSLS): Measuring undergraduates' evaluation of scientific information and arguments. CBE—Life Sciences Education, 11(4), 364-377.

Johnson, M., & Green, S. (2004). On-line assessment : the impact of mode on student performance. 1–16.

Laugksch, R. C. (2000). Scientific literacy: A conceptual overview. Science Education, 84(1), 71–94. https://doi.org/10.1002/(SICI)1098-237X(200001)84:1<71::AID-SCE6>3.0.CO;2-C

National Academy of Engineering and National Research Council (2014). STEM Integration in K to 12 Education: Status, Prospects, and an Agenda for Research. Washington, DC: The National Academies Press. https://doi.org/10.17226/18612.

National Academy of Sciences (2016). Science Literacy: Concepts, contexts and consequences. https://books.google.com.ph

National Research Council [NRC]. 2012. A Framework for K to 12 Science Education: Practices, Crosscutting Concepts, and Core Ideas. Washington, DC: The National Academies Press. https://doi.org/10.17226/13165

OECD (2013). PISA 2012 Assessment and Analytical Framework PISA 2012 Assessment and Analytical Framework. In OECD Report. https://doi.org/10.1787/9789264190511-en

OECD (2015), "PISA for Development", www.oecd.org/pisa/aboutpisa/pisafordevelopment.htm

OECD (2018). "PISA for Development Science Framework"' in PISA for Devlopment Assessment and Analytical Framework: Reading, Mathematics and Science, OECD Publishing, Paris. DOI: https://doi.org/10.1787/9789264305274-6-en

OECD (2019a). PISA2018 Assessment and Analytical Framework. http://www.oecd.org/education/pisa-2018-assessment-and-analytical-framework-b25efab8-en.htm

OECD (2019b), PISA 2018 Results (Volume II): Where All Students Can Succeed, PISA, OECD Publishing, Paris, https://doi.org/10.1787/b5fd1b8f-en

Pearson, P. D., Moje, E., & Greenleaf, C. (2010). *Literacy and science: Each in the service of the other. Science*. https://doi.org/10.1126/science.1182595

Piaget, J., & Inhedler, B. (1969). *The psychology of the child*. Basic Books.

Porcalla, D. (2017, June 25). *The Philippine Star*. Number of elementary, high school dropouts rising - lawmaker.

Roser, M. & Ortiz-Ospina, E. (2020). *Primary and secondary education*. Published at online *OurWorldInData.org.* Retrieved from: 'https://ourworldindata.org/primary-and-secondary-education'

Sadler, T. D., & Zeidler, D. L. (2009). Scientific literacy, PISA, and socioscientific discourse: Assessment for progressive aims of science education. *Journal of Research in Science Teaching*. https://doi.org/10.1002/tea.20327

Scheuermann, F. & Bjornson, Julius (2009). The transition to computer- based assessment. Luxembourg, Office for Official Publications of the European Communities

Tienken C.H. (2017*). Understanding PISA results*, Kappa Delta Pi Record, 53:1,6-8,Doi 10.1080100228958.2017.1264806

UNESCO (2015). *EFA global monitoring report: Education for all 2000-2015*. Paris: UNESCO [Google Scholar]

Webb, N. (1997; 2006). *Research monograph number 6: Criteria for alignment of expectations and assessments on mathematics and science education*. Washington, D.C.: CCSSO.

World Bank (2011). *Learning for all: Investing in people's knowledge and skills to promote development.* World Bank Group Education Strategy 2020*,* World Bank*,*Washington DC, http://biblioteka-krk.ibe.edu.pl/opac_css/doc_num.php?explnum_id=201.

About the Authors

Dr. Rosario Martinez-Belmi has been active in Science Education for the last 25 years starting as a High School Biology and Chemistry teacher and then as a faculty at the Philippine Normal University (PNU) teaching Science major subjects, professional education and research courses. She served as Deputy Dean of the PNU College of Flexible Learning and ePNU, the academic unit that is actively engaged in teacher training and distance education. She earned her BS Zoology, MAT in General Science and PhD in Science Education in UPLB, DLSU-Manila, and PNU, respectively.

Dr. Glen R. Mangali obtained his Doctor of Philosophy in Science Education from the Philippine Normal University under a DOST-SEI scholarship with a GPA of 1.0. He received various scholarships and grants from DOST and CHED. He was given various professional awards such as the Knight Award for International Journal, Best Research Paper and Best Paper Presenter. He has presented and published research studies, both in local and international journals in the field of education, globalization, andragogy, pedagogy, science education and biological science. He is a science textbook writer, a research consultant, peer reviewer in local and international journals and a senior researcher at the Colegio de San Juan de Letran-Manila.

Chapter 4

PISA Global Competence Framework vis-a-vis Philippine 2016 K to 12 Curriculum in Social Studies and Values Education

Rowena R. Hibanada, Carl O. Dellomos, and Rene C. Romero
Philippine Normal University, Manila

Abstract

The Philippine K to 12 Curriculum for Social Studies and Values Education is designed to ensure the holistic development of Filipino learners and prepare them for global competitiveness. The country's initial participation in the Program for International Student Assessment (PISA) yielded very low student performance placing the country at the bottom among 79 countries. To gauge the readiness of Filipino learners for and to inform decisions on future participation of the Philippines in PISA, this study examined the alignment of the PISA Global Competence Assessment Framework vis-à-vis the 2016 Philippine Kto12 Curriculum in Social Studies and Values Education. Through document analysis and curriculum mapping, the study found out that the Kto12 Social Studies and Values Education Curriculum is minimally aligned with the PISA Global Competence Assessment Framework. The study recommends continuous curriculum review and improvement of the Kto12 Curriculum and the implementation of relevant intervention programs and support systems from different education stakeholders, including country-based publishing and testing companies.

Keywords: *curriculum-assessment alignment, Kto12 Curriculum in Araling Panlipunan, Kto12 Curriculum in Edukasyon sa Pagpapakatao, PISA Assessment Framework*

INTRODUCTION

In 2018, the Department of Education (DepEd) participated in the Programme for International Student Assessment or PISA. This was the first time the Philippines participated in PISA, one of numerous international educational assessment agencies in the world. Anchored on DepEd's policy guidelines on assessment, the participation of the Philippines in PISA articulated the Department's willingness to join International Assessments to establish baseline and international benchmarking data, to measure the effectiveness of teaching and learning, and to provide evidences that will aid policy formulation, planning and programming at all levels (DepEd, 2017). A possible indicator to measure effectiveness of student performance is obtained from the results of international large scale assessments (ILSAs) including PISA. These ILSAs can provide significant information and quality data to inform decisions on how to improve learning outcomes of basic education students. In its first attempt to participate in the PISA, the Philippines scored below the average and ranked last in Reading Comprehension and second to the lowest in Mathematics and Science among 79 countries (DepEd, 2018).

As the world has become more and more complex with the advent of the 21st century and the many cultural, economic, political, technological, and environmental changes that it brings, the way people live has been greatly affected. These changes drive nations and people to strive for a more interdependent, collective, and sustainable life along with more openness to understand differing views and diverse issues. Given this perspective and to respond to the emerging changes, the member countries of the United Nations drafted the 2030 Sustainable Development Goals (SDG) where the goal for Education (SDG 4) calls for an international action to ensure inclusive and equitable

quality education and promote life-long learning opportunities for all with learning outcomes highlighting access, learning skills and outcomes of children and adults by 2030. Its goals and targets by 2030 include subgoal 4.7 which states that "by 2030, ensure that all learners acquire the knowledge and skills needed to promote sustainable development, including, among others, through education for sustainable development and sustainable lifestyles, human rights, gender equality, promotion of a culture of peace and non-violence, global citizenship and appreciation of cultural diversity and of culture's contribution to sustainable development." Its indicator includes (Indicator 4.7.1) extent to which (i) global citizenship education and (ii) education for sustainable development, including gender equality and human rights, are mainstreamed at all levels in: (a) national education policies; (b) curricula; (c) teacher education; and (d) student assessment (United Nations, 2016)

Education indeed is a powerful tool to achieve the UN Sustainable Development Goals. With all the inevitable changes emerging today demanding a new mindset and skill set, it is not enough anymore for people to know how to read, write and do math. There is an urgent need now to develop new skills, knowledge, behavior, and dispositions to live in an interconnected and globalized world. Given this need, Global Citizenship Education (GCEd) has become an important aspect in educating the young to prepare them to develop a sense of belonging to a broader community and common humanity, to be a global citizen. GCEd emphasizes political, economic, social and cultural interdependence and interconnectedness between the local, the national and the global (UNESCO, 2014). It aims primarily to develop the students' global competence, i.e. a set of skills, knowledge, behavior and dispositions to "successfully adapt to changes and to lead meaningful and productive lives" (UNESCO, 2014). Students need to learn the knowledge, skills, behaviors

and disposition to thrive as global citizens and to live in a more just, peaceful, tolerant, inclusive, secure and sustainable world.

The former UN Secretary General Ban Ki-moon underscored the idea that education is a means to foster global citizenship as it has the power to shape a sustainable future and a better world. This pronouncement succinctly expresses the need for education policies that promote peace, mutual respect and environmental care (The Global Education First Initiative, 2012).

Dewey (1916) posited that citizenship education is essential in systems that benefit as many people as possible. He referred to education as a socially functioning unit securing direction and development among the young through participating in the "life of the group in which they belong" (p.10), with the life of the group constituting community life. Delors (1996), who identified the four pillars of education, described one of the four pillars- "learning to live together" as a foundation of education. This pillar of learning helps an individual to "develop an understanding of others and their history, traditions and spiritual values by which the recognition of growing interdependence and common analysis of risks and challenges of the future… people are compelled to engage in common projects or manage the inevitable conflicts in an intelligent and peaceful way."

The PISA 2018 Global Competence Framework

PISA is an international assessment that covers three fundamental domains: Reading Literacy, Mathematics Literacy and Scientific Literacy. Each year, PISA includes one innovative domain for its assessment focus. In PISA 2018, the innovative domain was global competence. Its assessment framework is shown in Figure 4.1.

Figure 4.1

Global Competence

In the framework, Global Competence is defined as the combination of four dimensions - examining issues, understanding perspectives, interacting, and acting; each of which necessitates a combination of knowledge, skills, attitudes, and values (OECD Asia Society, 2018). Global Competence builds on specific cognitive content, process and socio-emotional skills (Figure 4.1).

The assessment includes a Student Survey Questionnaire that aims to gather information about students' self - report on their knowledge, attitude and skills. In addition, the PISA 2018 assessment of global competence included a part where teachers and school leaders are asked to be respondents in the survey. This survey was intended to gather information which can assist participating countries to assess their own performance, confirm their best practices, and help them learn from one another.

The PISA 2018 Global Competence Framework provides data about education systems around the world in terms of how the youth are prepared to understand their communities and the global realities around them, how they are trained to respond to global issues, how they are guided to interact respectfully with others, and how they are taught to collaborate in taking appropriate and relevant action towards creating a more equitable, conflict-free and sustainable communities.

Many countries in the world regularly participate in ILSAs; one of those ILSAs is PISA which provides evidence-based information on whether or not quality of education is achieved based on the given assessment. Though ILSAs are a relatively new phenomenon, they have significantly influenced the educational system in many countries around the world to adopt curricular reforms. The results PISA yields provide a highly comparative data on the educational system of many countries. Governments benefit from the PISA data as these can be analyzed cross sectionally and contextually within a given educational system. This has become an international benchmarking activity for a number of participating countries, e.g. Laos and Mongolia who participated in order to benchmark their curricular programs internationally. For these countries, participation in PISA is an opportunity to determine if their standards in education could be at par with those of the rest of the world (Addey & Sellar, 2015). Countries with dismal performance results look at their PISA participation as a step forward towards globalizing their system of education. PISA results are regarded by many participating countries as an important basis for educational policy reforms (Lockheed, Prokic-Breuer, & Shadrova, 2015).

For economically advanced countries such as Finland, Japan and Singapore, participation in PISA serves as a feedbacking mechanism to improve their system of education, curriculum and

pedagogy. Japan has modified its national curriculum to include PISA type application of knowledge approaches (Addy et al, 2015). For Singapore and Finland, their PISA results are used to understand how their educational system is leveraging to promote environmental or global education.

The Department of Education, mandated to ensure access to quality basic education for all Filipinos, is committed to participate in various national and international system assessments to guide its efforts in addressing the challenge of improving the quality of basic education in the country. DepEd participated in the 2018 cycle of PISA with the view that the results can provide relevant insights on student performance and inform policy decisions of the Department. The participation yielded results that show the country has much to do before it can claim that our educational system is at par with that of the Southeast Asian countries, if not with the rest of the world.

The 2018 PISA was administered to 15-year old students in the participating countries. In the Philippines, these are students born in 2002 and were enrolled in secondary schools for School Year 2017-2018. The Filipino PISA takers were most likely Junior High School (JHS) students at the time of the test. The PISA 2018 test in the Philippines was administered in English pursuant to the PISA 2018 Technical Standards requiring participating countries to use their language of instruction as the language of testing. PISA 2018, the seventh PISA cycle, was participated in by 600,000 students from 79 countries and delivered through a two-hour computer-based examination (DepEd, 2018).

The most recent major educational reform in the country is the implementation of the Kto12 Curriculum mandated by Republic Act (RA) 10533 or the Philippine Enhanced Basic Education Law. The Kto12 Curriculum is designed to develop

holistically the Filipino learners equipped with 21st century skills and prepare them to be locally and globally competitive. The curricular reform is guided by the standards and principles of an effective curriculum that is learner-centered, inclusive, developmentally-appropriate, relevant, responsive, researched-based, culture sensitive, contextualized and global. It shall use pedagogical approaches that are constructivist, inquiry-based, reflective, collaborative and integrative (R.A. 10533).

The Kto12 Basic Education Curriculum aims to mold a holistically developed Filipino possessing 21st century skills and who is ready for employment, entrepreneurship, middle level skills development and higher education upon graduation from Grade 12 (DepEd, 2017). Moreover, the ideal Kto12 graduate is one who manifests patriotism and nationalism, love of humanity, respect for human rights, appreciation of the role of national heroes in the historical development of the country, observance of rights and duties of citizenship, strong ethical and spiritual values, moral character and personal discipline, critical and creative writing, scientific and technological knowledge, and vocational efficiency (Philippine Constitution, Article XIV, sec. 3).

Therefore, the ideal graduate is one who has discovered his/her potential in a child-centered and value-driven teaching-learning environment; one who is enabled to create his/her own destiny in a global community; and one who loves his/her country and is proud to be a Filipino (DepEd's vision statement, 2013). The Kto12 curriculum in Edukasyon sa Pagpapakatao (EsP)/Values Education and Social Studies is designed for learners to help them achieve the desired non-cognitive learning outcomes related to discovering their Filipino identity, to instill in them the spirit of nationalism and patriotism, and to help them acquire the right knowledge, skills and attitude for global citizenship.

To evaluate the attainment of the Kto12 curriculum learning outcomes, DepEd took the initiative to participate in PISA 2018. The question of alignment of the intended and implemented curriculum to the attained curriculum measured by national and international assessments is an important factor to consider in preparing students to participate in such an assessment. Hence, it was deemed important to pursue this present study to find out if the competencies in the Kto12 Curriculum in Social Studies and EsP/Values Education is aligned with the PISA Global Competence Framework (PISA GCF for brevity). Also this study was conducted to inform future review and improvement of the Kto12 Curriculum.

This study examined the degree of alignment of the competencies covered in the Philippine Kto12 Curriculum in Social Studies and Values Education with the 2018 PISA GCF. The insights gained from this study will hopefully help education leaders, educators and other stakeholders to conduct educational research specific to the implementation of the Kto12 curriculum to inform decision making and policy formulation of DepEd to ensure quality education for all.

Statement of the Problem

This study aimed to examine the alignment of the PISA GCF with the competencies in the Kto12 Curriculum for Social Studies and EsP/Values Education to help understand and contextualize the results of the Philippine Performance in PISA 2018 as input to future curricular reforms. Specifically, it aimed to answer the following objectives:

1. Determine the degree of alignment of the PISA Global Competence Framework (PISA GCF) with the competencies

in the Kto12 Curriculum in Araling Panlipunan/Social Studies and Edukasyon sa Pagpapakatao (EsP)/Values Education

2. Identify the gaps in the Kto12 Araling Panlipunan/Social Studies and Edukasyon sa Pagpapakatao (EsP)/Values Education Curricula vis-a-vis the PISA CGF

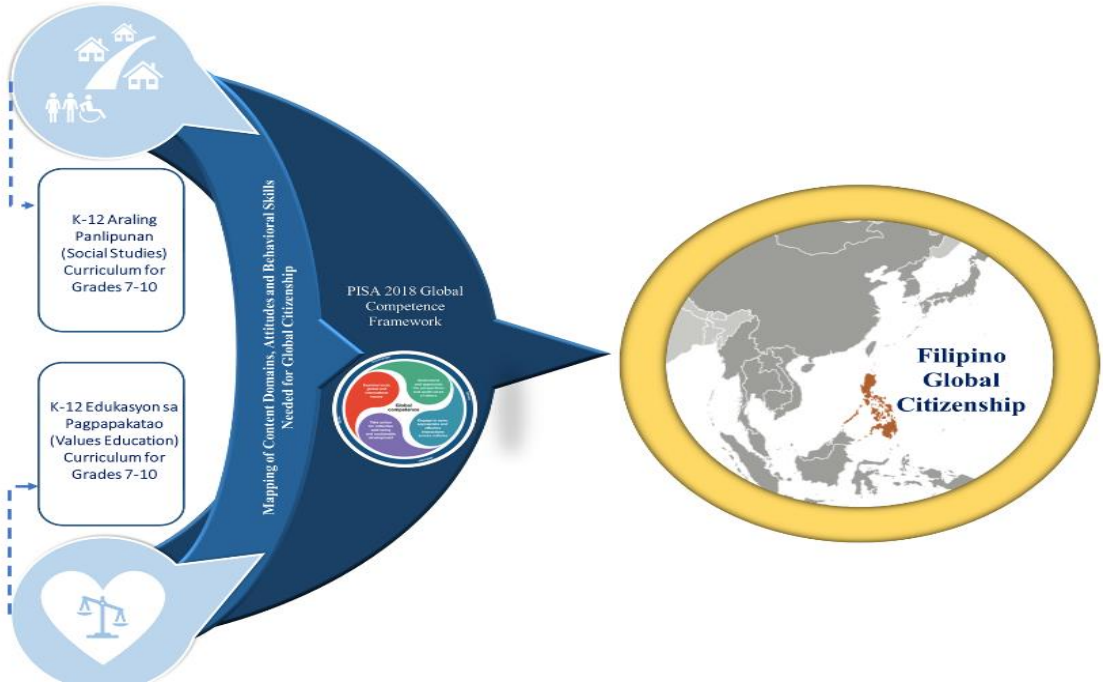
Conceptual Framework

Evaluation is an important part in the management cycle of curriculum implementation and in the continuous improvement of the whole educational system. Evaluating the implemented curriculum vis-à-vis the attained curriculum was deemed significant to gather substantive feedback on the outcomes, objectives and targets set for instruction. Guided by the principles of curriculum evaluation, this study aimed to get a glimpse of how the intended curriculum for Grades 7 to 10 in Social Studies and EsP/Values Education aligns with the attained curriculum using the PISA GCF. Figure 4.2 represents the conceptual model of this study.

Finally, given the framework shown above (Figure 4.2), the components; namely: elements of knowledge, competencies required, and level of cognitive demand were used in mapping/ evaluating the Kto12 Curriculum for Grades 7-10 in Social Studies and EsP/Values Education. However, the procedural (cognitive processes) knowledge can only be drawn based on the learning competencies reflected in the guide. The PISA GCF is compared with the Kto12 learning competencies using verbal cues, and the context of the task expected of the learner presented in the performance standards of the guide. The same bases were used to identify the level of cognitive demand that a particular learning competency and content standard calls for.

Figure 4.2

Conceptual Framework of the Study



The Kto12 Intended Curriculum is assumed to have a good degree of alignment with the PISA GCF to predict readiness of the Philippines to participate again in PISA in the future, and more importantly to determine if indeed competencies actually address the need to develop students to become better global citizens. In order to ascertain if the intended curriculum and the PISA GCF are aligned, a curriculum mapping was done.

Studies from other countries include examining models of teaching and the influence of International Studies of Student Achievement on Mathematics Teaching and Learning (Mesa, Gomez, & UiHock., 2011). A study was conducted by McGuinness (2018) to compare six Competency Frameworks across six countries or individual states – Northern Ireland, New Zealand, Singapore, Victoria/Australia, British Columbia/Canada and

Finland. The country competency framework was mapped via-a vis an international key competency framework. In Canada, the Ministry of Education mapped the competencies in the Ontario curriculum and the international (Finland, Singapore, Australia) curricula in the study entitled *Towards defining 21st century competencies* (2018). The said study provided a solid basis for the development of a competency framework for Ontario in terms of identification, definition and incorporation of 21st Century competencies in the curriculum, and expectations and learning experiences.

METHODOLOGY

The present study is a qualitative investigation which utilized official documents in the official website of DepEd and studies/researches published online as sources of data to determine if the Kto12 Curriculum contains learning competencies that prepare Filipino students to participate in international large-scale assessments like PISA. Through document analysis, the PISA GCF was mapped against the competencies in the 2016 Kto12 curriculum in Social Studies and EsP/Values Education for Grades 7 to 10 (DepEd, 2016).

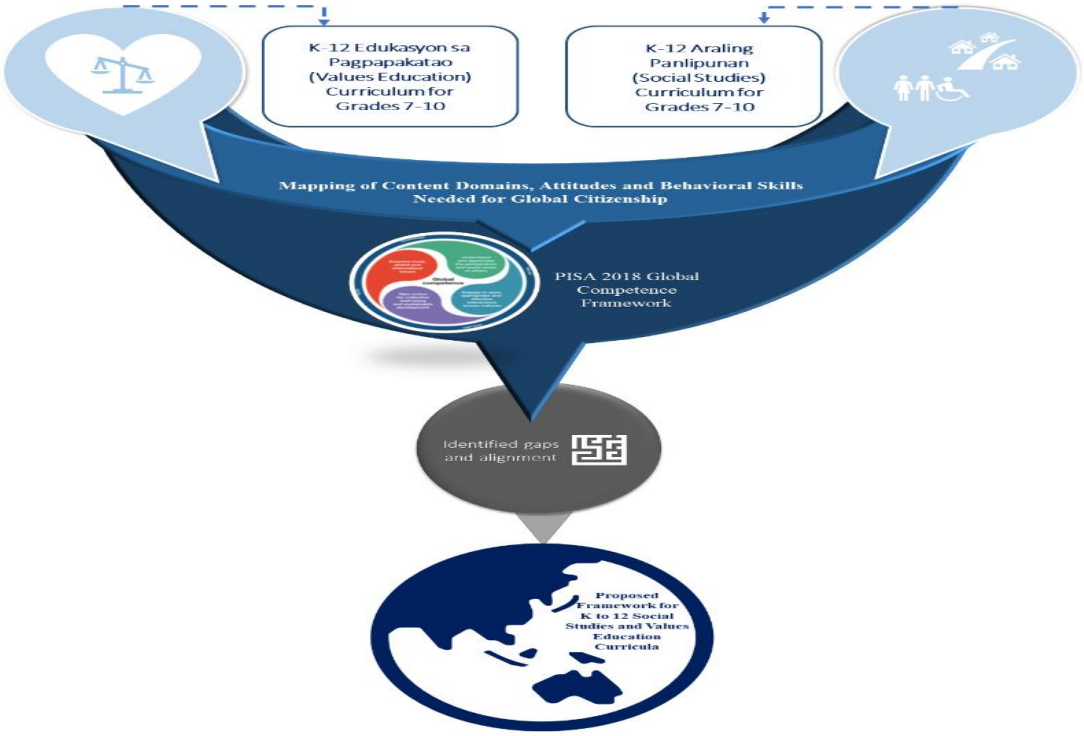
In doing the curriculum mapping, validation of content and analysis matrix were used as shown in Figure 4.3. Curriculum mapping was done based on the assumption that knowledge and capabilities are developed in educational pathways. In other words, a curriculum map makes curricula more transparent, and it demonstrates the links between elements within, or between, different curriculum frameworks (Greatorex et al, 2019). This kind of analysis is a reflective approach in analyzing curricula where a program is mapped and compared to a given framework or another curriculum. In other words, curriculum mapping helps to

identify benchmarks in curriculum design and implementation, outline differences and similarities, and emphasize the prioritized core competencies. Lastly, it helps in analyzing the curriculum against the desired outcomes and international standards.

The number code of the Kto12 curriculum in Social Studies and EsP/Values Education was encoded in the matrix. For reliability, the researchers made individual independent evaluation per analysis of the two subject areas. A separate coding was done per subject area, and mapping of competencies was conducted afterwards. The researchers then identified gaps and alignments of the PISA GCF vis-à-vis the competencies in the Kto12 curriculum for Social Studies and EsP/Values Education.

Figure 4.3

Methodological Framework of the Study



To begin the analysis proper, the PISA GCF was reviewed and examined by using the actual themes on Content domains, Attitudes, and Behavioral Skills vis a vis the Kto12 Curriculum in Social Studies and EsP/Values Education. The Learning Competencies aligned with the PISA GCF were classified as explicit or implicit learning competencies based on the actual terms used in the Kto12 curriculum. The analysis proceeded by translating and back translating the actual learning competencies across Grades 7 to 10. Through this, the percentage of alignment of the learning competencies was computed and presented. The alignment description was based on the scale shown in Table 4.1

Table 4.1

Table of Alignment

Adjectival Descriptors	Percentage
Perfect Alignment	100%
High Alignment	80.1%-99.9%
Moderate Alignment	60.1%-80%
Slight Alignment	40.1-60%)
Low Alignment	20.1-40%
Very low Alignment	.1-20%
No Alignment	0

Although the review of the competencies was based on the most objective professional judgment of the researchers, still there are limitations to the method used, specifically on curriculum mapping. Firstly, the review is constrained to a codified curriculum, which may differ from the implemented curriculum. Comparison based on documentary analysis may be limited as the contexts in which the curriculum is implemented

were not taken into account. Secondly, data were recorded/translated in the researchers' language, and this may affect the quality of the study since it is mediated by the quality and appropriateness of the translation done (Elliot, 2014). Lastly, the mapping gives a glimpse of how the PISA GCF is represented in the written and intended curriculum, however, a follow-up study is proposed to be done later to determine how the curriculum is enacted and experienced in different contexts.

RESULTS AND DISCUSSION

The Global Competencies in the Values Education and Social Studies Curricula

Global Competencies in the K to 12 Curriculum for Araling Panlipunan/Social Studies and Edukasyon sa Pagpapakatao/Values Education are seen as critical and fundamental in fulfilling the very purpose of the subjects in the K to 12 curricular programs. In the curriculum for EsP/Values Education, the core competencies are developed into four themes per grade level in an "expanding spiral" design from Kindergarten through Grade 12. From the themes, the essence of aligning learning competencies to global citizenship competencies can be gleaned. This is clearly stated in the Curriculum Guide for Edukasyon sa Pagpapakatao/ Values Education which states:

> Ang mga pangunahing kakayahang ito ay nililinang sa apat na tema sa bawat taon sa paraang "expanding spiral" mula Kindergarten hanggang Grade 12. Ang sumusunod ang apat na tema: (a) Pananagutang Pansarili at Pagiging Kasapi ng Pamilya, (b) Pakikipagkapwa at Katatagan ng Pamilya, (c) Paggawa Tungo sa Pambansang Pag-unlad at Pakikibahagi sa Pandaigdigang Pagkakaisa, at (d) Pagkamaka-Diyos at Preperensya sa Kabutihan. Pitong pangunahing

> pagpapahalaga (core values) ang nililinang sa mga temang ito: Kalusugan at Pakikiisa sa Kalikasan, Katotohanan at Paggalang, Pagmamahal at Kabutihan, Ispiritwalidad, Kapayapaan at Katarungan, Likas-kayang Pag-unlad, Pagkamaka-Pilipino at Pakikibahagi sa Pambansang Pagkakaisa (DepEd, 2016).

A complementary purpose can be observed in the K to 12 curriculum for Social Studies, the subject itself studies how people or groups of people, the community and society live, how they interact and connect with others and their environment and many more. Students are taught to be citizens who are observant, reflective, responsible, productive, environment-oriented, nationalistic, and person-oriented, with national and global perspectives and appreciative of past and present social issues, with an eye towards shaping the future.

> Ang Araling Panlipunan ay pag-aaral ng mga tao at grupo, komunidad at lipunan, kung paano sila namuhay at namumuhay, ang kanilang ugnayan at interaksyon sa kapaligiran at sa isa't isa, ang kanilang mga paniniwala at kultura, upang makabuo ng pagkakakilanlan bilang Pilipino, tao at miyembro ng lipunan at mundo at maunawaan ang sariling lipunan at ang daigidig, gamit ang mga kasanayan sa pagsasaliksik, pagsisiyasat, mapanuri at malikhaing pag-iisip, matalinong pagpapasya, likas-kayang paggamit ng pinagkukunang-yaman, at mabisang komunikasyon. Layunin ng Araling Panlipunan ang paghubog ng mamamayang mapanuri, mapagmuni, responsable, produktibo, makakalikasan, makabansa, at makatao, na may pambansa at pandaigdigang pananaw at pagpapahalaga sa mga usapin sa lipunan sa nakaraan at kasalukuyan, tungo sa pagpanday ng kinabukasan (DepEd, 2016).

The guiding definitions and themes of EsP/Values Education and Social Studies in the Kto12 Curriculum are clear and direct with regard to personal renewal, holistic wisdom and citizenship

participation for learners to make a difference in the global community - letting our Filipino-ness be felt in a globalizing world with national and global perspectives and showing appreciation of past and present social issues to contribute in shaping the future. These are complemented in the two subjects in basic education, and this must not be overlooked or misinterpreted.

Table 4.2 shows the comparative analysis of the content domains and subdomains of the scenarios identified in the PISA GCF and the competencies identified in the Kto12 curriculum in Social Studies and EsP/Values Education for Grades 7 to 10.

The data in Table 4.2 show that in Grade 7, 13.94% of the Kto12 learning competencies (LCs) are found to be aligned with the content domains and subdomains of the scenarios in the PISA GCF, where 11 out of the 79 competencies are explicit and seven are implicit. In Grade 8, 14.29% of the Kto12 LCs are aligned with the content domains and subdomains of the scenarios in the PISA GCF, where six out of 42 competencies are implicit. In Grade 9, 12.50% of the K to 12 LCs are aligned with the PISA GCF, where two out of the 80 competencies are explicit and eight are implicit. For Grade 10, 25.40% of the K to 12 LCs for Social Studies are aligned with the PISA GCF on content domains, where nine out of 63 are explicit and seven are implicit. Overall, very low alignment is observed between the K to 12 LCs in Social Studies and the Content Domains of the PISA GGF.

Table 4.2

Alignment of the Kto12 Social Studies Learning Competencies with PISA Global Competence Framework - Content Knowledge Domain

PISA Global Competence Framework Content Domains and Subdomains of the Scenarios (Assessed in The Cognitive Test)	K TO 12 Curriculum							
	G7		G8		G9		G10	
	*E	I	E	I	E	I	E	I
CD.1 Culture and Intercultural Relations	2	4	0	2	0	0	2	3
SD 1.1. Identity formation in Multicultural Societies	1	0	0	1	0	0	0	1
SD 1.2. Cultural Expressions and Cultural Exchanges	1	3	0	0	0	0	0	1
SD 1.3. Intercultural Communication	0	0	0	0	0	0	0	0
SD 1.4. Perspective Taking, Stereotypes, Discrimination, and Intolerance	0	1	0	1	0	0	2	1
CD.2 Socio Economic Development and Interdependence	2	0	0	2	0	6	2	0
SD 2.1. Economic Interaction and Interdependence	1	0	0	1	0	3	1	0
SD 2.2. Human Capital Development and Inequality	1	0	0	1	0	3	1	0
CD.3 Environmental Sustainability	4	0	0	1	1	1	2	3
SD 3.1. Natural Resources and Environmental Risks	2	0	0	0	1	0	1	2
SD 3.2. Policies, Practices, Behaviors and Environmental Sustainability	2	0	0	1	0	1	1	1
CD.4 Institutions Conflicts and Human Rights	3	3	0	1	1	1	3	1
SD 4.1. Prevention of Conflicts and Hate Crimes	1	0	0	0	0	0	1	0
SD 4.2. Universal Human Rights and Local Traditions	1	3	0	0	1	0	1	0
SD 4.3. Political Participation and Global Engagement	1	0	0	1	0	1	1	1
Explicit and Implicit competencies hit in K-12 Curriculum	11	7	0	6	2	8	9	7
Number of Competencies in Kto12 Curriculum for Araling Panlipunan	79		42		80		63	
% of competencies reflected on Kto12 Curriculum	13.94%		14.29%		12.50%		25.40%	

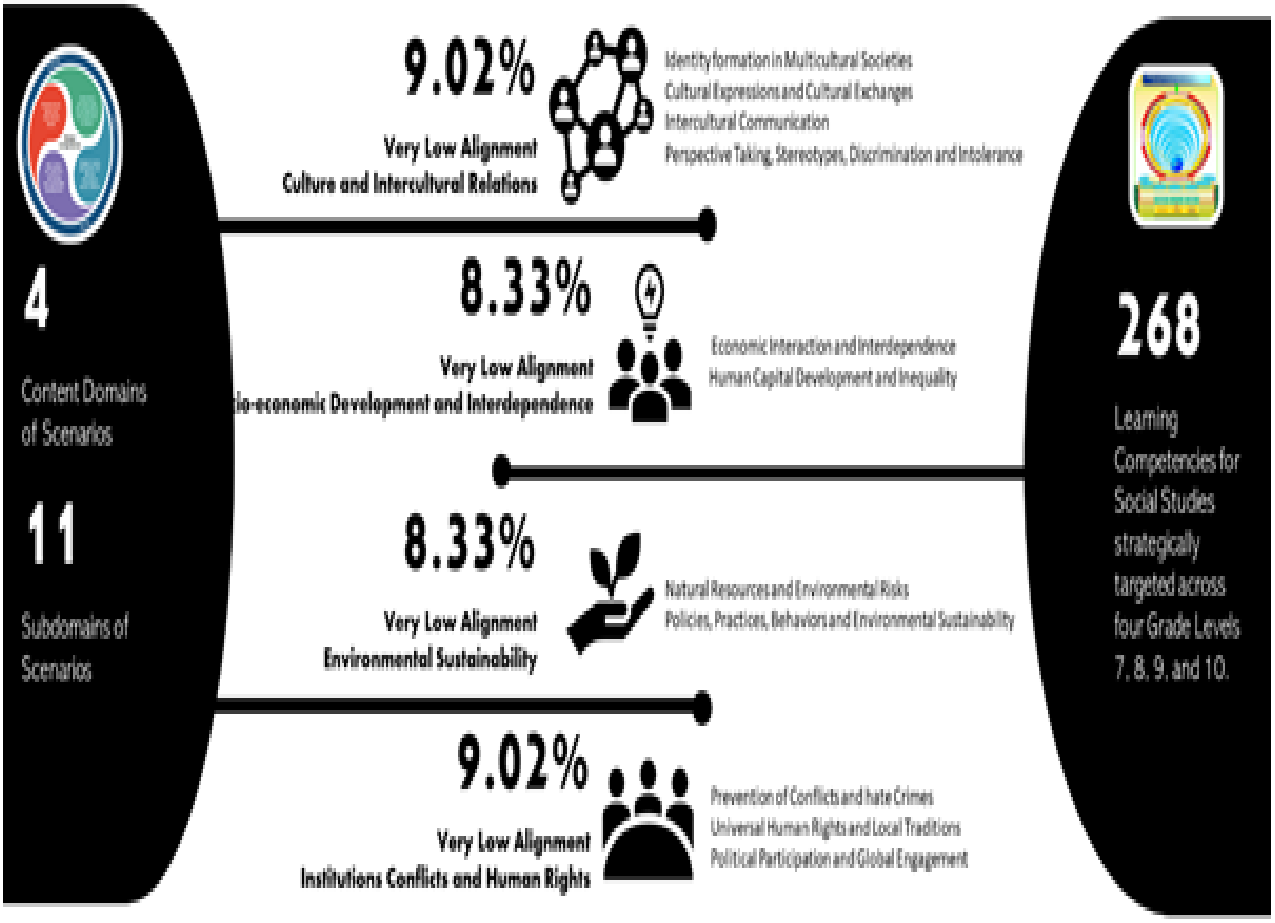
*Legends: E-Explicit, I-Implicit

Contrary to expectations, this study did not find a significant alignment of the PISA GCF on culture and intercultural relations, socio-economic development and interdependence, environmental sustainability, and institutional conflicts and human rights as global competencies with the K to 12 LCs in Social Studies. This is a paradox of what the curriculum guide for Social Studies is trying to achieve under the theme of Kultura*, Pagkakakilanlan at Pagkabansa (Culture, Identity, and Nationality).* As mentioned in the theme for *Kultura, Pagkakakilanlan at Pagkabansa* of *Araling Panlipunan,* the concept of culture refers to the totality of beliefs, values, traditions, and way of life of a group or society, along with its products such as language, art, and so on. It is also stated on theme, that the identity of the group and its members is culturally anchored, like in the Philippines and in other parts of the world. Some aspects of culture are changing, while others continue to exist today. By studying this theme, students are expected to develop a strong identity as members of the youth group, as individuals and as Filipinos, and they are expected to understand and respect the various cultures in the Philippines. Identity as a Filipino will be the basis of a nationalist perspective, which in turn will help them develop a broader worldview. This clear contention of the theme was not substantially observed in the alignment of Araling Panlipunan/Social Studies with those in the PISA GCF.

One thing noticeable is the expectation to develop students' identity as young individuals and Filipinos who show respect towards different cultures in the Philippines in order for them to build a more extensive perspective of the world. Figure 4.4 shows some of the competencies that were deemed aligned either explicitly or implicitly with the PISA GCF - Content Domains.

Figure 4.4

Alignment of the K to 12 Learning Competencies in Araling Panlipunan/Social Studies with PISA Global Competence Framework on Content Domains and Sub-Domains



Social Studies Curriculum (SSC) - Culture and Intercultural Relations (CCR) focuses on the characteristics of Asian countries

The learning competencies in the Social Studies Curriculum on culture and intercultural relations show very low alignment with

the PISA GCF***.*** The results reveal that the SSC-CCR for Grades 7 and 10 focuses on how the students should demonstrate understanding of the relationship of environmental factors and people in shaping the ancient Asian civilization. Hence, they are expected to have a deep understanding of how people interact with and shape their environment.

Moreover, the SSC also aims to teach students an understanding of current affairs and issues in the world today. These results, however, do not elucidate on how students can learn by: a) reflecting on their own cultural identity and that of their peers; b) examining popular attitudes against people in their cultures; or c) studying illustrative cases of conflict or productive integration between cultural groups - all of these are emphasized in the CCR. A sample competency under SSC-CCR can be seen below.

> ***AP7HAS-Ii-1.9:***
> *Examines the relevance of human resources of Asian countries to the development of livelihoods and societies in the present day based on: Population, Age composition, life expectancy, gender, population growth rate, type of employment, employment income, income per person, percentage of literacy and migration*

Social Studies Curriculum (SSC) - Socio-economic Development and Interdependence (SDI) converges the concepts of transformation, development, continuity, and globalization

The analysis revealed that there is a very low alignment of the Kto12 SSC - SDI with the PISA GCF for this domain, and this is

observed explicitly in the SSC for Grades 7 and 10. However, the SSC gives importance to how Asians should respond to the challenges of change, development and continuity of East and Southeast Asia in Transitional and Modern Times (16th to 20th Century). It appears that the curriculum targets the students' ability to conduct critical reviews of the transformation, development and continuity of East and Southeast Asia. This can be observed in the competency provided below.

> ***AP7KIS-IVi-1.23:***
> *Examines the difference in the level of advancement and development of South and Southeast Asia using statistics and related data*

In addition, SSC-SDI gives value on globalization and its origins to prompt students to examine different institutions in the society. It also highlights the assessment of the implications of unemployment in the life and development of a country. With this, students will have to be taught to make sense of how local, regional and global systems contribute to the growth trends in Asian countries and the differences in resources accessible to individuals.

Social Science Curriculum (SSC) - Environmental Sustainability (ES) highlights Macro Issues and Implications on Natural Resources and Climate Change

Students require a solid base to deal with environmental concerns in order to support and promote environmental sustainability. Learning programs in the area of environmental management allow students to consider the diverse processes and policies affecting the need for and usage of natural capital. SSC-ES as a domain for Global Competence is included in Grades 7, 9, and 10. In addition, SSC-ES underscores valuing the relationship between

humans and the environment in developing the Asian society. The same emphasizes the value of natural resources in Asia as a driving force for economic well-being and development in the East and Southeast Asia. This is explicitly stated in the competency as cited below.

AP7HAS-Ie-1.5:
Illustrates the natural resources of Asia

Furthermore, the SSC-ES emphasizes the different factors that trigger climate change and asks students to think about possible programs and policies, both local and international, to address the problem. Also, this ES calls attention to assessing the effects of climate change on people. However, the performance standards and learning competencies are focused on a more macro level making the issue of climate change seemingly artificial and not genuinely related to the common people's experiences/concerns in their daily life and struggles to live for the future.

Social Studies Curriculum (SSC) - Institutions' Conflicts and Human Rights (ICHR) merits the importance of a more inclusive community

The fourth knowledge domain in the PISA GCF focuses on formal and informal organizations that foster sustainable international ties and respect for fundamental human rights. The Kto12 SSC-ICHR, like in the first three domains of knowledge for SSC, shows a very low alignment with the PISA GCF, however, the learning competencies are aligned explicitly for Grades 7, 9, and 10. Understanding human rights and responsibility is an important part of the SSC program because it allows learners to engage thoroughly and meaningfully in the lives of their families, with

people from other countries, and with the world. A sample competency for SSC-ICHR is provided below.

> ***AP7KIS-IVg-1.18:***
> *Examines and compares the principles that promote the Rights of the people in general, and of women, indigenous groups, caste members in India and other sectors of society*

Acquiring profound understanding of this domain is essential and beneficial for young people to establish ideals such as unity, non-discrimination, freedom, fairness, non-violence, empathy, and respect. However, the SSC is quite ambiguous on how these abstract concepts can be understood by people from all walks of life, especially those from the poorest of the poor, and how students can relate these to local experiences.

Figure 4.5 presents the levels of the Kto12 global competencies vis-a-vis the PISA GCF on cognitive skills. The data in Figure 4.5 show that in Grade 7, 5.06% of the Kto12 LCs were observed at the basic and intermediate levels, where three competencies out of 79 are implicitly identified at the basic level, and only one is explicit. In Grade 8, 7.14% of the LCs were observed at the basic and intermediate levels, where three out of 79 are implicitly identified at the basic level, and one is explicit at the intermediate level. In Grade 9, 1.25% of the LCs or one out of 80 was observed at the intermediate level of global competence. And, in Grade 10, 4.76% or three out of 63 LCs were observed at the basic and intermediate levels, where one is implicit and two are explicit.

Figure 4.5

Mapping of Cognitive Skills and Level of PISA Global Competencies vis-a-vis the Kto12 Social Studies Curriculum

Cognitive Skills	Subskills/ Sub-Category	Level of Global Competencies (Grade)																							
		Grade 7						Grade 8						Grade 9						Grade 10					
		B		In		A		B		In		A		B		In		A		B		In		A	
		E	I	E	I	E	I	E	I	E	I	E	I	E	I	E	I	E	I	E	I	E	I	E	I
CS1. Evaluate information, formulate arguments, and explain complex situations or problems	SS1.1 Selecting sources (range)		■																						
	SS1.2 Weighing sources (reliability and relevance)																								
	SS1.3 Employing sources (reasoning with evidence)																								
	SS1.4 Describing and explaining complex situations or problems								■												■				
CS2. Identify and Analyze multiple perspectives and world views	SS2.1 Recognizing perspectives and world views																					■			
	SS2.2 Identifying connections		■						■													■			
CS3. Understand differences in communication	SS3.1 Understanding communicative contexts and respectful dialogue			■																					
CS4. Evaluate actions and consequences	SS4.1 Considering actions									■															
	SS4.2 Assessing consequences and implications		■													■									
Levels of Global Competencies hit based on the Kto12 Curriculum for Araling Panlipunan Competencies		3 Implicit-Basic Level 1 Explicit-Intermediate						2 Implicit-Basic Level 1 Explicit-Intermediate						1 Explicit-Intermediate						1 Implicit-Basic Level 2 Explicit-Intermediate					
Number of Global Competencies hit based on the Kto12 Curriculum for Araling Panlipunan Competencies		4						3						1						3					
Number of Competencies in the Kto12 Curriculum for Araling Panlipunan		79						42						80						63					
% of Global Competencies hit based on the Kto12 Curriculum for Araling Panlipunan Competencies		5.06%						7.14%						1.25%						4.76%					
Legends: B-Basic Level, In-Intermediate Level, A-Advanced Level, E-Explicit, I-Implicit																									

Figure 4.6 shows the attitudes and behavioral skills based on the PISA GCF across grade levels vis-a-vis the Kto12 LCs. In Grade 7, 7.59% of the KSA competencies are aligned with the PISA GCF, however, most of the LCs are implicitly observed, and the focus is on knowledge of global and intercultural issues, perspective taking, openness toward people from other cultural backgrounds, respect for people from other cultural backgrounds, and global mindedness. In Grade 8, 2.38% or one is implicitly observed under the attitude competency of the SSC, and this was found to be aligned with PISA GCF, i.e. the sense of the world under global mindedness. In Grade 10, 15.87% of the LCs are aligned with the PISA GCF; eight are explicit and two are implicit. Knowledge of global and intercultural issues, adaptability, perspective taking, openness toward people from other cultural backgrounds, respect for people from other cultural backgrounds, global mindedness are observed in the PISA GCF.

Gaps in the Social Studies Curriculum vis-a-vis the PISA Global Competence Framework

Cognitive skills, attitudes, behavioral skills received considerable attention in various assessment methodologies on students' performance especially in Social Studies. Notably, these skills are included in the Kto12 LCs which endeavor to make Filipino students more impartial, rational, active and globally aware citizens. However, data show that there is very low alignment of the Kto12 LCs in the Social Studies Curriculum with the PISA GCF. These skills should have been appreciated in the different themes identified in the curriculum guide for Social Studies. Though there are some learning competencies that were evidently targeted and considered aligned explicitly and implicitly by the researchers, the number of aligned competencies is still considered at an exceptionally low level (Figure 4.7).

Figure 4.6

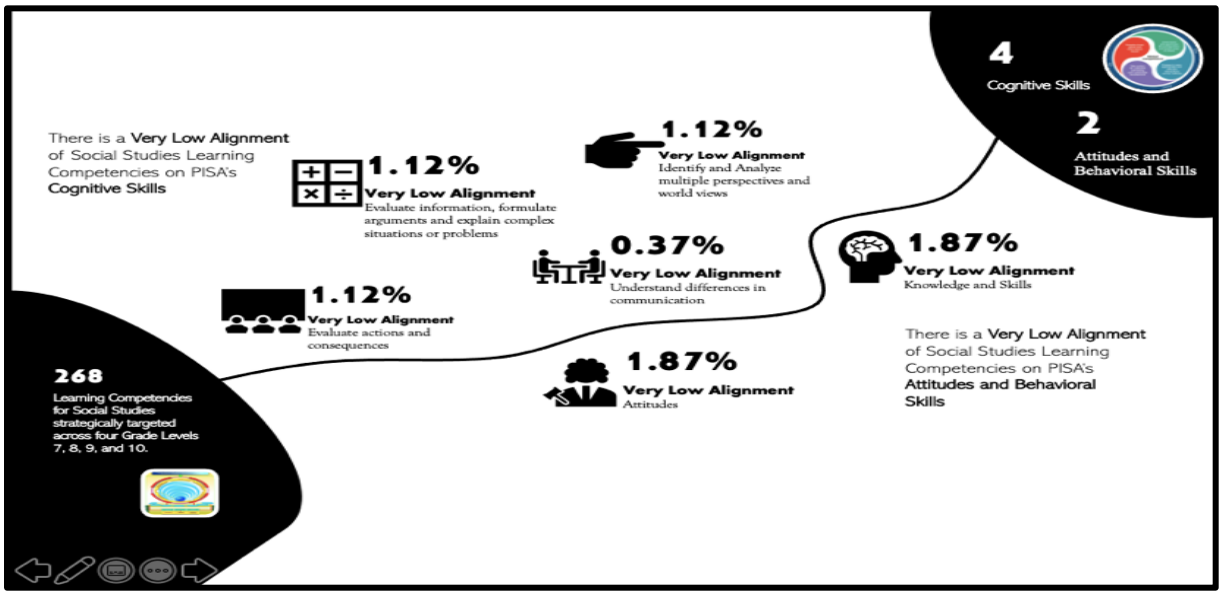
Mapping of Attitudes and Behavioral Skills in the PISA GCF vis-a-vis the Kto12 Social Studies Curriculum in the Philippines

Attitudes and Behavioral Skills (Soft Skills)	Subskills	Grade 7		Grade 8		Grade 9		Grade 10	
		E	I	E	I	E	I	E	I
D1. Knowledge and Skills	SD1.1. Knowledge of Global and Intercultural Issues		■						■
	SD1.2. Ability to communicate in Multicultural Contexts								
	SD1.3. Adaptability							■	
	SD1.4. Perspective taking		■					■	
D2. Attitudes	SD2.1. Openness toward people from other cultural backgrounds		■					■	
	SD2.2. Respect for people from other cultural backgrounds		■					■	
	SD2.3. Global Mindedness								
	SD2.3.1 Sense of the World				■			■	
	SD2.3.2 Responsibility for Others in the World		■					■	
	SD2.3.3 Sense of Interconnectedness		■						■
	SD2.3.4 Global Self Efficacy							■	
	SD2.3.5 Global Engagement							■	
Explicit and Implicit competencies hit in K-12 Curriculum		6 Implicit KSAs		1 Implicit A		0		8 Explicit KSAs 2 Implicit KSAs	
Number of Knowledge, Skills, and Attitudes hit based on the Kto12 Curriculum for Araling Panlipunan Competencies		6		1		0		10	
Number of Competencies in the Kto12 Curriculum for Araling Panlipunan		79		42		80		63	
% of Knowledge, Skills, and Attitudes hit based on the Kto12 Curriculum for Araling Panlipunan Competencies		7.59%		2.38%		0		15.87%	

Legends: E-Explicit, I-Implicit, K-knowledge, S-Skills, A-Attitudes

Figure 4.7

Alignment of the K to 12 Learning Competencies in Araling Panlipunan/Social Studies Curriculum with the PISA Global Competence Framework on Cognitive Skills, Attitudes, and Behavioral Skills



Social Studies Curriculum - Cognitive Skills (SSC-CS) recognizes Economic Development: Causes and Implications

The Cognitive Skills needed in global comprehension are important indicators across all aspects of students' global competence. In SSC CS, data show that there is a very low alignment of learning competencies with the PISA GCF. However, it is quite evident that the Kto12 SSC tried to target the same cognitive skills present in the PISA GCF, and this can be observed in the listed learning competencies. The same Cognitive Skills targeted in the Learning Competencies can be observed explicitly in Grades 9 and 10, and in several content standards and performance standards identified in the curriculum, a sample of which is stated below.

AP9MYK-IIj-13:
Justifies the necessary intervention and government regulation in the works economical to the various market structure to meet the needs of citizen

Social Studies Curriculum (SSC) - Attitudes and Behavioral Skills (ABS) values Sustainable Development and Human Rights

Appropriate attitudes and behavioral skills are needed by learners to go through their everyday lives. Also they need to be culturally knowledgeable as a supplementary enabler to their cognitive skills. SSC-ABS highlights the relevance of ABS in dealing with various contemporary issues such as Migration, Human Rights, Sustainable Development, and Gender. It is interesting to note that this is explicitly stated in the learning competencies for Grade 10, however, this can be better placed in the Grade 7 or 8 curriculum to introduce the competencies early on in Junior High School and to be reinforced in the later grades. This observation can be observed in one of the competencies provided below.

AP10ICC-IVi- 10:
Explain the importance of cooperation of citizens and government to solve the problems of society

Upon examination of the alignment of the learning competencies in the Kto12 Social Studies Curriculum vis-a-vis the PISA 2018 GCF, several key findings were observed as follows:

1. The Kto12 Social Studies Curriculum underscores the importance of global competence in the Philippine Education System to develop more pluralist and globally sensitive

Filipino learners. However, the Social Studies subject in Junior High School only highlights the Philippines and other Asian countries focusing on the people and the economies, the culture and intercultural relations, and the concepts of transformation, development, continuity, and globalization. In the cognitive domain, topics such as Intercultural Communication, Cultural Expressions and Cultural Exchanges, Political Participation and Global Engagement, and Prevention of Conflicts and Hate Crimes are not covered in any grade level in the Social Studies Curriculum.

2. The themes and foci of the learning competencies across Grades 7 to 10 in the Social Studies Curriculum are aligned minimally with the PISA GCF in a seemingly intertwined manner among the topics in the curriculum guide. However, there may have been some hindrances in fulfilling its purpose since there is very low alignment with the PISA GCF, and one of these might have been the non-usage of global citizenship/competencies language. Also there is more focus given to learning concepts and repetition of competencies.

3. The cognitive process and skills domain of PISA GCF are needed in reviewing/rewriting the competencies in the curriculum which are important to develop globally competent citizens such as selecting sources (range), weighing sources (reliability and relevance), employing sources (reasoning with evidence), describing and explaining complex situations or problems, recognizing perspectives and worldviews, identifying connections, understanding communicative contexts and respectful dialogue, and assessing consequences and implications. The competencies enumerated cannot be found in any year level.

4. There is only a minimal gap in the attitudes and values domain of the PISA GCF vis-a-vis the learning competencies in the Social Studies Curriculum.

5. Finally, the overall analysis of Kto12 Social Studies Curriculum reveals a low percentage concurrence with the PISA GCF.

The Global Competencies in the Kto12 EsP/Values Education Curriculum

Table 4.3 shows the comparative analysis of the content domains and subdomains of scenarios identified in the PISA GCF and the competencies identified in the Kto12 EsP/Values Education Curriculum for Grades 7 to 10.

The data show that in Grade 7, 17.19% of the Kto2 LCs in the EsP/Values Education Curriculum (VEC for brevity) are aligned with the content domains and subdomains of the PISA GCF, where 11 out of 64 competencies are explicitly stated and seven are implicit. In Grade 8, 7.81% of the LCs are aligned with the PISA GCF, where five out of 64 competencies are implicit, and none are explicitly aligned. In Grade 9, it was observed that 22.73 % of the LCs are aligned with the PISA GCF, where six out of 66 competencies are explicit and nine are implicit. And, in Grade 10, 15.62% of the LCs for EsP/Values Education are aligned with the PISA GCF on content domains, where one out of 64 is explicit and nine are implicit. Overall, there is evidence of very low alignment of the Kto12 LCs in EsP/Values Education with the Content Domains of the PISA GCF as presented in Figure 4.8.

Table 4.3

Mapping of Cognitive Skills and Level of PISA Global Competence Framework in the Kto12 EsP/Values Education Curriculum

PISA Global Competence Framework Content Domains and Subdomains of the Scenarios (Assessed in The Cognitive Test)	K TO 12 Curriculum							
	G7		G8		G9		G10	
	*E	I	E	I	E	I	E	I
CD.1 Culture and Intercultural Relations	1	3	0	1	1	4	0	3
SD 1.1. Identity formation in Multicultural Societies	1	1	0	1	0	1	0	1
SD 1.2. Cultural Expressions and Cultural Exchanges	0	1	0	0	0	1	0	1
SD 1.3. Intercultural Communication	0	0	0	0	0	1	0	0
SD 1.4. Perspective Taking, Stereotypes, Discrimination, and Intolerance	0	1	0	0	1	1	0	1
CD.2 Socio Economic Development and Interdependence	0	3	0	0	1	2	0	1
SD 2.1. Economic Interaction and Interdependence	0	1	0	0	0	1	0	1
SD 2.2. Human Capital Development and Inequality	0	2	0	0	1	1	0	0
CD.3 Environmental Sustainability	0	0	0	0	2	0	0	2
SD 3.1. Natural Resources and Environmental Risks	0	0	0	0	1	0	0	1
SD 3.2. Policies, Practices, Behaviors and Environmental Sustainability	0	0	0	0	1	0	0	1
CD.4 Institutions Conflicts and Human Rights	1	3	0	4	2	3	1	3
SD 4.1. Prevention of Conflicts and Hate Crimes	0	1	0	2	0	1	0	1
SD 4.2. Universal Human Rights and Local Traditions	1	1	0	1	2	1	1	1
SD 4.3. Political Participation and Global Engagement	0	1	0	1	0	1	0	1
Explicit and Implicit competencies hit in Kto12 Curriculum	2	9	0	5	6	9	1	9
Number of Competencies in Kto12 Curriculum for Edukasyon sa Pagpapakatao	79		42		80		63	
% of competencies reflected on Kto12 Curriculum	13.92%		11.90%		18.75%		15.87%	

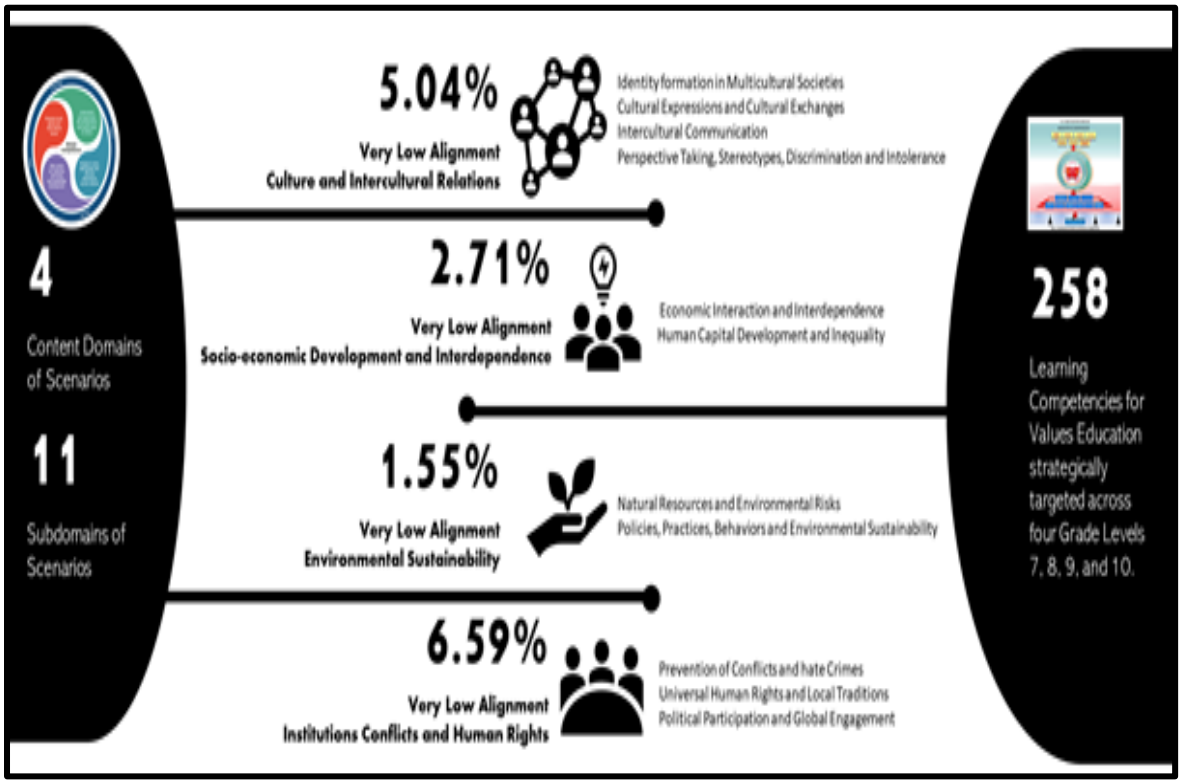
*Legends: E-Explicit, I-Implicit

Domains and Sub-Domains

Edukasyon sa Pagpapakatao (EsP) or Personhood Education, formerly called Values Education (VE), in the Kto12 curriculum focuses on the basic skill of functional literacy of deciding and acting responsibly towards the common good. This competency aims to ensure that participation of Filipino students in their community and country is supported by evidence-based arguments and actions rooted from a pluralist perspective of a multicultural society and inclusive growth. However, it was observed that there is a very low alignment of the learning competencies (LCs) in EsP/VE with the PISA GCF.

Figure 4.8

Alignment of the K to 12 Learning Competencies in EsP/Values Education with PISA Global Competence Framework on Content



EsP/Values Education Curriculum (VEC) Culture and Intercultural Relations (CCR) values Family Communication and Adolescents' tasks

The EsP/Values Education LCs on culture and intercultural relations show very low alignment with the PISA GCF even if the curriculum explicitly states that students are expected to apply the appropriate steps in cultivating five expected capabilities and actions (developmental tasks) as adolescents. It seems that this particular LC in the EsP/VEC CCR is targeted explicitly in Grades 7 and 8 only, but not necessarily followed through in the next grade levels, as stated in the sample competency provided below.

EsP7PS- Ib-1.4:
Applies appropriate steps to develop five expected capabilities and behaviors (developmental tasks) during adolescence

EsP/VEC - Socio-economic Development and Interdependence (SDI) accentuates Workmanship

Quality is one of the key goals in the Kto12 EsP/VEC, and this is evident in the inclusion of a learning competency on quality and workmanship. The EsP/VEC SDI focuses on how students should value quality and good workmanship in doing one's work. This can be gleaned from a sample competency stated below.

EsP9KP- IIIh-10.4:
Completes a task or product that has quality or workmanship

Figure 4.9 presents the levels of the Kto12 learning competencies based on PISA GCF on cognitive skills. Data show that in Grade 7, 6.25% of the Kto12 LCs in EsP/VEC are observed, where 4 out 64 are implicitly identified at the basic level. In Grade 8, 7.81% of the LCs are observed, where 5 out 64 are implicitly identified at the basic level. In Grade 9, 9.09% of the LCs or 6 out 66 are observed at the basic level. Overall, LCs in the EsP/VEC have a low level of alignment with the PISA GCF in cognitive skills.

Figure 4.9

Mapping of Cognitive Skills and Level of Global Competencies in EsP/VEC

Cognitive Skills	Subskills/ Sub-Category	Level of Global Competencies (Grade)																							
		Grade 7						Grade 8						Grade 9						Grade 10					
		B		In		A		B		In		A		B		In		A		B		In		A	
		E	I	E	I	E	I	E	I	E	I	E	I	E	I	E	I	E	I	E	I	E	I	E	I
CS1. Evaluate information, formulate arguments, and explain complex situations or problems	SS1.1 Selecting sources (range)		■												■										
	SS1.2 Weighing sources (reliability and relevance)														■										
	SS1.3 Employing sources(reasoning with evidence)																								
	SS1.4 Describing and explaining complex situations or problems		■												■										
CS2. Identify and Analyze multiple perspectives and worldviews	SS2.1 Recognizing perspectives and worldviews		■						■																
	SS2.2 Identifying connections								■						■										
CS3. Understand differences in communicatio n	SS3.1 Understanding communicative contexts and respectful dialogue								■																
CS4. Evaluate actions and consequences	SS4.1 Considering actions		■						■						■										
	SS4.2 Assessing consequences and implications								■						■										
Levels of Global Competencies hit based on the Kto12 Curriculum for Edukasyon sa Pagpapakatao Competencies		4 Implicit-Basic Level						5 Implicit-Basic Level						6 Implicit-Basic Level						0					
Number of Global Competencies hit based on the Kto12 Curriculum for Edukasyon sa Pagpapakatao Competencies		4						5						6						0					
Number of Competencies in the Kto12 Curriculum for Edukasyon sa Pagpapakatao		79						42						80						63					
% of Global Competencies hit based on the Kto12 Curriculum for Edukasyon sa Pagpapakatao Competencies		5.06%						11.90%						7.50%						0					
Legends: B-Basic Level, In-Intermediate Level, A-Advanced Level, E-Explicit, I-Implicit																									

Figure 4.10 shows the attitudes and behavioral skills based on the PISA GCF across grade levels vis-a-vis the learning competencies in the Kto12 EsP/VEC. In Grade 7, 9.38% of the KSA competencies are aligned with the PISA GCF, mostly are implicitly observed which focused on knowledge of global and intercultural issues, perspective taking, openness toward people from other cultural backgrounds, respect for people from other cultural backgrounds, and global mindedness. In Grade 8, 10.94% or 1 implicit attitude competency for Social Studies is aligned with the PISA GCF, which is the sense of the world under global mindedness. In Grade 9, 21.21% of the KSA competencies are aligned with the PISA GCF, where 5 KSA competencies are explicit and 9 are implicit. In Grade 10, 15.87% of the KSA competencies are aligned with the PISA GCF, where 8 are explicit and 2 are implicit.

Gaps in the EsP/Values Education Curriculum vis-a-vis the PISA Global Competence Framework

Through the EsP/Values Education Curriculum, students can learn Cognitive Skills, Attitudes and Behavioral Skills that will help them develop strong life-long learning skills rooted from Philosophy. They can also learn the skills of self-help so they cope with issues related to growing up and becoming mature. The teaching of EsP/Values Education is anchored on the philosophy of Personalism on Humanity and the Ethics of Virtue. According to the philosophy of Personalism, relationships are always rooted in humanity. In our relations, we create our humanity. In Virtue Ethics, a good person practices good habits and avoids bad habits. These are the tenets of global citizenship education, the major platform to develop and acquire global competencies among Filipino learners.

Figure 4.10

Mapping of Attitudes and Behavioral Skills in PISA GCF vis-a-vis the learning competencies in EsP/VEC

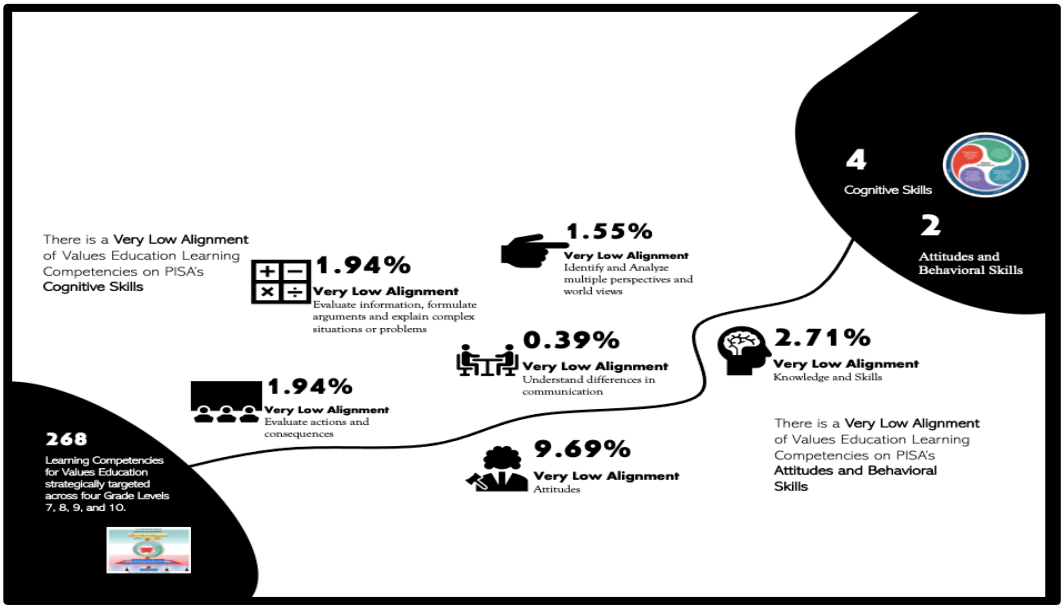
Attitudes and Behavioral Skills (Soft Skills)	Subskills	Grade 7		Grade 8		Grade 9		Grade 10	
		E	I	E	I	E	I	E	I
D1. Knowledge and Skills	SD1.1. Knowledge of Global and Intercultural Issues				■		■		
	SD1.2. Ability to communicate in Multicultural Contexts								
	SD1.3. Adaptability				■		■		
	SD1.4. Perspective taking		■				■		■
D2. Attitudes	SD2.1. Openness toward people from other cultural backgrounds	■			■		■		■
	SD2.2. Respect for people from other cultural backgrounds					■			■
	SD2.3. Global Mindedness								
	SD2.3.1 Sense of the World					■	■		
	SD2.3.2 Responsibility for Others in the World				■		■		
	SD2.3.3 Sense of Interconnectedness				■	■	■		■
	SD2.3.4 Global Self Efficacy	■	■		■	■	■		
	SD2.3.5 Global Engagement	■	■		■	■	■		■
Explicit and Implicit competencies hit in the Kto12 Curriculum		3 Explicit KSAs 3 Implicit KSAs		7 Implicit KSAs		5 Explicit KSAs 9 Implicit KSAs		5 Implicit KSAs	
Number of Knowledge, Skills, and Attitudes hit based on the Kto12 Curriculum for Edukasyon sa Pagpapakatao Competencies		6		7		14		5	
Number of Competencies in the Kto12 Curriculum for Edukasyon sa Pagpapakatao		79		42		80		63	
% of Knowledge, Skills, and Attitudes hit based on the Kto12 Curriculum for Edukasyon sa Pagpapakatao Competencies		7.59%		16.67%		17.5%		7.93%	
Legends: E-Explicit, I-Implicit, K-knowledge, S-Skills, A-Attitudes									

This can be observed in the statement below directly excerpted from the Edukasyon sa Pagpapakatao/Values education curriculum guide.

Ang Batayang Konseptwal ng Edukasyon sa Pagpapakatao ay batay sa pilosopiyang Personalismo tungkol sa pagkatao ng tao at sa Etika ng Kabutihang Asal (Virtue Ethics). Ayon sa pilosopiya ng Personalismo, nakaugat lagi sa pagpapakatao ang ating mga ugnayan. Nililikha natin ang ating pagpapakatao sa ating pakikipagkapwa. Sa Virtue Ethics naman, sinasabing ang isang mabuting tao ay nagsasabuhay ng mga virtue o mabuting gawi (habits) at umiiwas sa mga bisyo o masamang gawi. Samakatwid, ang nagpapabuti sa tao ay ang pagtataglay at ang pagsasabuhay ng mga mabuting gawi.

However, data show that there is a very low alignment of the Kto12 learning competencies in the EsP/VEC with the Cognitive Skills, Attitudes and Behavioral Skills in PISA GCF (Figure 4.11).

Figure 4.11
Alignment of the K to 12 Learning Competencies in EsP/Values Education Curriculum with the PISA Global Competence Framework on Cognitive Skills, Attitudes, and Behavioral Skills



EsP/VEC-Cognitive Skills (CS) embraces topical complexity

Global competence also draws on common "skills" in cognitive, communication and socio-emotional skills including knowledge processing, intercultural communication skills, perspective taking, conflict resolution skills and adaptability. Globally competent students may argue about knowledge from different sources, such as textbooks, teachers, influential people, conventional and digital media. EsP/VEC - CS encompasses learning competencies that are targeted from assessing decisions and actions to various realizations, platforms, principles, and societal dimensions. However, the cognitive processes are not specific in relation to processing information about the topics in the curriculum guide, and this needs to be considered in drafting learning competencies. A sample competency below shows such inference.

> ***EsP7PB- IIIh-12.4:***
> *Conducts examination and affirmation of decisions and actions amidst the competing influences of external factors that affect the formation of values.*

EsP/VEC-Attitudes and Behavioral Skills (ABS) promotes communal mindedness

Global competence reflects and is driven by core behaviors or attitudes. EsP/VEC-ABS advocates a perspective in which people see themselves as connected to different societal groups and experience a sense of duty for their members, while upholding human dignity. However, EsP/VEC-ABS does not include competencies that would help learners form a worldview for them to learn how to establish a connection with the world community and value their actions that may affect the members of foreign

nations. Thus, there is a need to recalibrate the EsP/VEC-ABS to focus on learning competencies that will showcase a Filipino worldview on oneness and global community. A sample competency for VEC-ABS below shows such communal mindedness.

> ***EsP9TT-IIa-5.2:***
> *Examines human rights violations that exist in the family, school, village / community, or society / country*

An analysis of the alignment of the LCs in the EsP/VEC with the PISA GCF reveals that:

1. In the cognitive domain, topics such as Intercultural Communication, Cultural Expressions and Cultural Exchanges, institutions and conflicts and environmental sustainability - natural resources and environmental risks - are not covered in any grade level in the Kto12 EsP/VEC.

2. The Kto12 learning competencies in the EsP/VEC on cognitive skills are not aligned with the cognitive process and skills domain in the PISA GCF. In this domain, competencies which are important to be a globally competent citizen such as selecting sources (range), weighing sources (reliability and relevance), employing sources (reasoning with evidence), Describing and explaining complex situations or problems, recognizing perspectives and worldviews, identifying connections, understanding and communicative contexts and respectful dialogue and assessing consequences and implications cannot be found in any grade level.

3. There is only a minimal gap observed in the attitudes and values domain of PISA GCF vis-a-vis the learning competencies in the EsP/Values Education curriculum. However, the ability to communicate in multicultural

contexts using language and adaptability and responsibility for others are values and behaviors lacking in the learning competencies in the EsP/Values Education Curriculum.

4. Both the Social Studies and the EsP/Values Education curricula lack the skills present in the PISA GCF cognitive process domain. Interestingly, competencies in the cognitive process and skills in the PISA subdomain such as evaluate information, formulate arguments and explain complex situations or problems listed the skills as selecting, weighing, employing sources and describing and explaining complex situations or problems show a very low congruence with the learning competencies in the Social Studies and EsP/Values Education curricula.

5. In a cross analysis of the PISA results, similar skills are also listed in the assessment of Reading Literacy (English). The PISA 2018 results revealed that Filipino students performed significantly low in Reading and Literacy with the highest mean score of 343 points for locating Information in the process subscale; 335 for understanding; and 333 for evaluating and reflecting. Meanwhile they obtained a mean of 332 in single source and 341 in multiple sources. The overall results fall short in achieving the OECD standards in Reading Literacy. The interrelated skills assessed in PISA imply that development of these skills should be integrated in the three subjects; namely: Araling Panlipunan/Social Studies, EsP/Values Education, and Reading (English). The skills in PISA reading literacy and the cognitive process sub-skills in the PISA Global Competence Framework complement in enabling the Filipino learners to assess the quality and credibility of information and to formulate arguments and explain complex situations that call for finding solutions to address the needs of the local and global community.

CONCLUSIONS AND RECOMMENDATIONS

The analysis made on the Philippine Kto12 curriculum documents and the PISA 2018 Global Competence Framework has led to the following conclusions and recommendations to inform decisions on possible adjustments in the curriculum.

First, the global competencies are integrated and stated explicitly in the Kto12 Curriculum which can be seen clearly in the articulated mission, goals, outcomes, and framework of the Social Studies and EsP/Values Education Curricula.

Second, the content and competencies on global citizenship are minimally plotted in both the Social Studies and EsP/Values Education curricula. Moreover, both curricula are lacking in the area/domain of global competence/global awareness when examined for alignment with the PISA GCF. A very low alignment of learning competencies in the SSC and EsP/VEC is evident in the ff. subdomains: culture and intercultural relations, interdependence, and institutions' conflicts and human rights.

Competencies in the PISA GCF cognitive process and skills in the ff. subdomains - evaluate information, formulate arguments and explain complex situations or problems listed the skills selecting, weighing, employing sources and describing and explaining complex situations or problems - show a very low congruence with the LCs in the Social Studies and EsP/Values Education curricula.

In addition, there is also a very low congruence in subdomain intercultural communications (global language and communication and global interrelatedness) in the two curricula. It is also noted that the focus of the competencies is in the national

context, and there is a significantly high regard for the Asian context.

Third, the learning competencies found in both curricula are not articulated in the language of the PISA Global Competence Framework. This may cause difficulty for school heads and teachers to translate them systematically and effectively when unpacking the curriculum into specific learning outcomes and integrate them in actual classroom teaching practice.

Finally, from data drawn from the document analysis, it can be concluded that the Social Studies and EsP/Values Education Curricula have low alignment with the PISA global competence framework. Based on this, the current Kto12 curriculum in Social Studies and EsP/VE needs to be revised to include the competencies in the PISA GCF if DepEd really sees the need to aspire for international alignment of our basic education curriculum. Another is to do a second level curriculum mapping vis-a vis international standards for global competence, 21st century skills and other international benchmarks to address particularly the areas not covered in the curriculum to ensure that the performance of Filipino students is comparable with international standards.

Specifically, the following are also recommended:

1. Review the existing educational policies and programs as regards integration and embedding of global competencies language in the goals, outcomes, content and processes to make these competencies explicit and to foster clarity in its development at the school and classroom level.
2. Reassess the Kto12 curriculum to validate the results of this study for the purpose of: a) examining the learning

competencies to give emphasis on culture and intercultural relations, interdependence, and institutions' conflicts and human rights, evaluate information, formulate arguments and explain complex situations or problems listed the skills selecting, weighing, employing sources and describing and explaining complex situations or problems subdomain intercultural communications (global language and communication and global interrelatedness) in the 2 curricula; and b) doing a cross examination of the skills needed to be developed in reading literacy that align with global competence.

3. Apart from using the ASEAN context, a global lens is needed in the development of the competencies in the Social Studies Curriculum and the Edukasyon sa Pagpapakatao/Values Education Curriculum, specifically in intercultural understanding and global communication.

4. Articulate in the curriculum the language of PISA global competence and translate them systematically and effectively to facilitate the unpacking of the curriculum into specific learning outcomes and integrate them in classroom teaching practice.

5. Train teachers on global competence skills. DepEd thru NEAP and concerned education agencies should provide professional development programs for teachers on the teaching and integration of global competencies in the curriculum. Teacher Education Institutions or TEIs, like the Philippine Normal University, should continue to provide training programs or short term courses for teachers and education leaders to ensure they get quality continuing professional education which will help improve/enhance their teaching practices and ensure learning is informed by

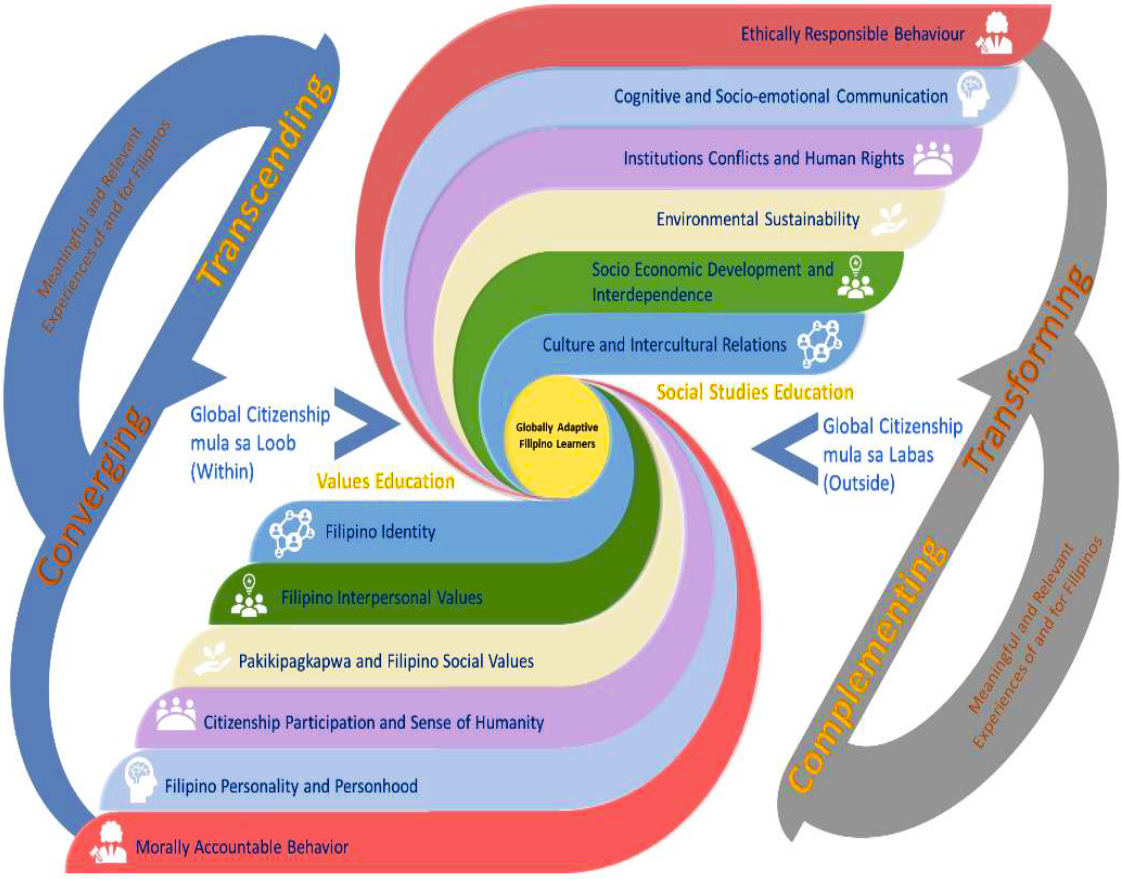
research, assessment results, goals, and outcomes of the curriculum.

6. Prioritize the development of quality and relevant instructional materials in Social Studies and EsP/Values Education on global competence by calling on reputable publishing companies and other stakeholders to take the initiative to help DepEd, aside from those that are prepared by the teachers themselves, to produce quality textbooks and teaching resource materials that are Kto12-compliant, internationally-benchmarked, and accessible to all Filipino learners.
7. Adopt, if possible, the proposed Social Studies and EsP/Values Education Framework for Global Competence developed in this present study. The proposed framework for social studies and EsP/values education on global competence is anchored on the PISA Global Competence Framework. The researchers acknowledge that the themes of the PISA GCF are relevant and appropriate to Filipino learners (Figure 4.12). The proposed framework is committed to realizing the success of teaching Social Studies and EsP/Values Education in the Philippines focusing on lifelong learning to lifelong adaptability.

The researchers believe that the proposed framework would be relevant in crafting the most essential learning competencies (MELCs) which DepEd is implementing now in this time of the COVID-19 pandemic to ensure all basic education students will still continue with their studies, and that learning delivery approaches suited to the local context and diversity of learners are utilized well.

Figure 4.12

Proposed Complementing, Converging, and Transcending Global Competence Framework for DepEd's Social Studies and Values Education Curricula



With the education sector in particular facing challenges in the real world due to globalization and the use of contemporary technology and VUCA, which explains the volatile, unpredictable and constantly evolving educational climate that is the new normal in global education, basic education institutions need to respond and adapt quickly to changes. Collectively, educational institutions need to anticipate and adapt to changes quickly and efficiently by having effective strategies and practices in place.

Therefore, the task for the future of schooling, training, and research would be to harness people's instinctively interested and exploratory disposition, and to build social protections for those more explicitly or adversely affected by VUCA's threatening aspects. Specifically, social studies and EsP/values education play a significant role in securing that life and transpersonal skills for global adaptability are prioritized. Most essential learning competencies can be approached through the proposed framework vis-a-vis the VUCA environment and the globalizing society.

The proposed framework emphasizes that one of the goals of education is for Filipino learners to be "globally adaptive" which means that the ultimate goal of social studies and values education for Filipino learners is to optimize a whole world approach (i.e. recognizes the importance of other countries' best practices in various fields [interests] across contexts [cultures]). This dichotomy of global competencies are driven by two forces of Global Citizenship, i.e. from within (mula sa loob) and outside (mula sa labas).

Global citizenship *mula sa loob* (within) refers to factors that influence the Filipino learners to identify themselves from their socio-political origins, cultural roots, and consciousness to puzzle out their significance in an inclusive community of global citizens. Global citizenship *mula sa labas* (outside) refers to factors that influence the Filipino learners to use and adopt best practices from other parts of the world to be responsible and accountable as global citizens.

These forces are gauged by relevant and meaningful experiences of Filipinos through four approaches to facilitate the development of global competence, namely: a) converging, b) transcending, c) complementing, and d) transforming. These approaches can be used to make sure that learning competencies for global citizenship will not promote distortion, alienation, and

marginalization of the experiences of Filipino learners to better represent themselves in a pluralist world that values communal respect and love for common humanity.

REFERENCES:

Addey, Camilla, and Sellar Sam. (2017 - forthcoming revised edition). ‘’Why do countries participate in PISA? Understanding the role of international large-scale assessments in global education policy’’. In, Verger, A. Novelli, M. Altinyelken, H.K. *Global Education Policy and International Development: New Agendas, Issues and Policies*. Bloomsbury Academic

Basic Education System by Strengthening Its Curriculum and Increasing the Number of Years for Basic Education, Appropriating Funds Therefor and for Other Purposes. Retrieved from http://www.senate.gov.ph/lis/bill_res.aspx?congress=15&q=SBN-3286, September 30, 2014.

Delors. J (1996). Learning: the treasure within; report to UNESCO of the International Commission on Education for the Twenty-first Century. UNESCO Publishing. Retrieved from https://www.gcedclearinghouse.org/sites/default/files/resources/%5BENG%5D%20Learning_0.pdf

Department of Education (2019). PISA 2018 National Report of the Philippines. Retrieved from https://www.deped.gov.ph/wp-content/uploads/2019/12/PISA-2018-Philippine-National-Report.pdf

Department of Education (2017). DepEd Order No. No. 29. s.2017 on Policy Guidelines on System Assessment in the K to 12 Basic Education Program. Retrieved from https://www.deped.gov.ph/2017/06/05/do-29-s-2017-policy-guidelines-on-system-assessment-in-the-k-to-12-basic-education-program/

Department of Education (2016). K to 12 Gabay Pangkurikulum Araling Panlipunan Baitang 1-10. Retrieved from https://www.deped.gov.ph/wp-content/uploads/2019/01/AP-CG.pdf

Department of Education (2015).DepEd Order No. No. 8. s.2015 on Policy Guidelines on Classroom Assessment in the K to 12 Basic Education Program. Retrieved from https://www.deped.gov.ph/2015/04/01/do-8-s-2015-policy-guidelines-on-classroom-assessment-for-the-k-to-12-basic-education-program/

Dewey J (1916). *Democracy and Education*. New York: Free Press, pp.10-11.

Elliott, G. (2014). Method in our madness? The advantages and limitations of mapping other jurisdictions educational policy and practice. Research Matters. A Cambridge Assessment Publication.(17), 24-28. https://www.researchgate.net/publication/284182582_Method_in_our_madness_The_advantages_and_limitations_of_mapping_other_jurisdictions'_educational_policy_and_practice retrieved February 18, 2020

Greatorex, J., Rushton, N., Coleman, T., Darlington, E. & Elliott, G. (2019). Towards a method for comparing curricula. Cambridge Assessment Research Report. Cambridge, UK: Cambridge Assessmenthttps://www.gse.harvard.edu/news/17/12/pisa-2018-test-include-global-competency-assessment

Lockheed, M., Prokic-Breuer, T. & Shadrova, A. (2015). The Experience of Middle-Income Countries Participating in PISA 2000-2015. Paris, OECD.

McGuinness C. (2018) Research-Informed Analysis of 21st Century Competencies in a Redeveloped Primary Curriculum Queen's University, Belfast

Mesa V., Gómez P., UiHock C., (2011). Influence of International Studies of Student Achievement on Mathematics Teaching and Learning. Retrieved from https://deepblue.lib.umich.edu/bitstream/handle/2027.42/87950/MesaGomezChea_Influence_Final.pdf?sequence=1ret on February 18, 2020

OECD Asia Society (2018). Teaching for Global competence in a rapidly changing world. Asia Center for Global Education. https://asiasociety.org/education/teaching-global-competence-rapidly-changing-world

Ontario (2016). Towards Defining 21st Century Competencies for Ontario. Foundation Document for Ontario. http://edugains.ca/resources21CL/About21stCentury/21CL_21stCenturyCompetencies.pdf

Pring, R. (2016). Preparing for citizenship: Bring back John Dewey Citizenship, Social and Economics Education 2016, Vol. 15(1) 6–14 https://journals.sagepub.com/doi/pdf/10.1177/2047173416646467 ret January 10, 2020

Republic of the Philippines (2013). Republic Act No. 10533 also known as Enhanced Basic Education Act of 2013. https://www.officialgazette.gov.ph/2013/05/15/republic-act-no-10533/

Republic of the Philippines (1987). The 1987 Constitution of the Republic of the Philippines, Article XIV, Section 3. (2). Retrieved from https://www.officialgazette.gov.ph/constitutions/the-1987-constitution-of-the-republic-of-the-philippines/the-1987-constitution-of-the-republic-of-the-philippines-article-xiv/

The Global First Initiative (2013). Global Education First Initiative Launch. http://www.unesco.org/new/en/gefi/about/ https://www.youtube.com/watch?v=GqVVeCluPeU ret/accessed .February 18,2020

United Nations (2016). Sustainable Development Goals. Retrieved from sustainabledevelopment.un.org

UNESCO (2014). Global citizenship education: Preparing learners for the challenges of the 21st century. Retrieved from https://unesdoc.unesco.org/ark:/48223/pf0000227729

About the Authors

Dr. Rowena Raton-Hibanada, is an Assistant Professor at PNU. She specialized in Social Science for her bachelor's degree (PNU); Values Education for her master's degree (UAP); Educational Leadership and Management Program for her doctorate degree (DLSU); and Civic Education for her certificate program (UAP). She has received various awards for her outstanding performance as a teacher, leader, and citizen to include the Metrobank Foundation Outstanding Teacher of the Philippines (2008), Outstanding UNESCO Educator of the Philippines (2019), and a fellow of UNESCO APCEIU Global Citizenship Education Trainers and ILEP-Fulbright Distinguished Awards for International Leaders in Education Program in 2010.

Mr. Carl O. Dellomos finished his Master of Health Social Science (Full Scholar) under Ford Foundation International Scholarship at the De La Salle University-Manila in 2014. He is a licensed professional teacher with specialization in Values Education. He is also a Lifetime-Member of Philippine Mental Health Association, Inc. (PMHA), Board Member (Kadiwa) of Pambansang Samahan sa Sikolohiyang Pilipino (PSSP) January 2014 – present, and Executive and Board Secretary of the National Association of Professional Teachers, Inc. He is an advocate of Sikolohiyang Pilipino for Teaching and Learning.

Prof. Rene C. Romero was with the Philippine Normal University for more than four decades where he served the university in various capacities as Faculty in both undergraduate and graduate levels, Head of the Social Science Department, Director of the International Linkages and Extension, and Special Assistant to the PNU President. Prof. Romero was assigned Coordinator of UNESCO ASPNET (Associated Schools Project), a position he held for 15 years, and played a major role in the dissemination and implementation of programs related to UNESCO thrusts, like peace and human rights education, education for sustainable development, global education, among others.

Chapter 5

PISA Creative Thinking Framework vis-à-vis K to 12 Philippine Arts and English Language Curricula

Teresita T. Rungduin and Marla C. Papango
Philippine Normal University, Manila

Abstract

The study examined the alignment of the Kto12 Philippine Arts and English Language Arts curricula with the indicators and domains of PISA Creative Thinking Framework. Using content analysis as the primary research design, the study found out that the creative thinking indicator *generating creative ideas* is more aligned with the competencies in the two curricula than with any other indicator in the PISA framework. However, competencies related to *generating diverse ideas* and *evaluating and improving ideas* need to be covered more to ensure that students generate not only creative ideas, but also different, novel, or original ideas. For the PISA creative thinking domains on visual and written expressions, they are apparent in the culminating activities in both curricula per grading period. They are applied in the different artistic and literary traditions from different places in the country and in the world. Although the curricula underscore visual and written expressions, there is also a need to emphasize *knowledge creation and problem solving*, which may either be social or scientific. Moreover, teachers implementing the two curricula must be made aware of the analytical, critical, and reflective processes involved in developing creative thinking among the learners. With this, teachers need to consistently integrate creative thinking indicators and domains in the Arts, English Language Arts and other subjects as they prepare their learners to handle and cope with other real-life demands.

Keywords: *arts curriculum, creative thinking, PISA, OECD,*

INTRODUCTION

Teaching creative thinking has become an educational imperative since creativity ranks among the 21st century skills needed for people to succeed in this day and age (Partnership for 21st Century Skills, 2010). Assessment of 20th Century Skills or ATCS (2010) from the University of Melbourne also underscores the importance of creative thinking and innovation as ways of thinking in this century. Alongside communication, collaboration, and critical thinking, creative thinking completes the 21st century literacy skills. In the Department of Education's Kto12 Conceptual Framework (2012), creative thinking forms part of the *learning and innovation skills* which make up one of the four skills crucial to the realization of a holistically developed Filipino with 21st century skills. Other skills that appear in the K to 12 Conceptual Framework include communicating effectively, enriching skills in information, media, and technology; and developing appropriate life and career skills.

The need to understand the nature of creativity and creative thinking together with the most appropriate ways of assessing them has become a paramount concern among educators. Creativity and learning represent interrelated phenomena (Gajda, Karwowski, & Beghetto, 2017). When children are provided with opportunities that require them to think of novel solutions, the creative act becomes an instance of learning. Creativity in schools is associated with high interest in the arts and improved levels of problem solving (Baas, Koch, Nijstad, & De Dreu, 2015). When it comes to academic outcomes, studies show that quasi-cognitive factors such as creativity and emotional intelligence affect school performance (Mourgues, Hein, Tan, Iii, & Grigorenko, 2016). Given the link between and among creativity, emotional intelligence, problem solving, and learning, assessment of

creative thinking can provide valuable insights into improving instruction for more meaningful learning.

Meanwhile, the Organization for Economic Cooperation and Development Program for International Student Assessment (OECD/PISA) has been conducting large-scale assessments that inform policies toward attainment of major educational outcomes across nations. Primarily, PISA assesses the reading, mathematics, and science knowledge and skills ability of 15-year-olds in relation to handling real-life challenges (Konan, Chatard, Selimbegović, & Mugny, 2010). Policies and practices covering how educators and stakeholders engineer education are based primarily on the results of PISA. Furthermore the equity and quality of learning outcomes in the world are approximated by PISA which makes it a viable tool for educational and curriculum improvement (Bybee, McCrae, & Laurie, 2009). Drawing on data from PISA 2018, the Philippines reportedly performed lower than the other 78 participating countries and economies (San Juan, 2019). With the country's below par performance in the PISA 2018 examination, the need to review and analyze the present curriculum vis-à-vis the PISA competencies has become imperative especially since in 2021, PISA will include creative thinking as an additional assessment area. For its part, the Department of Education (DepEd) launched in December 2019 the ***Sulong Edukalidad*** program to establish reforms for quality education. The program aims to implement aggressive reforms in four key areas: (1) the Kto12 curriculum alignment, review and upgrading; (2) learning facilities improvement; (3) training of teachers and school heads; and (4) stakeholders' engagement and collaboration (DepEd Statement, 2019).

PISA (2019) views creativity as multidimensional and social in nature. The framework borrows from Plucker, Beghetto and Dow (in PISA, 2019) who define creativity as a process that

produces a perceptible product that is both novel and useful in a social context, the process is characterized by combining aptitude, process and environment. Furthermore, creativity means being able to paint a picture, compose a song or poetry, produce fiction, act on stage and/or sing and dance. Thus, people point to the Humanities and the Language Arts as fertile grounds for studying creativity and creative thinking. However, PISA distinguishes between two kinds of creativity – the 'Big C' determined by talent and the 'little c' that is honed through education and practice. Between the two types, PISA focuses more on the assessment of the 'little c' or the 'everyday creativity' to minimize the effect of talent on the test performance (Konan et al., 2010). Creativity requires some lateral or creative thinking - the ability to view things from another light or to think out of the box. The culture and arts program and the language arts are significant areas which celebrate creativity and creative thinking. Appreciation of one's cultural heritage is one of the main thrusts of the DepEd Kto12 Arts curriculum for Junior High School, while communicative competence for the English language Arts. Both curricula make it possible for learners to apply and display creative thinking as they produce art in varied forms.

Evidently the intention of the Kto12 Arts and English Language Arts curricular programs is to showcase learners' creativity and creative thinking. The arts class, no doubt, aims to train students to use their imagination in crafting original artworks. In fact, problem finding and solving in humanities play a more significant role in creativity, than it does with science and math tasks (Abdulla, Paek, Cramond, & Runco, 2018). On the other hand, the English Language Arts class hones creativity through creative expression (verbal and non-verbal) among students. Specifically, there is a significant relationship between English proficiency and creativity when it comes to metaphoric

activity (Wang & Cheng, 2016). It appears that English proficiency is directly proportional with using English creatively.

This study was conducted to inform curriculum designers how creativity is explicitly and implicitly integrated in the Kto12 secondary curricula in Arts and the English Language Arts specific for the secondary level. The Grade 7 to 10 Arts Curriculum was chosen as a point of reference for creativity because of its potential and obvious benefits in developing students' higher order thinking, and the students in these grade levels are also the target examinees of PISA. The English Language Arts was likewise chosen because of the verbal creativity component set in the PISA Creative Thinking Framework. Ultimately, this study aimed to examine the alignment of the competencies in the Kto12 Arts and English Language Arts curricula with those in the PISA Creative Thinking Framework, and find out which of those competencies directly address creativity-related outcomes.

In the first place, the investigation is significant to address curricular gaps that can inform decisions in improving the Kto12 program. The recommendations offered can help in instructional design which highlights how competencies can be integrated with other learning areas that complement the Arts and English Language Arts curricula. Secondly, it will draw insights on the number of competencies that target creative thinking in the two curricular programs. Inasmuch as the Kto12 curriculum aims to breed holistic individuals equipped with the 4 Cs, noting specific competencies relative to creative thinking will help teachers and other stakeholders in ensuring that they are taught and are mastered by Filipino students. Likewise, identifying the gaps will help educators in preparing lessons and programs to better address the needs of Filipino learners specific to developing creativity and creative thinking. Thirdly, the analysis of creative thinking competencies will provide the necessary information to

educators about the aspects of the curriculum that are essential in meeting international standards. Since the Philippines also targets international competitiveness in education, knowing the standards upon which 15-year-old Filipinos are assessed will help guide educators in preparing students for world demands. In the time of the pandemic, the results will provide teachers, curriculum designers and other stakeholders with relevant information to formulate and design instructional materials in the Arts and English Language Arts that consider the context of the learners who will be taught through various modalities, e.g. blended, purely online, or modular. Lastly, the analysis of the creative thinking assessment vis-a-vis the current Kto12 curriculum will provide stakeholders and policymakers evidence-based decisions on curriculum and educational policies.

Statement of the Problem

The study analyzed the alignment between the competency model of the PISA 2021 Framework and the Philippines' Kto12 Arts and English Language Arts curricula for Junior High School (Grades 7 to 10). Specifically, it aimed to address the following objectives:

1. determine the degree of alignment of the PISA Creative Thinking Framework with the Philippines' Kto12 Curriculum in Arts and English Language Arts for Grades 7- 10; and.
2. determine the gaps in the Grade 7-10 Kto12 Arts and English Language Arts curricula vis-a-vis the PISA Creative Thinking Framework.

Conceptual Framework

The PISA Creative Thinking Framework (2019) emphasizes creative thinking as providing effective solutions to advance knowledge which involves the generating, evaluating and improving ideas. This definition has been a product of extensive study on creative thinking and is considered an appropriate perspective given the 15-year-old PISA examinees. PISA emphasizes the difference between creativity with a 'Big C' and a 'little c' creativity where the 'Big C' entails talent, expertise, and deep engagement in a particular field in order to produce technological revolutions and other *magnum opuses*. On the other hand, creativity with a 'little c' involves the everyday applications of creative thinking. Examples of the 'little c' from Kaufman and Beghetto (cited in OECD, 2019) include creatively solving scheduling problems in school or at work or innovating on how family photos would be displayed. Of the two types of creativity, PISA items center on tasks related to the more malleable 'little c' that may be honed ultimately by one's experiences and education.

Working on the premise that creativity is a necessary competence for students to develop, learning outcomes documented in the Arts and English Language Arts Curriculum guides were examined in relation to their alignment with the PISA Creative Thinking Framework. Drawing from evidence-centered design, the competency model for creative thinking involves three domains - expressive, knowledge creation, and problem solving domains (OECD, 2010). These domains are described across three indicators of performance: (1) create diverse ideas; (2) produce creative ideas; and (3) evaluate and improve ideas. The expressive component further splits creative expressions as written (e.g. story writing) and visual (e.g. infographics), while knowledge creation and problem solving have two sub-domains which are social (solutions to social problems) and scientific

(experiment ideas to investigate an observation). This composite measurement showing a 2 (expressive) x 4 (subdomains) x 3 (indicators) pattern was used in examining the Kto12 curriculum guide in the Arts and English Language Arts.

The Arts Curriculum is intended to help learners visualize the culture and its people, highlighting the accomplishments done through creative endeavors, and their expressions of worship and building a community. Expressions of these include visual, kinetic and tactile symbolic systems. Moreover, the curriculum showcases the study of Philippine folk music and arts in Grade 7; Asian arts and music in Grade 8; Western arts and music in Grade 9; and integration of contemporary arts and music in Grade 10. The appreciation from within or acknowledging one's culture highlights the scholarly understanding of local artists, arts, crafts, and indigenous materials aimed at strengthening students' identity as Filipinos. This is followed by topics/lessons aimed at strengthening students' Asian identity, and finally focusing on teaching students how to become global citizens with a fine eye and a refined taste in appreciating both local and foreign culture and arts.

Research studies focusing on how creative thinking is demonstrated in the arts underscore the claim that arts promote the development of creative ideas (Theurer, Rogh, & Berner, 2020). The development is said to positively affect students' traits, motivation, environmental conditions, and domain specific skills. Drawing on the premise that behavioral indicators specific to creativity come from the interaction between different components and conditions, the current study intended to identify the competencies that directly address the indicators of performance set by OECD. Moreover, when arts and technology are integrated, an increase in cognitive and academic benefits is ensured (Liem, Martin, Anderson, Gibson, & Sudmalis, 2014).

This interplay between the arts and other subjects such as science and mathematics may increase students' problem-solving skills and creative thinking. In another research done by Liem, Martin, Anderson, Gibson, and Sudmalis (2014), creative thinking as demonstrated by arts-related ICT has permeated music education and has become influential in music-related activities.

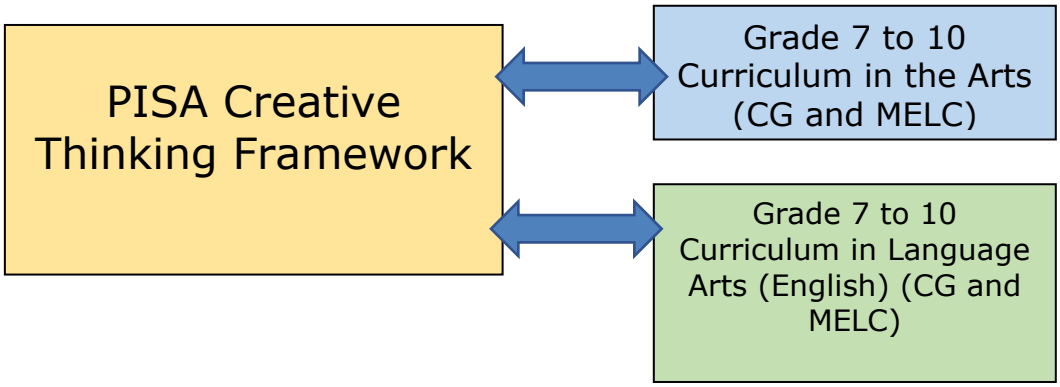
Meanwhile, the Language Arts and Multiliteracies Curriculum (LAMC) or the English Language Arts Curriculum for Grades 7 to 10 uses the spiral progression approach to train students on communicative competence and multiliteracies. Specifically, the English language curriculum aims to teach global skills like viewing, listening, reading, speaking, and writing through literature. Notably, the curriculum framework seems to place a premium on making meaning through language where understanding cultural heritage via literature and mastering language processes and strategies are key. Some evidence of creative thinking in the current English Language Arts program can be seen in the product and performance outputs required of students. In the PISA Framework, students' outputs must show their capacity to think creatively. Creative outputs, be they verbal or non-verbal, can give insights on the success of the creative thinking process (Amabile, 1996; PISA, 2019).

Despite the creative outputs required in both curricula, the need to probe deeper into the extent as to which the two curricular programs approximate the PISA Framework on creative thinking is deemed a necessary step towards curriculum improvement and/or enhancement. Given this context, the present study aimed to determine the alignment of competencies in the Arts and the English Language Arts curricula for Grades 7 to 10 with the PISA Creative Thinking Framework in terms of these identified indicators of performance: (1) develop diverse ideas; (2) produce creative ideas; and (3) evaluate and refine ideas.

Figure 5.1 shows the PISA Creative Thinking Framework (PISA-CTF) used as a substantiating guide in analyzing the Kto12 Arts and English Language Arts curricula for Grades 7 to 10. A mapping of competencies between the PISA-CTF indicators of performance and the Grade 7 to 10 learning competencies was done. In providing relevant information to the mapping, the minimum essential learning competencies (MELCs) issued by DepEd to address the challenges brought about by the COVID-19 pandemic to the education sector in terms of the design and delivery of instruction were considered.

Figure 5.1

Conceptual Framework



METHODOLOGY

This qualitative study made use of content analysis as its main approach. Using the Philippine Kto12 curriculum guide (CG) in Arts and in English, an analysis was done starting with categorizing the competencies based on the PISA-CTF indicators and domains, and then grouping them to facilitate the analysis. Through document analysis, the curriculum guides (CGs) were mapped against the existing PISA-CTF. Mapping was done by encoding the CG codes and categorizing them in the appropriate

creative thinking competency. The competencies from the CGs were reviewed per grade level and per quarter. The analysis also covered the content and performance standards. Each CG competency was studied as to whether it falls under a certain PISA creative thinking indicator. Coding was done next using a present-not present and explicit-implicit approach. Competencies are considered explicit if they directly target the indicators of creative thinking, whereas implicit competencies are those which help students in performing the indicators.

A two-level analysis was done to examine the competency-alignment. The first level involved categorizing the competencies according to the PISA performance indicators for creative thinking where students are able to demonstrate their ability to (1) develop diverse ideas; (2) produce creative ideas; and (3) evaluate and refine ideas. The second level of analysis, on the other hand, focused on classifying the competencies based on thematic content, i.e. if the competency demonstrates a creative expression or if it leads to knowledge creation and problem-solving. The mapping of the competencies was done next, and the results were consolidated after a thorough deliberation.

In the process of the review, the researchers discussed their biases (assumptions, past experiences, and orientation) that might shape or influence the interpretation of the study similar to the process undertaken by Butina (2015). Specifically, biases were addressed in the present study by providing a detailed procedure used for data collection and analysis, and an audit trail was undertaken where the mapping done was iteratively counter checked by both researchers. This is similar to what Butina (2015) did in her study where counterchecking of the narratives was done in collaboration with her project adviser. For this present study, data were authenticated by the researchers themselves by doing the same coding processes used in doing the alignment.

RESULTS AND DISCUSSION

Creativity in the Kto12 Arts Curriculum for Grades 7-10

The results of the analysis are presented in the succeeding tables. Table 5.1 presents key competencies in the Arts curriculum that are explicitly categorized under each of the PISA performance indicators. This means that these competencies have been worded to show competencies relative to creative thinking.

Table 5.1

Mapping of the PISA Creative Thinking Indicators vis-à-vis the Kto12 Arts Curriculum for Grades 7-10

PISA Framework	Grades 7-10 Arts Curriculum Competencies								
Creative Behavior Indicators	Grade 7		Grade 8		Grade 9		Grade 10		Total
	Explicit N=23	Implicit N=0	Explicit N=23	Implicit N=0	Explicit N=21	Implicit N=0	Explicit N=24	Implicit N=0	N=91
Generate diverse ideas	13% (3)	0	13% (3)	0	33% (7)	0	17% (4)	0	19% (17)
Generate creative ideas	57% (13)	0	52% (12)	0	57% (12)	0	54% (13)	0	55% (50)
Evaluate and improve ideas	30% (7)	0	35% (8)	0	10% (2)	0	29% (7)	0	26% (24)

The table presents the number of times the PISA performance indicators for creative thinking are noted explicitly in the Arts curriculum. Under **generating diverse ideas**, the students are expected to demonstrate their capacities to think flexibly across domains. This indicator asks students to write different captions for a given stimulus or combine shapes in

multiple ways to produce visual products (expressive domain). Likewise, this indicator is measured when students generate multiple and different solutions to problems that are interpersonal and intrapersonal in nature, or when they are asked to develop multiple mathematical methods to solve an open problem (knowledge creation and problem-solving domain). As can be gleaned from the results, 19% of the competencies in the Arts curriculum are categorized under this indicator. A Grade 7 competency, e.g. to discuss *one's mood, express one's ideas in looking at the objects or artifacts*, is an example of this indicator. Generating diverse ideas is concretely manifested in the Grade 9 competency, specifically *understanding a country's culture and history through its art.* Both competencies are significant in enhancing art appreciation skills and in igniting the students' passion to do art work.

The second PISA creative thinking indicator '**generate creative ideas**' highlights appropriate and novel ideas coming from students in the different domains. Here, students are asked to provide responses that are task-significant that may not have been conceived by others (OECD, 2010). Covering indicators pertaining to student behaviors such as producing advocacy posters or infographics the domain enhances expression. The next domain expects students to design strategies to effectively promote an idea, enhancing knowledge creation and problem solving. In the Arts curriculum, 55% of the competencies were identified under this indicator which are spread throughout the four year levels. The same competencies are covered but with a different focus for every grade level, e.g. for Grade 7, the discussions are about Philippine Arts. The competencies under this domain include *designing Luzon-inspired art exhibits to showcase history and culture* in Grade 7; *creating locally-assembled crafts using traditional techniques* (e.g., wood-carving or hand painting etc.) in Grade 8; *designing Western classical*

theater opera and play with the visual elements and components in Grade 9; and *using artworks to reflect the traditions/history of a community* in Grade 10.

The third PISA creative thinking indicator '**evaluate and improve ideas'** centers on developing skills in using innovative ways to improve ideas after a thorough evaluation of these ideas. Here, students are encouraged to change or continue other people's outputs while iterating on their own ideas (OECD, 2013). The indicator is observed under the expressive domain, where students make an original improvement to the title of some artwork (written); or design one's own art exhibition (visual). In the knowledge creation and problem solving domain, the indicator is manifested through asking students to innovate to a suggested solution (social) or making an original improvement to a suggested experiment (scientific). The Arts competencies under this indicator include tracing the indigenous or foreign influences reflected in the design of an artwork, craft or artifact; and using artworks to understand the cultural history of an art period.

The thematic content areas in Table 5.2 reflect the domains where creative thinking is coursed through. Creative expression which is covered in 74% of the competencies includes visual and written articulation, while problem-solving and knowledge creation that involve social and scientific ways of solving problems is covered in only 26%. This comprehensive view of creative thinking highlights progress in the classroom through creative achievement which is a form of creative expression (i.e. expressing one's internal thoughts and imagination through arts and music), knowledge creation (i.e. collaboratively processing knowledge that is new to the group and understanding), or creative problem-solving (i.e. problems across domains are creatively solved). The review showed that the Arts Curriculum is inclined to enhance creative expression. Sixty-four (64)

competencies were found to be directly linked to visual expression of creative thinking. These competencies include incorporating the design and form of artifacts and object in one's creation in Grade 7; designing an exhibit inspired by Southeast Asian arts and crafts in Grade 8; communicating ideas through different media techniques, showing the characteristics of the Renaissance and the Baroque periods (e.g. Fresco, Sfumato, etc.) in Grade 9; use of media in choreographing the movements and gestures to deliver a performance in Grade 10.

Table 5.2

Mapping of the PISA Creative Thinking Domains vis-à-vis the Kto12 Arts Curriculum for Grades 7-10

Creative Thinking Domains	**Grades 7-10 Arts Curriculum Competencies**								
	Grade 7		**Grade 8**		**Grade 9**		**Grade 10**		**Total**
	Explicit N=23	Implicit N=0	Explicit N=19	Implicit N=0	Explicit N=21	Implicit N=0	Explicit N=24	Implicit N=0	N=87
Creative expression	70% (16)	0	63% (12)	0	90% (19)	0	71% (17)	0	74% (64)
Knowledge creation and problem solving	30% (7)	0	37% (7)	0	10% (2)	0	29% (7)	0	26% (23)
Content Areas	Philippine Folk Music and the Arts		Asian Music and Arts		Western Music and Arts		Application of Contemporary Music and Arts		

On the other hand, competencies pertaining to knowledge creation and problem solving revolve around tracing indigenous and foreign artwork taking into account its design in Grade 7; utilizing the principle regarding design elements and appreciating the artifacts and art objects in Grade 8; using criteria from the

Western Classical art tradition in evaluating works of art in terms of artistic concepts and ideas in Grade 9; and organizing a school play by utilizing visual components (stage design, costume, props, etc.) in Grade 10.

A number of research studies that analyzed the non-cognitive and cognitive predictors of academic success (Spengler, Brunner, Martin, & Lüdtke, 2016) is worth mentioning here. Spengler et al. used the PISA results among primary and secondary students and correlated it with various personality traits (as a prototypical noncognitive factor), with results showing that the two variables are relevant in predicting educational outcomes. Specifically conscientiousness and openness were found to be important noncognitive factors that may shape students' educational development. Furthermore the two traits were linked to an increase in creative thinking and problem-solving among the student-respondents. In another study, Kaufman (2007) found out that there is a mild but positive relationship between school academic achievement and creativity. A positive link has been found between teacher ratings of creativity and divergent thinking scores in self-reported academic achievement, as well as between high school grade point average and creativity scores. In the present study, creative thinking is believed to be pivotal in addressing the capacity of students to generate new ideas, provide adjustments to solutions to problems, and develop an appreciation of how expressions should be presented and used. The creative thinking competencies in the Kto12 Arts curriculum describe how a person's cultural knowledge and appreciation influence artistic traditions from different places in the country and in the world. Such recurrence happens because the Kto12 Arts Curriculum is grounded in performance-based learning and follows a spiral progression of processes, concepts, and skills (Curriculum Guide for Music and Arts, 2016). Iteration of these competencies supports the development of creative

thinking among Junior High School students since creativity is developed over time until it becomes a way of thinking. In discussing creativity contexts, four stages of creativity were described by Kaufmann (2007): preparation, incubation, illumination, and verification. On the other hand, Botella et al. (2013) presents six stages; namely, idea or vision, documentation and reflection, first sketches, testing, provisional objects, and series. Sadler-Smith (2016), for his part, identifies five stages which include preparation, incubation, intimation, insight, and verification. Despite the variety of stages of creativity developed by experts on creative thinking and innovation, the fact remains that the act of creating undergoes processes. Though the stages differ depending on the contexts they are used and understood, all contribute to the increased performance of secondary school learners.

In the case of the Kto12 Arts Curriculum for Junior High School, students are taught creativity by initially asking them to analyze art elements and principles to identify the distinct characteristics and the representative artists of a specific period/country under study. Then, they are asked to express their moods, ideas or thoughts using selected artworks and identify their function by evaluating how the artworks are given meaning in a country's culture. After which, students are expected to acquire appreciation of the traditions/history of an art period, compare its characteristics with that of the Philippines, evaluate the artwork through communicating ideas, experiences, and stories by showing the characteristics of the period. Finally, students are required to mount their own exhibits of artworks with characteristic features of the period they have studied.

Based on the analysis done, it is apparent that the common words used in describing how students will develop creativity include *reflect*, *appreciate*, *incorporate*, *trace*, *create*, *mount an*

exhibit, *derive*, and *improvise*. The intention to promote a sense of nationalism through love and appreciation of one's ethnic roots is explicit in all four quarters of the Junior High school Arts Curriculum highlights, as Liem et. al. (2014), the social and scientific component of creative thinking. In the other grade levels, the competencies encouraging creativity are focused more on reflecting and appreciating artifacts coming from Asia, the Western countries, and the contemporary arts. This is usually followed by an exhibit of the artworks created by the students using the techniques learned in class. Towards the fourth quarter, a culmination activity showcasing all things learned from quarters 1-3 by the students will be presented by doing choreography, taking roles, and performing in front of an audience. These competencies are intended to increase the students' ability to express themselves through written and visual work.

As a whole, the Arts Curriculum aims to give students an opportunity to use creative expression and value the meaning of culture and the arts. Needless to say, teachers implementing this curriculum have to be trained to handle competently the analytical, critical, and reflective processes involved in teaching the arts so they can better help learners to think creatively, especially to prepare them in producing the needed outputs per quarter. Relative to this, it appears that it is indeed important to link creative thinking skills (generating ideas) to other real-life demands through subjects like economics (entrepreneur), history, geography, science and others.

Creativity in the Kto12 English Language Arts and Multiliteracies Curriculum (LAMC) for Grades 7 to 10

Table 5.3 presents the data on the explicit and implicit creative thinking skills in the English LAMC for Grades 7 to 10. Competencies are considered explicit if they directly state the

performance indicators such as generate diverse ideas, generate creative ideas, and evaluate and improve ideas. On the other hand, competencies are regarded as implicit if they focus on skills that help students attain the creative thinking indicators.

Table 5.3

Mapping of the PISA Creative Thinking Indicators vis-à-vis the Kto12 English LAMC for Grades 7 to 10

PISA Framework	**Grade 7-10 English LAMC Competencies**								
Performance	**Grade 7**		**Grade 8**		**Grade 9**		**Grade 10**		**Total**
Indicators	**Explicit N=16**	**Implicit N=5**	**Explicit N=12**	**Implicit N=9**	**Explicit N=16**	**Implicit N=4**	**Explicit N=12**	**Implicit N=10**	**N=80**
Generate diverse ideas	31% (5)	20% (1)	33% (4)	33% (3)	25% (4)	0	17% (2)	20% (2)	26% (21)
Generate creative ideas	56% (9)	40% (2)	67% (8)	33% (3)	75% (12)	75% (3)	67% (8)	50% (5)	58% (46)
Evaluate and improve ideas	13% (2)	40% (2)	0	33% (3)	0	25% (1)	17% (2)	30% (3)	16% (13)

As shown in Table 5.3, the competencies in the Kto12 English LAMC for Grades 7 to 10 that address the PISA creative thinking indicators present an almost similar picture as those in the Arts Curriculum. Both curricula highlight **generating creative ideas** across grade levels. In the case of the Kto12 English LAMC, 58% of the competencies address **generating creative ideas**; 26% focus on **generating diverse ideas;** and only 16% center on **evaluating and improving ideas**.

PISA competencies on creative thinking, it should be noted, center not only on **generating ideas** or ***ideational fluency***, but more so on **generating diverse ideas** or **ideational flexibility**. Specifically, the PISA test on creative thinking focuses on students' capacity to think flexibly across domains like *recommending different solutions to a problem; writing different*

stories not widely conceived about; or creating various ways of visually representing ideas. In the case of the Kto12 English LAMC, **generating diverse ideas** is explicitly covered in 31% of the competencies in Grade 7; 33% in Grade 8; 25% in Grade 9; and only 17% in Grade 10. These competencies seemingly are meant to encourage students to express their ideas, opinions, and feelings about various topics read, listened to, or watched. They also aim to train students to choose their own topic, organize information about a chosen topic, and present those in various graphic organizers. However, the results are quite alarming since Grade 10 competencies yielded only 17% in **generating diverse ideas.** At the outset, Filipino Grade 10 learners, the target group of the PISA examination, may not do well in the said exam because they lack training in creative thinking.

In the English LAMC, a number of competencies train students to express their personal opinions in response to multimedia stimuli like interviews, jokes, anecdotes, and films. For instance, *expressing appreciation for sensory images used; expressing ideas, opinions and feelings during interviews, panel discussion, debates and forums; expressing beliefs and opinions based on materials viewed*; and *getting different viewpoints on various local and global issues* are some competencies that encourage students to communicate their ideas creatively. Since these competencies encourage communication of personal ideas, they also provide the necessary avenue for students to think creatively and communicate their very own diverse thoughts.

To clearly articulate **generating diverse ideas** as an indicator of creative thinking in the curriculum, there is a need to restate some of the competencies in the English LAMC to include words like *diverse, different, varied, personal or original* for more ideational flexibility.

Other competencies are intended to aid students in the process of **generating diverse ideas**. For example, competencies such as *organizing information from a material viewed; arranging notes using a variety of graphic organizers;* and *organizing notes from an expository text* all hope to train students on brainstorming diverse ideas and in organizing thoughts using a range of graphic organizers. Although labeled as implicit, these competencies are crucial in preparing students for more creative endeavors like writing paragraphs and essays or producing imaginative work.

As was earlier stated, 58% of the competencies in the Grade 7 to 10 English curriculum address the second facet of creative thinking that is **generating creative idea***s*. Similarly, the PISA exam underscores students' ability to **generate creative ideas** which are the tangible **products** or **results** of creative thought. Unlike in the Arts Curriculum where products appear in the form of outputs like paintings, sculptures, and other crafts, the English LAMC trains students in composing various text types that are mainly academic, literary, and journalistic ones. Moreover, competencies in the English LAMC explicitly target **generating creative ideas** through production of different text types such as narrative texts, factual and personal recounts, informational texts, explanations, persuasive texts and transactional texts. It is worthy to note that the competencies in generating creative ideas in writing use verbs like *compose*, *develop*, and *craft*.

The act of composing entails an equally complex writing process that is made of component parts like prewriting, writing, revising, and editing before publishing. Each of these component parts, in turn, has micro-processes essential to the production of a creative output. Moreover, students are expected to perform these processes in writing various text types with different text features and language structure. This requires students to have

ample practice in the composing process from Grade 7 to 10. If generating diverse and creative ideas are emphasized in the writing process, students would most likely fare better in the PISA creative thinking examination.

Aside from developing creative idea generation through **products**, the English curriculum also targets creative thinking through **performances** where students deliver or present various types of speeches, stage plays, and other creative dramatics. In these presentations, students are expected to employ a variety of verbal and non-verbal strategies to effectively convey their thoughts and feelings. They are also asked to make use of different graphic organizers and multimedia technology to aid them in presenting a persuasive speech, a reader's theater, or a one-act play among others.

A third PISA indicator of creative thinking is the students' ability to **evaluate and improve upon ideas**. Evaluating one's thoughts or ideas and improving upon them remain inherent in the composing process and are therefore embedded in the creative idea generation competencies earlier surveyed. Nevertheless, only 16% of the competencies from the English curriculum train learners in evaluating ideas and improving upon them. Some examples of competencies that encourage learners to evaluate social issues, challenge ideas, and present solutions or recommendations include, discovering conflicts in literary texts; asking higher order thinking skills questions; evaluating the personal significance of literary texts; relating the text to felt problems in the society; and evaluating literature as a means to resolve social issues.

As a whole, the Kto12 English LAMC for Grades 7 to 10 addresses the three indicators in the PISA Creative Thinking Framework in various degrees. The curriculum is specifically

aligned with *generating creative ideas* with 58% of the competencies focusing on creating products and performances in both oral and written forms. However, the English curriculum is minimally aligned with *evaluating and improving ideas* with only 16% and with *generating diverse ideas* with only 26%. A closer analysis of the nature of the writing and production processes in the language arts reveals that competencies that address the three indicators need to be widely distributed in terms of frequency across the grade levels in Junior High School. *Generating diverse ideas* and *evaluating and improving upon ideas* are equally important components of the composing process. Thus, all three must be considerably represented in the curriculum, and they should all be treated as complementary facets of creative thinking.

PISA Creative Thinking Domains in the Kto12 English LAMC for Grades 7 to 10

Table 5.4 documents the three domains of creative thinking in the PISA-CFT vis-a-vis the competencies in the English LAMC for Grades 7 to 10. As early as the Elementary grades, the English curriculum has already placed great premium on creative responses to build oral language fluency, to develop writing skills, and to foster a positive attitude towards learning. Creative expression, both written and visual, is manifested mostly in the competencies under Literature, Oral Language and Fluency, and Writing and Composition.

Table 5.4 shows the mapping of PISA creative thinking domains or the thematic content areas in the English LAMC.The PISA Creative Thinking domains on *knowledge creation* and *creative problem* solving are addressed through the analysis of issues presented mostly in literary texts. Since the English curriculum is literature-based, language is learned through the

appeal of literature. It becomes the primary content and context of discussion where students analyze subject matters and themes apparent in the literary texts. Students use various critical lenses in analyzing literatures from the Philippines (Grade 7), Africa and Asia (Grade 8), England and America (Grade 9) and the World (Grade 10).

Table 5.4

Mapping of the PISA Creative Thinking Domains vis-à-vis the Kto12 English LAMC for Grades 7-10

Creative Thinking Domains	Grade 7-10 English LAMC Competencies								
	Grade 7		Grade 8		Grade 9		Grade 10		
	Explicit N=11	Implicit N=5	Explicit N=9	Implicit N=6	Explicit N=13	Implicit N=6	Explicit N=10	Implicit N=8	Total N=68
Creative expression	80% (9)	40% (2)	90% (8)	50% (3)	90% (12)	50% (3)	80% (8)	60% (5)	74% (50)
Knowledge creation and problem solving	20% (2)	60% (3)	10% (1)	50% (3)	10% (1)	50% (3)	20% (2)	40% (3)	26% (18)
Content Areas	Philippine Literature		Afro-Asian Literature		Anglo-American Literature		World Literature		

Specifically, Junior High School students are expected to learn *knowledge creation* and *problem solving* in English as they *study particular social issues, concerns, or dispositions in real life and relate these to text content* (EN9RC-IVb-2.18); *resolve conflicts in literature through nonviolent ways* (EN7LT-II-a-4); and r*esolve conflicts within, between, and among societies to evaluate literature* (EN10LT-IVe-21). In the PISA framework, creative problem solving is categorized into social and scientific problem solving. As would be expected of the humanities, the language curriculum promotes social problem solving skills, while scientific problem solving is glossed over.

A sample item on **verbal expression** in the PISA examination requires students to create a story based on six images in the order they are presented. Examinees receive a high score if the story is original, demonstrates a rich imagination and is well structured (PISA, 2019). It is interesting to note that the competencies in the English curriculum on analyzing stories based on the elements of fiction and composing forms of literary writing both prepare Grade 10 students for the PISA creative thinking test. While the literature-based English curriculum prepares students for this type of item, there is still a need to underscore **originality** either in the competencies or in the standards for assessing students' creative work to encourage them to exercise divergent thinking and originality. It is important to note here that originality, in the context of the PISA Framework, pertains to what Guilford (1950, cited in OECD, 2019) terms as 'statistical infrequency' characterized by "qualities of newness, remoteness, novelty or unusualness, and refers to deviance from patterns observed within the population at hand" (p. 23).

Another sample PISA item assesses **visual expression** by asking the examinees to design a logo for a festival or an event. While this is directly addressed in the Arts Curriculum, the English Language Arts Curriculum realizes this competency only as a classroom activity which may or may not be assigned or tackled explicitly by the teacher. This item also requires students to click and drag figures or shapes presented on the computer in designing a logo, for example, which requires using drawing tools. Doing so would be such a breeze for an average millennial although tech-anxiety can also be a factor among students who are not familiar with technology or the use of a computer for test taking. Such an item points to the need for integrating technology and ICT in the language classroom as it asks students for a short description of the design they will produce, and at the same time 'describing' as a language function is also tested.

A third item focuses on **social problem solving** where examinees are asked to describe three different solutions to address a social issue like water conservation for example. The solutions must be totally different from one another, and examinees are to write the recommendations only in five minutes. The sample item tests students' ability to generate **diverse** ideas and it places a considerable demand on English language proficiency. Students must demonstrate everything that they have learned about the structure and the language of recommendations together with the concepts of coherent and succinct language. Teachers, therefore, need to train students more on writing recommendations to solve social issues in a problem-solution expository type of writing which is explicitly provided only in Grade 8 and earlier in Grade 5.

Overall, the three sample items reveal that language functions like narrating, describing, and explaining problem-solutions play a huge role in demonstrating creative thinking in the PISA examination. Although language proficiency is not written as a criterion, the need to communicate ideas clearly and accurately figures in the production of comprehensible answers be they in creative verbal and non-verbal expressions or in social problem solving.

Developing English language proficiency brings to the fore the other language competencies in the English Language Arts, which when added together amount to a considerable number of competencies that must be taught and mastered in English LAMC. For instance, the language competencies in the first quarter of Grade 7 English alone amounts to 50 competencies that must be developed in nine weeks. Moreover, these competencies had to be taught in two meetings; thus a total of 98 competencies are listed in the entire quarter. In effect, English teachers need to

target 9 to 10 competencies in a 4-hour per week time allotment. While the frequencies vary across grading periods from Grades 7 through 10, the fact remains that too many competencies are taught in the Junior High School Curriculum in English.

Indeed, the spiral progression and cumulative approach that explain the iteration of competencies allow for mastery of skills in listening, speaking, reading, writing, viewing, vocabulary, study strategies, and grammar. However, if the competencies are too many to be addressed effectively within the time allotted in the curriculum, no mastery will be attained in the long run. Therefore, while alignment exists between the PISA indicators of creative thinking and the English LAMC, this alignment could still be strengthened in a decluttered curriculum which allows for mastery of essential language and literature competencies per quarter and per grade level.

Thus, with the Most Essential Learning Competencies (MELCs) released by DepEd in May 2020 to address the delivery of basic education in the time of COVID-19 pandemic, the Kto12 Curriculum was in a sense decongested and streamlined. In the context of the English LAMC, competencies in Grade 7 MELCs have been reduced to 29. The competencies in Grade 8 have been streamlined to cover only 26 competencies; Grade 9 now has only 10; and Grade 10 with 23. This streamlining promotes the mastery of the essential competencies; however, the MELCs should still ensure that the PISA creative thinking indicators and domains are still addressed not only to prepare our students for the PISA 2021 and beyond, but to equip them with skills and competencies to face future world demands as well.

CONCLUSIONS AND RECOMMENDATIONS

The analysis of the alignment of the Arts and the English Language Arts curricula with the PISA creative thinking framework reveals a strong alignment with the indicator on *generating creative ideas.* However, there is a need to balance this with the two other indicators of creative thinking - *generating diverse ideas* and *evaluating and improving ideas.*

Another observation is that the Junior High School competencies in both curricula focus more on creative expression than on knowledge generation and problem solving. Specifically, the Arts Curriculum relies heavily on visual expression, which is only one domain of creative thinking. Focusing on visual expression alone leaves out the written creative expression which is an equally important domain. The need to balance the creative expression through written, scientific and social domains is significant to address all competencies.

Further, few competencies directly address social problem solving and scientific problem solving, which should be enhanced so that students may link competencies in the Arts with skills and values in the other subject areas to ensure their holistic development as Filipino and global citizens. There is a need, for example, to ask students how crafts and exhibits may contribute to society's problems, and focus on designing solutions (e.g. creating textile using single-use plastic bottles). Lastly, although the number of competencies representing the arts is extensive, the lopsided inclination towards what is seen should be addressed. To do further research is likewise suggested to examine how the competencies are actualized by teachers in the classroom.

Similarly, the curriculum in English also needs to strike a balance between and among generating diverse ideas, generating

creative ideas, and evaluating and improving ideas. In doing so, curriculum planners and implementers must underscore the interdependence between and among the three indicators of creativity especially in the composing process. Also, the English curriculum must strongly emphasize the concept of 'diverse' in generating diverse ideas. This is emphasized in the PISA Creative Thinking Framework because, after all, it is in promoting diversity of ideas that teachers encourage students to pursue original thinking. By saying so, the competency statements on generating ideas must clearly mention the words "diverse" and "original" to constantly remind stakeholders of the value of "thinking out of the box."

Moreover, for the curriculum to train students on creative thinking more effectively, creative expression should be developed through a balance between written and visual expressions. The English LAMC, as it is, provides ample training on written expression given the various text types students are expected to write from Grades 7 through 10. However, there is a need to focus on the composing process in the earlier grades, so that Grades 9 and 10 students would have ample time to learn how to generate **diverse** and **creative** ideas as they propose solutions to social and scientific problems they experience.

Visual expression, on one hand, is only noted through the use of graphic organizers, visual aids, technology-aided presentations, stage designs, and other non-verbal techniques. Creative visual expression, while possibly heavily used in the actual classroom (i.e. in curriculum implementation), must be clearly stated in the English curriculum. The same thing must be done with social and scientific problem solving since doing so underscores the interdisciplinary crossings between the Language Arts, the Arts, the Social Sciences, STEM, and ICT curricula.

Notably while this study centers on the analysis of the written curricula in the Arts and in the English Language Arts, and therefore does not cover the investigation of what happens in the field, the curriculum implementation must be given considerable attention. This means that the competencies may promote creative thinking in various thematic domains, but they have to be effectively taught given appropriate instructional planning and learning resources by teachers who have considerable content knowledge and strategic pedagogical skills.

Lastly, in support of DepEd's **Sulong Edukalidad** program, teacher pedagogical skills should be enhanced in developing creative thinking among learners. Specifically, there is a need to train teachers on the indicators and domains of creative thinking alongside the strategies in teaching it so they can breed divergent thinkers who can generate creative ideas and who can evaluate and improve those ideas. To address this, collaboration between and among institutions should be encouraged to share best practices and build a learning environment that enables creative thinking through individual and social enablers that ensure effective problem solving, creative expression, and knowledge creation. Finally, to make the development of creative thinkers a school, a community, and a national goal, there is a need to engage all stakeholders in the process of sustaining the enablers of creative thinking.

REFERENCES

Abdulla, A. M., Paek, S. H., Cramond, B., & Runco, M. A. (2018). Problem Finding and Creativity: A Meta-Analytic Review. *Psychology of Aesthetics, Creativity, and the Arts*, *14*(1), 3–14. https://doi.org/10.1037/aca0000194

Baas, M., Koch, S., Nijstad, B. A., & De Dreu, C. K. W. (2015). Conceiving creativity: The nature and consequences of

laypeople's beliefs about the realization of creativity. *Psychology of Aesthetics, Creativity, and the Arts*, *9*(3), 340–354. https://doi.org/10.1037/a0039420

Borgonovi, F., & Pokropek, A. (2019). Seeing is believing: Task-exposure specificity and the development of mathematics self-efficacy evaluations. *Journal of Educational Psychology*, *111*(2), 268–283. https://doi.org/10.1037/edu0000280

Butina, M. (2015). A narrative approach to qualitative inquiry. *Clinical Laboratory Science*, 28, 190-196. Retrieved from http://www.ascls.org

Bybee, R., McCrae, B., & Laurie, R. (2009). PISA 2006: An assessment of scientific literacy. In *Journal of Research in Science Teaching*. https://doi.org/10.1002/tea.20333

Department of Education (2012). *K to 12 Conceptual Framework*

Department of Education (2016). *K to 12 Curriculum Guide - Art*

Department of Education (2016). K *to 12 Curriculum Guide - English*

Gajda, A., Karwowski, M., & Beghetto, R. A. (2017). Supplemental Material for Creativity and Academic Achievement: A Meta-Analysis. *Journal of Educational Psychology*, *109*(2), 269–299. https://doi.org/10.1037/edu0000133.supp

Konan, P. N. D., Chatard, A., Selimbegović, L., & Mugny, G. (2010). Cultural diversity in the classroom and its effects on academic performance : A cross-national perspective. *Social Psychology*, *41*(4), 230–237. https://doi.org/10.1027/1864-9335/a000031

Liem, G. A. D., Martin, A. J., Anderson, M., Gibson, R., & Sudmalis, D. (2014). The role of arts-related information and communication technology use in problem solving and achievement: Findings from the programme for international

student assessment. *Journal of Educational Psychology*, *106*(2), 348–363. https://doi.org/10.1037/a0034398

Mourgues, C. V., Hein, S., Tan, M., Iii, R. D., & Grigorenko, E. L. (2016). The Role of noncognitive factors in predicting academic trajectories of high school students in a selective private school. *European Journal of Psychological Assessment*, *32*(1), 84–94. https://doi.org/10.1027/1015-5759/a000332

OECD (2013). *PISA 2012 Assessment and Analytical Framework PISA 2012 Assessment and Analytical Framework*. *OECD Report*. https://doi.org/10.1787/9789264190511-en

OECD (2019). *PISA 2021 Creative thinking framework: Third draft*. OECD.

San Juan, R. (2019). DepEd welcomes PISA results, recognizes "gaps" in education quality | Philstar.com. *Philippine Star*. Retrieved from https://www.philstar.com/headlines/2019/12/04/1974229/deped-welcomes-pisa-results-recognizes-gaps-education-quality

Spengler, M., Brunner, M., Martin, R., & Lüdtke, O. (2016). Role of personality in predicting (Change in) students' academic success across four years of secondary school. *European Journal of Psychological Assessment*, *32*(1), 95–103. https://doi.org/10.1027/1015-5759/a000330

Theurer, C., Rogh, W., & Berner, N. (2020). Psychology of Aesthetics , Creativity , and the Arts Interdependencies Between Openness and Creativity of Fifth Graders. *Psychology of Aesthetics, Creativity, and the Arts*.

Wang, H. Chun, & Cheng, Y. show. (2016). Dissecting language creativity: English proficiency, creativity, and creativity motivation as predictors in EFL learners' metaphoric creativity. *Psychology of Aesthetics, Creativity, and the Arts*, *10*(2), 205–213. https://doi.org/10.1037/aca0000060

About the Authors

Dr. Teresita Rungduin is a Professor of Developmental and Clinical Psychology and a faculty of the College of Graduate Studies and Teacher Education Research at the Philippine Normal University (PNU). Her training in psychology started at the PNU where she took her Bachelor of Arts in Psychology and pursued her degree in Master of Arts in Education with specialization in School Psychology in 2010. She continued specializing in this discipline at the University of the Philippines-Diliman where she earned her PhD in Psychology with specializations in Developmental and Clinical Psychology under the Commission on Higher Education Faculty Development Program. She is interested in positive psychology research especially in the subject of forgiveness (*pagpapatawad*). Her dissertation focused on examining the life narratives of people who had forgiven and the processes the people had undergone to forgiveness. Her research interests involve studies in forgiveness, *kapwa*, values, *sama* and *gaan ng loob* in organizations, gender and developmental issues of people in the different stages in life.

Ms. Marla C. Papango is an Associate Professor at the Philippine Normal University Faculty of Arts and Languages. She holds an MA in Education major in Literature and a Certificate in Campus Writing and Advising from PNU. She also holds an online certificate in Critical Thinking in the EFL Classroom from the University of Oregon American Institute. As a teacher trainer, she has conducted numerous pre-service and in-service training for public and private institutions. Some regional and national trainings she has conducted include, Alternative and Performance Assessment; Facilitating Mentor Training in English, Maths and Sciences; Critical Thinking in the Language and Literature Classroom; Technology in the Language Class, the Whole School Approach to Teaching; Mother-Tongue Based Multilingual Education; Understanding by Design (UbD); and the K-12 English Curriculum. She also capped a series of workshops for the Pedagogical Retooling in Mathematics, Languages and Science (PRIMALS) for the Department of Education and the Basic Education Sector Transformation or BEST under Australia Aid. Her research interests include, ESL teacher quality, curriculum and assessment in language education, blended learning, and design and development of language programs. As a researcher, she has presented various papers in language teaching and research internationalization in AsiaTEFL, Cambodia TESOL, Vietnam TESOL, and SEAMEO-Regional English Language Center in Singapore.

Chapter 6

PISA Financial Literacy Framework vis-à-vis the Philippine Kto12 Curriculum in Social Studies and Mathematics

Feliece I. Yeban [1] and Joselito G. Florendo[2]

Philippine Normal University [1] University of the Philippines [2]

Abstract

The Philippine Kto12 Curriculum for Social Studies and Mathematics and the PISA Financial Literacy Framework were reviewed to find out their degree of alignment or non-alignment. Through document analysis and curriculum mapping, the study found out that the Social Studies and Mathematics competencies for Grades 7 to 10 are not aligned with the PISA Financial Literacy Framework. The study recommends a serious revision of the Social Studies curriculum and an enhancement of the Mathematics curriculum because simple infusion of financial literacy concepts will not be enough to develop financially proficient Filipinos. Along with the curriculum revision and enhancement, the implementation of a national financial literacy program targeting the parents and the larger community is recommended because mere classroom exposure to financial literacy may not be efficient.

Keywords: *curriculum-assessment alignment, Kto12 Curriculum in Social Studies, Kto12 Curriculum in Mathematics, PISA Assessment Framework*

INTRODUCTION

Financial literacy refers to knowledge of concepts and principles that enable individuals to understand, manage, and plan their financial affairs. It is globally acknowledged as an essential life skill. A financially literate citizenry is an important element of economic and financial stability and development.

According to the Organization for Economic Cooperation and Development (OECD, 2009), a lack of financial literacy could lead to ill-informed financial decisions which could have an adverse impact on financial health in all levels - personal, national, and global. In 2010, OECD initiated the development of a financial literacy framework for the Programme for International Student Assessment (PISA).

The first financial literacy items were included in PISA 2012, the first large-scale international study to assess the financial literacy of young people. The working definition of financial literacy for PISA 2012 is as follows:

> Financial literacy is knowledge and understanding of financial concepts and risks, and the skills, motivation and confidence to apply such knowledge and understanding in order to make effective decisions across a range of financial contexts, to improve the financial well- being of individuals and society, and to enable participation in economic life (OECD, 2013, p144).

The PISA 2015 Financial Literacy Assessment has five (5) levels of proficiency (OECD, 2017, p.73) identified and described as follows:

> Level 1 – Students can identify common financial products and terms and interpret information relating to basic financial concepts. They can recognize the difference

between needs and wants and can make simple decisions on everyday spending. They can recognize the purpose of everyday financial documents such as invoices and apply single and basic numerical operations (addition, subtraction or multiplication) in financial contexts that they are likely to have personally experienced.

Level 2 – Students begin to apply their knowledge of common financial products and commonly used financial terms and concepts. They can use given information to make financial decisions in contexts that are immediately relevant to them. They can recognize the value of a simple budget and can interpret prominent features of everyday financial documents. They can apply single basic numerical operations, including division, to answer questions involving finance. They show an understanding of the relationships between different financial elements, such as the amount of use and the costs incurred.

Level 3 – Students can apply their understanding of commonly used financial concepts, terms and products to situations that are relevant to them. They begin to consider the consequences of financial decisions and they can make simple financial plans in familiar contexts. They can make straightforward interpretations of a range of financial documents and can apply a range of basic numerical operations, including calculating percentages. They can choose the numerical operations needed to solve routine problems in relatively common financial literacy contexts, such as budget calculations.

Level 4 – Students can apply their understanding of less common financial concepts and terms to contexts that will be relevant to them as they move towards adulthood, such

as bank account management and compound interest in saving products. They can interpret and evaluate a range of detailed financial documents, such as bank statements, and explain the functions of less commonly used financial products. they can make financial decisions taking into account longer-term consequences, such as understanding the overall cost implication of paying back a loan over a longer period, and they can solve routine problems in less common financial contexts.

Level 5 - Students can apply their understanding of a wide range of financial terms and concepts to contexts that may only become relevant to their lives in the long term. They can analyze complex financial products and can take into account features of financial documents that are significant but unstated or not immediately evident, such as transaction costs. they can work with a high level of accuracy and solve non-routine financial problems, and they can describe the potential outcomes of financial decisions, showing an understanding of the wider financial landscape, such as income tax.

The results of PISA 2012 taken by 26,000 15-year old students suggest that, on average, 84.7% of students from the 18 participating countries, in addition to exhibiting Level 1 proficiency~~,~~, also display proficiency Level 2 which is the baseline of financial literacy proficiency. Financial literacy skills are found to be positively correlated with mathematics and reading skills. Only around 25% of the financial literacy score is related to competencies uniquely captured by the financial literacy assessment, while the remaining 75% reflects skills that can be as effectively measured in mathematics and/or reading assessments. Only one in ten students, on average, is proficient at level 5. This group of students can analyze complex financial

products and solve non-routine financial problems. It is to be noted, however, that 43% of students from Shanghai-China are at level 5 proficiency, followed by the Flemish community of Belgium coming in a far second (20%), then New Zealand (19%), and Australia (16%).

The second financial literacy test was included in PISA 2015 taken by around 48,000 students, representing about 12 million 15-year-olds from the 15 participating countries and economies. On average, 22% of students do not have level 1 financial skills. This means 78% of students have attained the base level 2 proficiency. Only one of ten students displayed Level 5 proficiency. Only around 25% of the financial literacy score is related to competencies uniquely captured by the financial literacy assessment, while the remaining 75% participating students reflect skills that can be as effectively measured using just the mathematics and/or reading sections of the assessment.

Results of the 2012 and 2015 PISA financial literacy assessments show that student performance in financial literacy is associated with their family socio-economic and cultural status. In other words, young students are generally likely to acquire their financial skills from their parents. It was also observed that students with at least one parent with tertiary-level education, on average, got higher scores, than did the rest. Moreover, students' financial literacy is associated with their understanding of the concept of saving, and those with bank accounts scored better than those without. Economically disadvantaged students scored 89 points lower than those in the higher socio-economic class.

For PISA 2018, some 600,000 students, representing about 32 million 15-year- olds in the schools of the 79 participating countries and economies, completed the assessment. Financial literacy was only an optional feature of the assessment, and it

consisted of 43 exercises with a one hour time limit. The results are yet to be released.

The PISA 2021 Financial Competence Framework vis-à-vis the Philippine Kto12 Mathematics and Social Studies Curricular Programs

The OECD is currently preparing to conduct the PISA 2021 assessment using a revised framework for financial literacy. The revised framework now defines financial literacy as follows:

> Financial literacy is knowledge and understanding of financial concepts and risks, as well as the skills and attitudes to apply such knowledge and understanding in order to make effective decisions across a range of financial contexts, to improve the financial well-being of individuals and society, and to enable participation in economic life (OECD, 2019, p.18).

The revised framework (OECD, 2019) is divided into three categories, namely: 1] **Content**, 2] **Process**, and 3] **Context. Conten**t refers to knowledge and understanding that students use in order to perform a particular task. There are four Content areas for PISA financial literacy: money and transactions, planning and managing finances, risk and reward, and financial landscape. **Process** refers to cognitive processes that students apply to respond to financial issues and situations. These include (1) *identifying financial information, (2) analyzing financial information and situations, (3) evaluating financial issues,* and (4) *applying financial knowledge and understanding*. **Context** refers to the different situations where financial literacy may be exercised. This would include application of the literacy domain on tasks that students encounter in *education and work, home and family, and individual* and *societal*.

The 2021 PISA Financial Literacy Assessment now considers attitudes and behavior also as aspects of financial literacy. Given this, it will now also look into how non-cognitive factors are related to the cognitive elements of financial literacy. The non-cognitive factors include a combination of 1) access to information and education; 2) access to and use of money and financial products; 3) financial attitudes; and 4) financial behavior.

In 2016, the Department of Education (DepEd) issued the curriculum guide for Social Studies (Araling Panlipunan) which contains the target competencies and performance standards from Kto12 grade levels. The curriculum seeks to develop the learners to be responsible citizens who have a strong sense of Filipino identity, able to participate actively in civic and community life at the national and international levels, and with a deep understanding of the past and current situation that propels them to engage in social transformation. The curriculum revolves around the following themes: 1) Self, Society, and the Environment; 2) Time, Continuity, and Change; 3) Culture, Identity, and Nationalism; 4) Rights, Responsibilities, and Citizenship; 5) Power, Authority, and Governance; 6) Production, Distribution, and Consumption; and 7) Regional and International. The themes serve as guideposts around which specific competencies for each grade level were crafted and social studies content was selected. Included in the curriculum guide is the emphasis on teaching the tools that the learners need to unlock as well as use to navigate through the identified themes. These tools include skills in observation, analysis and interpretation of data and information, research, and communication. Equally emphasized are ethical values that learners should be able to practice and apply in real life to demonstrate responsible citizenship.

The Mathematics Curriculum has likewise undergone a series of revisions to make it more updated and relevant. In the revision, critical thinking and problem solving are emphasized. There are five content areas in the curriculum, as adopted from the framework prepared by MATHTED & SEI (2010) as cited in DepEd (2016, p.3). These are: 1) Numbers and Number Sense; 2) Measurement; 3) Geometry; 4) Patterns and Algebra; and 5) Probability and Statistics. The Kto12 Curriculum revolves around these content areas in spiral progression. Learners are taught thinking and problem-solving skills through development of certain skills and processes such as knowing and understanding; estimating, computing and solving; visualizing and modelling; representing and communicating; conjecturing, reasoning, proving and decision-making; and applying and connecting (DepEd, 2016). Equally emphasized are relevant attitudes and values of accuracy, creativity, objectivity, perseverance, and productivity.

A review of both the goals and themes in the curriculum guide for Social Studies and Mathematics Curriculum would show that only one theme in social studies specifically relates to financial literacy which is Theme 6 – Production, Distribution, and Consumption that describes the inclusion of financial literacy as a component of this theme. How this is articulated in the competencies is what this review sought to discover. The Kto12 Mathematics Curriculum, on the other hand, does not mention financial literacy in any of its curricular themes. The review conducted aims to find out if the PISA Financial Literacy Framework is captured at least in the Social Studies and Mathematics Grades 7 to 10 in the K to 12 Curriculum.

Statement of Purpose

This review was conducted to determine if the financial literacy competencies used in PISA 2012, 2015, and 2018 were adequately covered in the Kto12 Social Studies and Mathematics curricula for Grades 7 to 10. Specifically, it sought to:

1. determine the degree of integration of PISA financial literacy competencies in the Kto12 Social Studies and Mathematics curricular programs; and
2. identify the gaps in the Kto12 Social Studies and Mathematics curricular programs based on the PISA Financial Literacy Framework.

Conceptual Framework

The Philippines ranked very low in the Mathematics, Reading Comprehension, and Science components of PISA 2018. Educators, education leaders, and the general public have endeavored to look for answers to explain the dismal performance of the country in the recent PISA. This prompted DepEd and other stakeholders to conduct a review of the implementation of the Kto12 Curriculum starting with a review of curricular alignment with the PISA Framework.

Webb (1997) defines curriculum alignment as the "degree to which expectations [i.e., standards] and assessments are in agreement and serve in conjunction with one another to guide the system toward students learning what they are expected to know and do." Research on curriculum alignment shows a strong correlation to student achievement (Squires, 2012). The PISA competencies serve as the standard to which Filipino learners' achievement is measured. One relevant question to ask in the

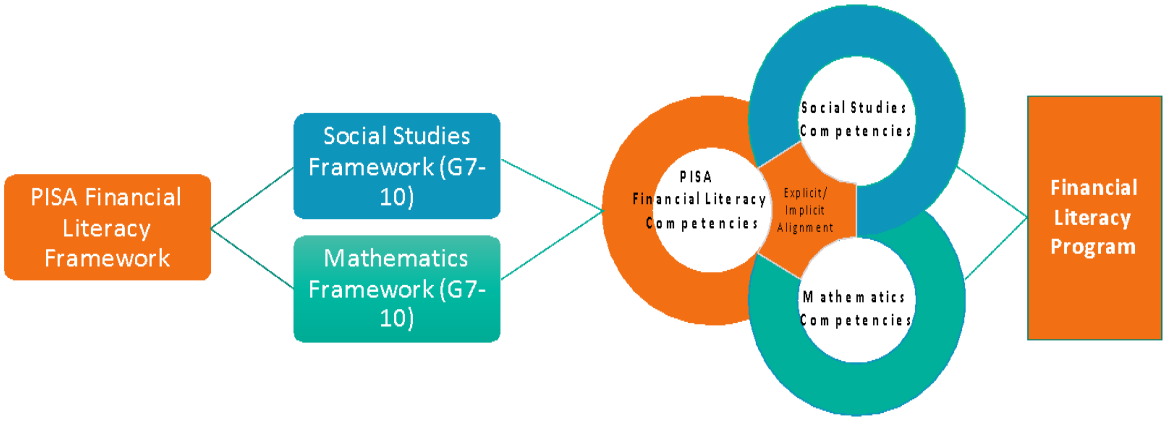
context of the PISA results is whether or not the Kto12 curriculum is consistent with what is being assessed by PISA.

It should be noted that the Philippines did not participate in the Financial Literacy Assessment which was offered as an optional feature of the test. However, the 2021 PISA will be administered soon, and assessing Filipino learners' financial literacy skills now is worth considering for this next round of assessment. One way to prepare for this is to conduct a review to find out if our existing Social Studies and Mathematics curricular programs are aligned with the PISA Financial Literacy Competency Framework.

Figure 6.1 shows the comparison of the PISA Financial Literacy Framework with the framework of the Kto12 curriculum for Social Studies and Mathematics for Grades 7 to 10. Each of the three frameworks being compared consists of program goals and curricular themes which serve as anchors for their respective competencies. Social Studies and Mathematics are both considered relevant subjects in Grades 7 to 10 for teaching financial literacy.

Figure 6.1

Conceptual Framework on Curriculum Alignment



The competencies for Social Studies and Mathematics are reviewed to see whether these are aligned either explicitly or implicitly with the PISA Financial Literacy competencies. Some competencies are assumed to overlap, and some gaps may emerge which could be used to integrate financial literacy competencies to enhance both curricular programs. It is also assumed that financial literacy can be learned outside the classroom and from the formal curriculum.

METHODOLOGY

The study used document analysis to review relevant materials available in the internet to define the context of the inquiry. The primary documents reviewed were the curriculum guides in Social Studies and Mathematics issued by DepEd in 2016. The competencies were then mapped using an analysis matrix and heat map. The Social Studies and Mathematics competencies that relate, either explicitly or implicitly, to each of the PISA Financial Literacy competencies were identified. Explicit alignment involves looking at the PISA financial literacy competencies that are specifically and directly found in the curriculum. Implicit alignment involves the researchers' use of their professional judgment to determine whether a PISA competency is indirectly addressed in the two curricular programs. The identified competencies were then tallied. The analysis matrix was evaluated by an independent reviewer to establish reliability. The reviewed matrix was then used as the data set for the analysis and interpretation.

RESULTS AND DISCUSSION

Are the Competencies in the Social Studies Curriculum Aligned with the PISA Financial Literacy Competencies?

After a careful review and examination of the competencies was done, it is evident that the competencies in the Kto12 Social Studies Curriculum in Grades 7 to 10 do not reflect PISA Financial Literacy (FL) competencies. Table 6.1 presents the basic data on the number of Social Studies competencies for each grade level as well as the total number of PISA FL competencies. It shows the mapping of PISA Financial Literacy (FL) Competencies vis-à-vis the competencies in the Kto12 Social Studies Curriculum for Grades 7 to 10.

Table 6.1

Mapping of the PISA Financial Literacy Competencies vis-à-vis Kto12 Social Studies Competencies for Grades 7 to 10

FL Content Domains/Competencies	Grade 7		Grade 8		Grade 9		Grade	
	E	I	E	I	E	I	E	I
CONTENT	E=Explicit				I=Implicit			
Money and Transactions	0	0	0	0	2	2	0	0
Planning and Managing Finances	0	0	0	0	7	1	0	3
Risk and Reward	0	0	0	0	0	1	0	0
Financial Landscape	0	1	0	0	7	4	0	4
PROCESSES								
Identify financial information	0	0	0	0	0	1	0	0
Analyse financial information and situations	0	0	0	0	0	0	0	0
Evaluate financial issues	0	0	0	0	0	3	0	0
Apply financial knowledge and understanding	0	0	0	0	0	1	0	0
CONTEXTS								
Education and work	0	1	0	0	0	0	0	0
Home and Family	0	0	0	0	1	0	0	0
Individual	0	0	0	0	1	0	0	0
Societal	0	5	0	0	5	4	1	1
# of Social Studies competencies aligned with the PISA Financial Literacy competencies	0	7	0	0	21	15	1	8
# of Social Studies competencies	135		43		81		67	
% of competencies aligned with PISA financial literacy	0	5.6	0	0	25.93	18.52	1.5	12
# of PISA financial literacy competencies included in the	0	3	0	0	19	12	1	3
% of PISA Financial Literacy competencies included in Social Studies Curriculum per grade	0	3.9	0	0	24.68	15.58	1.3	3.9
# of PISA Financial Literacy competencies (N=77)								
Total # of PISA Financial Literacy competencies explicitly included in G7-10 Social Studies (N=19)								
Total # of PISA Financial Literacy competencies implicitly included in G7-10 Social Studies (N=10)								

Based on the mapping done, three general statements can be deduced.

Among the four grade levels, Grade 9 Social Studies which is focused on the study of Economics has the highest percentage of competencies explicitly (25.93%) and implicitly (18.52%) aligned or related to PISA FL competencies. This is expected due to the nature of the subject matter.

However, it is disturbing to note that only 24.68% of the seventy-seven (77) PISA FL competencies are explicitly included, while 15.58% are implicitly addressed in Grade 9. Economics is considered the most critical subject to equip the learners with financial literacy skills, yet the review showed that the Economics curriculum does not adequately align with the PISA competencies for financial literacy.

Overall, the PISA FL competencies are minimally addressed in the Social Studies Curriculum from Grades 7 to 10 with only 20 (26%) of 77 competencies explicitly addressed, while 18 (23.4%) of those are implicitly considered. It could be surmised that the Social Studies Curriculum may not fully equip the Filipino learners with the financial literacy skills that meet the proficiency standard set by PISA.

In relation to the PISA FL competencies categorized into Content, Process, and Context, the present review included examination of the specific competencies under each category to determine whether or not they are adequately addressed in the curriculum. Table 2 contains the heat map for the **Content** category (Money and Transactions) to identify the PISA FL competencies covered by any of the competencies in Grades 7 to 10.

It can be gleaned from Table 6.2 that only three (highlighted in blue) or 18.75% of the sixteen (16) **Money and Transactions** competencies are included in the Economics curriculum (Grade 9). Arguably, the FL competencies may be sensitive to socio-economic and cultural factors, but the Economics curriculum may still be enhanced to accommodate some critical and relevant competencies. It is also worth noting that the other three Social Studies programs (Grades 7, 8 and 10) do not integrate financial literacy competencies to equip learners with skills in financial management and financial transactions.

Planning and managing finances is a sub-category of **Content**. It pertains to knowledge and ability to monitor and control income and expenses and knowledge and ability to make use of income and other available resources in the short and long terms to enhance financial well-being.

Table 6.3 shows that nine out of the 16 competencies or a high 56.25% are explicitly addressed in Economics, but very low in Contemporary Issues (Grade 10 Social Studies). It is again important to mention that the competencies in **Planning and Managing Finances** are not integrated in Grades 7 and 8, and for Grade 10 where learners need to be prepared to engage in financial transactions in the real world, there is very limited competencies included in the subject Contemporary Issues, which is considered another subject area apart from Economics where financial literacy would lend itself well.

Table 6.2

Mapping of the Financial Literacy (Money and Transactions) Competencies vis-à-vis the Kto12 Social Studies Curriculum for Grades 7 to 10

PISA FL Content Domains/Competencies	Grade 7		Grade 8		Grade 9		Grade 10	
	E	I	E	I	E	I	E	I
CONTENT	**E=Explicit**				**I=Implicit**			
MONEY AND TRANSACTIONS:	N=16							
Are aware of the different forms and purposes of money:								
Recognise bank notes and coins;	0	0	0	0	0	0	0	0
Understand that money can be exchanged for goods and services;	0	0	0	0	0	5	0	0
Understand that money spent on something is not available to be spent on something else;	0	0	0	0	0	0	0	0
Recognise that money can be stored in various ways, including at home, in a bank, in a post office or in other financial institutions, in cash or electronically;	0	0	0	0	6	0	0	0
Understand that money held in cash may lose value in real terms over time if there is inflation;	0	0	0	0	6	5	0	0
Recognise that there are various ways of paying for items purchased, receiving money from other people, and transferring money between people or organisations such as cash, cheques, card payments in person or online, electronic transfers online or via SMS or contactless payments with smartphones, and that new ones continue to be developed;	0	0	0	0	0	0	0	0
Understand that money can be borrowed or lent, and the purpose of interest (taking into account that the payment and receipt of interest is forbidden in some religions);	0	0	0	0	0	0	0	0
Are aware that other countries may use different currency from their own, and that exchange rates may change over time; and	0	0	0	0	0	0	0	0
Are aware of digital currencies.	0	0	0	0	0	0	0	0
Are confident and capable at handling and monitoring transactions:								
Can use cash, cards and payment methods through computers and mobile phones to purchase items;	0	0	0	0	0	0	0	0
Can use cash machines to withdraw cash;	0	0	0	0	0	0	0	0
Can check an account balance over the internet or through cash machines;	0	0	0	0	0	0	0	0
Can check receipts after making purchases, and can calculate the correct change if the transaction is made in cash;	0	0	0	0	0	0	0	0
Can work out which of two consumer items of different sizes would give better value for money, and understand that this may vary depending on the specific needs and circumstances of the consumer;	0	0	0	0	0	0	0	0
Can use common tools, such as paper-and-pen, spreadsheets, online platforms or mobile applications to monitor their transactions and support budget calculations; and	0	0	0	0	0	0	0	0
Can check transactions listed on a bank statement provided on paper or digitally, and note any irregularities.	0	0	0	0	0	0	0	0

Table 6.3

Mapping of the Financial Literacy (Planning and Managing Finances) Competencies vis-à-vis the Kto12 Social Studies Curriculum for Grades 7 to 10

PISA FL Content Domains/Competencies	Grade 7		Grade 8		Grade 9		Grade 10	
	E	I	E	I	E	I	E	I
CONTENT	E=Explicit				I=Implicit			
PLANNING AND MANAGING FINANCES:	N=16							
Knowledge and ability to monitor and control income and expenses:								
Identify various types of income relevant for young people and for adults (e.g. pocket money, allowances, salary, commission, benefits),	0	0	0	0	1	0	0	0
Be aware that rules for engaging in gainful employment may be different across young people and adults;	0	0	0	0	0	0	0	3
Understand different ways of discussing income (such as hourly wage and gross or net annual income) and that some factors that may affect income (such as different education or career paths);	0	0	0	0	1	0	0	0
Draw up a budget to plan regular spending and saving and stay within it; and	0	0	0	0	3	0	0	0
Be aware of factors that impact on living standards for any given income, including location, number of dependents and existing commitments.	0	0	0	0	1	0	0	0
Knowledge and ability to make use of income and other available resources in the short and long terms to enhance financial well-being:								
Understand the difference between needs and wants and the idea of living within one's means;	0	0	0	0	4	0	0	0
Understand how to manipulate various elements of a budget, such as thinking about different options for spending money, identifying priorities if income does not meet planned expenses, or finding ways to increase savings, such as reducing expenses or increasing income;	0	0	0	0	3	0	0	0
Assess the impact of different spending plans and be able to set spending priorities in the short and long term, also in the context of external spending pressure;	0	0	0	0	2	0	0	0
Understand the benefits of a financial plan for future events and plan ahead to pay future expenses: for example, working out how much money needs to be saved each month to make a particular purchase or pay a bill;	0	0	0	0	0	0	0	0
Understand that expenditure can be adjusted over time through borrowing or saving;	0	0	0	0	0	0	0	0
Understand the reasons why people may use credit, that borrowing money entails a responsibility to repay it, and that the amount to be repaid is usually	0	0	0	0	0	0	0	0
Larger than the amount borrowed due to interest payments (taking into account that the payment and receipt of interest is forbidden in some religions);	0	0	0	0	0	0	0	0
Understand the idea of building wealth, the impact of compound interest on savings, and the reasons why some people use investment products;	0	0	0	0	0	0	0	0
Understand the benefits of saving for long term goals or anticipated changes in circumstances (such as living independently);	0	0	0	0	0	0	0	0
Understand the risks of saving in cash, including the fact that money can be lost, stolen or may lose part of its value in real terms due to inflation; and	0	0	0	0	0	0	0	0
Understand how government taxes and benefits impact on personal and household finances.	0	0	0	0	0	1	0	0

The third sub-category of **Content** refers to **Risks and Rewards** which pertains to the ways of balancing and covering risks and managing finances in situations of uncertainty as well as understanding the potential for financial gains or losses given diverse financial contexts. Table 6.4 indicates that out of the 16 competencies, only one competency is covered and again only implicitly so and only in Economics. A perusal of the competencies under Risks and Rewards would seem to signify that Contemporary Issues offered in Grade 10 Social Studies could play a greater role in teaching financial literacy competencies which are issues-based. The absence of competencies under this sub-category in any of the grade levels is quite disturbing because the skills are necessary to enable the learners to navigate through complex financial situations that they may encounter in real life.

The last sub-category under **Content** is presented in Table 6.5 which is about understanding the consequences of changes in economic conditions and government's macroeconomic policies, such as changes in interest rates, inflation, taxation, ecological sustainability targets, or benefits for individuals, households and society. The competencies speak of the **Financial Landscape** that could greatly impact on individuals and communities. Table 6.5 shows that out of 21 competencies, seven are covered explicitly and two implicitly, all in Economics, while one competency is implicitly addressed in Asian Studies (Grade 7), and another one also implicitly addressed in Contemporary World (Grade 10).

Table 6.4

Mapping of the Financial Literacy (Risk and Reward) Competencies vis-à-vis the Kto12 Social Studies Curriculum for Grades 7 to 10

PISA FL Content Domains/Competencies	Grade 7		Grade 8		Grade 9		Grade 10	
	E	I	E	I	E	I	E	I
CONTENT	**E=Explicit**				**I=Implicit**			
RISK AND REWARD:	N=16							
Identifying those risks that - should the incident occur - are most likely to have a serious negative affect on a particular person, such as:								
Accident or injury,	0	0	0	0	0	0	0	0
Theft of personal property, passwords or data and digital assets,	0	0	0	0	0	0	0	0
Damage or loss of personal property,	0	0	0	0	0	0	0	0
Man-made and/or natural catastrophes.	0	0	0	0	0	0	0	0
Identifying and managing risks and rewards associated with life events or the economy, such as the potential impact of:								
Job loss, birth or adoption of a child, deteriorating health or mobility;	0	0	0	0	0	0	0	0
Fluctuations in interest rates and exchange rates; and	0	0	0	0	0	0	0	0
Other market changes.	0	0	0	0	0	0	0	0
Recognising that certain financial products (including insurance) and processes (such as saving) can be used to manage and offset various risks (depending on different needs and circumstances):								
Understand the benefits of saving for unanticipated changes in circumstances; and	0	0	0	0	0	0	0	0
Knowing how to assess whether certain insurance policies may be of benefit, and the level of cover needed.	0	0	0	0	0	0	0	0
Understanding the risk inherent in certain credit and investment products, such as risk of capital loss, variability of returns, and the implications of variable interest rates on loan repayments.	0	0	0	0	0	0	0	0
Understanding the benefits of contingency planning and diversification to limit the risk to personal capital.	0	0	0	0	0	0	0	0
Applying knowledge of the benefits of contingency planning, diversification and the dangers of default on payment of bills and credit agreements to decisions about:								
Various types of investment, savings and insurance products, where relevant; and	0	0	0	0	0	0	0	0
Various forms of credit, including informal and formal credit, unsecured and secured, rotating and fixed term, and those with fixed or variable interest rates.	0	0	0	0	0	0	0	0
Knowing and being cautious about the risks and rewards associated with substitutes for financial products, such as:								
Saving in cash or in unregulated digital financial instruments (which may include crypto-currencies, depending on national regulation), or buying property, livestock or gold as a store of wealth; and	0	0	0	0	0	0	0	0
Taking credit or borrowing money from informal lenders.	0	0	0	0	0	3	0	0
Knowing that there may be unidentified risks and rewards associated with new financial products (such as mobile payment products and online credit).	0	0	0	0	0	0	0	0

Table 6.5

Mapping of the Financial Literacy (Financial Landscape) Competencies vis-à-vis the Kto12 Social Studies Curriculum for Grades 7 to 10

PISA FL Content Domains/Competencies	Grade 7		Grade 8		Grade 9		Grade 10	
	E	I	E	I	E	I	E	I
CONTENT	E=Explicit				I=Implicit			
FINANCIAL LANDSCAPE:	N=21							
Awareness of the role of regulation and consumer protection	0	0	0	0	0	0	0	0
Knowledge of rights and responsibilities, and the ability to apply it to:								
Understand that buyers and sellers have rights, such as being able to apply for redress;	0	0	0	0	2	0	0	4
Understand that buyers and sellers have responsibilities, such as:								
Consumers/investors giving accurate information when applying for financial products;	0	0	0	0	0	0	0	0
Providers disclosing all material facts; and	0	0	0	0	0	0	0	0
Consumers/investors being aware of the implications of one of the parties not doing so.	0	0	0	0	1	0	0	0
Recognise the financial implications of contracts;	0	0	0	0	1	0	0	0
Recognise the importance of the legal documentation provided when purchasing financial products or services and the importance of understanding the content.	0	0	0	0	0	0	0	0
Knowledge and understanding of the financial environment, including:								
Understanding that different people and organisations may have incentives to provide certain financial information, products or services;	0	0	0	0	0	0	0	0
Being able to identify trusted sources of financial information and advice, and to distinguish marketing and ads from genuine and official information and educational messages;	0	0	0	0	0	0	0	0
Being alert to 'fake news' in the financial domain or with financial implications;	0	0	0	0	0	0	0	0
Identifying which providers are trustworthy, and which products and services are protected through regulation or consumer protection laws;	0	0	0	0	0	0	0	0
Identifying whom to ask for advice when choosing financial products, understanding that financial advice may be biased, and knowing where to go for help or guidance in relation to financial matters; and	0	0	0	0	0	0	0	0
Awareness of the financial risks and implications of sharing personal financial data, awareness that personal data may be used to create a person's digital profile which can be used by companies to offer products and services based on personal factors, and awareness of existing financial crimes such as identity theft and data theft;								
Applying an understanding of the financial risks of a lack of data protection to:								
Take appropriate precautions to protect personal data and avoid scams,	0	0	0	0	0	0	0	0
Conduct online transactions safely,	0	0	0	0	0	0	0	0
Know rights and responsibilities under the applicable regulation, including in the event of being a victim.	0	0	0	0	1	0	0	0

Knowledge and understanding of the (short- and long-term) impact of their own financial decisions on themselves, on others, and on the environment:								
Understand that individuals have choices in spending, saving and investing and each action can have consequences for the individual, for society and possibly for the environment; and	0	0	0	0	1	1	0	0
Recognise how personal financial habits, actions and decisions impact at an individual, community, national and international level	0	0	0	0	2	0	0	0
Understand the financial implications on society of ethics, sustainability and integrity and related behaviours (including for instance donations to non-profits/charities, green investments, corruption).	0	0	0	0	0	0	0	0
Knowledge of the influence of economic and external factors:								
Aware of the economic climate and understand the impact of policy changes such as reforms related to the funding of post-school training or compulsory savings for retirement;	0	1	0	0	3	2	0	0
Understand how the ability to build wealth or access credit depends on economic factors such as interest rates, inflation and credit scores; and	0	0	0	0	0	2	0	0
Understand that a range of external factors, such as advertising and pressure from family, friends and society, can affect individuals' financial choices and outcomes.	0	0	0	0	0	2	0	0

Moreover, out of the 69 competencies under the **Content** category, 19 (27%) and 10 (14.5%) are explicitly and implicitly addressed, respectively, in the Kto12 Social Studies curriculum where a substantial number are, as expected, found in Economics. The **Content** competencies form the "what to think" about financial literacy. They comprise the knowledge base of students about financial literacy. It becomes problematic then that a little more than 85% of the content they are supposed to know is missing in the curriculum.

The two remaining categories of PISA FL are **Process** and **Context**. The first pertains to the cognitive skills that learners use to respond to financial issues and situations, while the latter refers to the different situations where they may apply their financial literacy skills. These include application of both content and process related to financial literacy on tasks they may encounter in education and work, home and family, and the society.

Table 6.6 shows that three of the four **Process** competencies are addressed in Economics which indicate that the

Grade 9 Social Studies Curriculum gives emphasis also to cognitive skills as in the PISA FL framework. No other grade level accommodates these **Process** competencies since these competencies are rather specific to financial literacy.

Table 6.6

Mapping of PISA Financial Literacy (Process and Context) Competencies vis-à-vis the Kto12 Social Studies Curriculum for Grades 7 to 10

PISA FL Content Domains/Competencies	Grade 7		Grade 8		Grade 9		Grade 10	
	E	I	E	I	E	I	E	I
PROCESS	E=Explicit				I=Implicit			
Identify financial information	0	0	0	0	0	1	0	0
Analyse financial information and situations	0	0	0	0	0	0	0	0
Evaluate financial issues	0	0	0	0	0	3	0	0
Apply financial knowledge and understanding	0	0	0	0	0	1	0	0
N= 4								
CONTEXTS								
Education and work	0	1	0	0	0	0	0	0
Home and Family	0	0	0	0	1	0	0	0
Individual	0	0	0	0	1	0	0	0
Societal	0	5	0	0	5	4	1	1
N= 4								

The **Context** category tells us a different story. The competencies illustrating different levels of environment, where tasks relevant to financial literacy may be encountered by the learners, are adequately covered in all grade levels except in Grade 9 (World History).

It can be gleaned from the Table that the history-oriented social studies subjects do not significantly accommodate the teaching of cognitive skills relevant to financial literacy. The lack of explicit coverage of FL skills in the expanding environments that learners may navigate begs the question whether these subjects teach practical applications of skills at all to help learners thrive in

diverse situations. The grade level standards contained in Table 6.7 would show that there is opportunity to infuse financial literacy in every grade level. However, the competencies that detail how the grade level standard may be attained may not have been crafted with financial literacy in mind which would explain the limited infusion of FL into the list of competencies per grade level.

Table 6.7

Matrix of Grade Level Standards

Grade	Grade Level Standards (Filipino)	Grade Level Standards (English)
Grade 7	Naipamamalas ang malalim na pag-unawa at pagpapahalaga sa kamalayan sa heograpiya , kasaysayan, kultura, lipunan, pamahalaan at ekonomiya ng mga bansa sa rehiyon tungo sa pagbubuo ng pagkakakilanlang Asyano at magkakatuwang na pag-unlad at pagharap sa mga hamon ng Asya	Demonstrates deep understanding and appreciation for georgraphy, history, culture, society, government, and economy of countries in the region toward developing a sense of Asian identity to respond collaboratively to the challenges in Asia.
Grade 8	Naipamamalas ang malalim na pag-unawa at pagpapahalaga sa sama-samang pagkilos at pagtugon sa mga pandaigdigang hamon sa sangkatauhan sa kabila ng malawak na pagkakaiba-iba ng heograpiya, kasaysayan, kultura, lipunan, pamahalaan at ekonomiya tungo sa pagkakaroon ng mapayapa, maunlad at matatag na kinabukasan	Demonstrates a deep understanding and appreciation for collaborative action and response to global challenges to humankind despite diverse geography, history, culture, society, government, and economy towards attainment of a peaceful, prosperous, and stable future.
Grade 9	Naipamamalas ang malalim na pag-unawa at pagpapahalaga sa mga pangunahing kaisipan at napapanahong isyu sa ekonomiks gamit ang mga kasanayan at pagpapahalaga ng mga disiplinang panlipunan tungo sa paghubog ng mamamayang mapanuri , mapagnilay, mapanagutan, makakalikasan, produktibo, makatarungan, at makataong mamamayan ng bansa at daigdig	Demonstrates a deep understanding and appreciation for basic economic concepts and contemporary economic issues using skills and values in social studies to develop critical, reflective, accountable, pro-environment, productive, just, and humane citizens of the country and the world.
Grade 10	Naipamamalas ang malalim na pag-unawa at pagpapahalaga sa mga kontemporaryong isyu at hamong pang-ekonomiya, pangkalikasan, pampolitika, karapatang pantao, pang-edukasyon at pananagutang sibiko at pagkamamamayan sa kinakaharap ng mga bansa sa kasalukuyang panahon gamit ang mga kasanayan sa pagsisiyasat, pagsusuri ng datos at iba't ibang sanggunian, pagsasaliksik, mapanuring pag-iisip, mabisang komunikasyon at matalinong pagpapasya	Demosntrates deep understanding and appreciation for contemporary economic, ecological, political, and educational challenges as well as issues of human rights, civic competence, and responsible citizenship that the the country currently faces using skills in observation, data analysis, research, critical thinking, effective communication, and making informed decision.

Table 6.7 contains the grade level standard that is the terminal objective in teaching Social Studies. Relevant concepts are underscored to show the opportunities for infusion of financial literacy competencies.

Are the Competencies in the Kto12 Mathematics Curriculum for Grades 7-10 Aligned with PISA Financial Literacy Competencies?

Based on the review of competencies, the Kto12 competencies in the Mathematics curriculum for Grades 7 to 10 are **NOT** aligned with the PISA Financial Literacy (FL) competencies.

Table 6.8 presents the basic data on the number of PISA FL competencies vis-a-vis the Kto12 competencies for each grade level. The PISA FL competencies were mapped vis-à-vis the competencies in the Kto12 Mathematics Curriculum.

Table 6.8

Mapping the PISA Financial Literacy Competencies vis-à-vis Kto12 Mathematics Curriculum for Grades 7 to 10

PISA FL Content Domains/Competencies	Grade 7		Grade 8		Grade 9		Grade 10	
	E	I	E	I	E	I	E	I
CONTENT	E=Explicit				I=Implicit			
Money and Transactions	0	1	0	1	0	1	0	1
Planning and Managing Finances	0	5	0	5	0	5	0	5
Risk and Reward	0	3	0	3	0	3	0	3
Financial Landscape	0	1	0	1	0	1	0	1
PROCESSES								
Identify financial information	0	1	0	1	0	1	0	1
Analyse financial information and situations	0	1	0	1	0	1	0	1
Evaluate financial issues	0	0	0	0	0	0	0	0
Apply financial knowledge and understanding	0	1	0	1	0	1	0	1
CONTEXTS								
Education and work	0	1	0	1	0	1	0	1
Home and Family	0	1	0	1	0	1	0	1
Individual	0	0	0	0	0	0	0	0
Societal	0	1	0	1	0	1	0	1
# of PISA Financial Literacy competencies aligned with the Mathematics competencies	0	16	0	16	0	16	0	16
# of PISA Financial Literacy Competencies	77		77		77		77	
% of PISA Financial literacy competencies aligned with the Mathematics Curriculum	0	20.8	0	20.8	-	20.8	0	20.8

Based on the analysis of data presented in Table 6.8, the following general statements are made.

1. Across the four grade levels in Mathematics, there are no PISA FL competencies which are explicitly integrated with the competencies in the Kto12 Mathematics Curriculum.

2. The PISA FL competencies are only implicitly integrated with the Mathematics Curriculum and are minimally addressed from Grades 7 to 10 at only 20.8%.

Table 6.9 contains the heat map for the **Content** on Money and Transactions to identify the FL competencies covered by any of the competencies in Grades 7 to 10. It can be gleaned from Table 6.9 that only one (highlighted in blue) or 6.25% of the sixteen (16) competencies is implicitly addressed in Grades 7 to 10 of the Kto12 Mathematics Curriculum.

Table 6.10 contains the heat map for the **Content** on Planning and Managing Finances to identify the FL competencies covered by any of the competencies in Grades 7 to 10. Five out of the 16 competencies or 31.25% are implicitly addressed in the Kto12 Mathematics Curriculum.

Table 6.9

Mapping of the PISA Financial Literacy (Money and Transactions) Competencies vis-à-vis the Kto12 Curriculum for Grades 7 to 10

PISA FL Content Domains/Competencies	Grade 7		Grade 8		Grade 9		Grade 10	
	E	I	E	I	E	I	E	I
CONTENT	**E=Explicit**				**I=Implicit**			
MONEY AND TRANSACTIONS:	N=16							
Are aware of the different forms and purposes of money:								
Recognise bank notes and coins;	0	0	0	0	0	0	0	0
Understand that money can be exchanged for goods and services;	0	0	0	0	0	0	0	0
Understand that money spent on something is not available to be spent on something else;	0	0	0	0	0	0	0	0
Recognise that money can be stored in various ways, including at home, in a bank, in a post office or in other financial institutions, in cash or electronically;	0	0	0	0	0	0	0	0
Understand that money held in cash may lose value in real terms over time if there is inflation;	0	0	0	0	0	0	0	0
Recognise that there are various ways of paying for items purchased, receiving money from other people, and transferring money between people or organisations such as cash, cheques, card payments in person or online, electronic transfers online or via SMS or contactless payments with smartphones, and that new ones continue to be developed;	0	0	0	0	0	0	0	0
Understand that money can be borrowed or lent, and the purpose of interest (taking into account that the payment and receipt of interest is forbidden in some religions);	0	0	0	0	0	0	0	0
Are aware that other countries may use different currency from their own, and that exchange rates may change over time; and	0	0	0	0	0	0	0	0
Are aware of digital currencies.	0	0	0	0	0	0	0	0
Are confident and capable at handling and monitoring transactions:								
Can use cash, cards and payment methods through computers and mobile phones to purchase items;	0	0	0	0	0	0	0	0
Can use cash machines to withdraw cash;	0	0	0	0	0	0	0	0
Can check an account balance over the internet or through cash machines;	0	0	0	0	0	0	0	0
Can check receipts after making purchases, and can calculate the correct change if the transaction is made in cash;	0	0	0	0	0	0	0	0
Can work out which of two consumer items of different sizes would give better value for money, and understand that this may vary depending on the specific needs and circumstances of the consumer;	0	0	0	0	0	0	0	0
Can use common tools, such as paper-and-pen, spreadsheets, online platforms or mobile applications to monitor their transactions and support budget calculations; and	0	15	0	7	0	3	0	7
Can check transactions listed on a bank statement provided on paper or digitally, and note any irregularities.	0	0	0	0	0	0	0	0

Table 6.10

Mapping of the PISA Financial Literacy (Planning and Managing Finances) Competencies vis-à-vis Kto12 Curriculum for Grades 7 to 10

PISA FL Content Domains/Competencies	Grade 7		Grade 8		Grade 9		Grade 10	
	E	I	E	I	E	I	E	I
CONTENT	**E=Explicit**				**I=Implicit**			
PLANNING AND MANAGING FINANCES:	N=16							
Knowledge and ability to monitor and control income and expenses:								
Identify various types of income relevant for young people and for adults (e.g. pocket money, allowances, salary, commission, benefits),	0	0	0	0	0	0	0	0
Be aware that rules for engaging in gainful employment may be different across young people and adults;	0	0	0	0	0	0	0	3
Understand different ways of discussing income (such as hourly wage and gross or net annual income) and that some factors that may affect income (such as different education or career paths);	0	0	0	0	0	0	0	0
Draw up a budget to plan regular spending and saving and stay within it; and	0	15	0	7	0	3	0	7
Be aware of factors that impact on living standards for any given income, including location, number of dependents and existing commitments.	0	0	0	0	0	0	0	0
Knowledge and ability to make use of income and other available resources in the short and long terms to enhance financial well-being:								
Understand the difference between needs and wants and the idea of living within one's means;	0	0	0	0	0	0	0	0
Understand how to manipulate various elements of a budget, such as thinking about different options for spending money, identifying priorities if income does not meet planned expenses, or finding ways to increase savings, such as reducing expenses or increasing income;	0	15	0	7	0	3	0	7
Assess the impact of different spending plans and be able to set spending priorities in the short and long term, also in the context of external spending pressure;	0	15	0	7	0	3	0	7
Understand the benefits of a financial plan for future events and plan ahead to pay future expenses: for example, working out how much money needs to be saved each month to make a particular purchase or pay a bill;	0	15	0	7	0	3	0	7
Understand that expenditure can be adjusted over time through borrowing or saving;	0	0	0	0	0	0	0	0
Understand the reasons why people may use credit, that borrowing money entails a responsibility to repay it, and that the amount to be repaid is usually	0	0	0	0	0	0	0	0
Larger than the amount borrowed due to interest payments (taking into account that the payment and receipt of interest is forbidden in some religions);	0	0	0	0	0	0	0	0
Understand the idea of building wealth, the impact of compound interest on savings, and the reasons why some people use investment products;	0	15	0	7	0	3	0	7
Understand the benefits of saving for long term goals or anticipated changes in circumstances (such as living independently);	0	0	0	0	0	0	0	0
Understand the risks of saving in cash, including the fact that money can be lost, stolen or may lose part of its value in real terms due to inflation; and	0	0	0	0	0	0	0	0
Understand how government taxes and benefits impact on personal and household finances.	0	0	0	0	0	1	0	0

Table 6.11 contains the heat map for the **Content** on Risks and Rewards to identify the FL competencies covered by any of the competencies in Grades 7 to 10. Three out of the 16 competencies or 18.75% are implicitly addressed in the Kto12 Mathematics Curriculum.

Table 6.11

Mapping the PISA Financial Literacy (Risk and Rewards) Competencies vis-à-vis the Kto12 Curriculum for Grades 7 to 10

PISA FL Content Domains/Competencies	Grade 7		Grade 8		Grade 9		Grade 10	
	E	I	E	I	E	I	E	I
CONTENT	**E=Explicit**				**I=Implicit**			
RISK AND REWARD:	N=16							
Identifying those risks that - should the incident occur - are most likely to have a serious negative affect on a particular person, such as:								
Accident or injury,	0	0	0	0	0	0	0	0
Theft of personal property, passwords or data and digital assets,	0	0	0	0	0	0	0	0
Damage or loss of personal property,	0	0	0	0	0	0	0	0
Man-made and/or natural catastrophes.	0	0	0	0	0	0	0	0
Identifying and managing risks and rewards associated with life events or the economy, such as the potential impact of:								
Job loss, birth or adoption of a child, deteriorating health or mobility;	0	0	0	0	0	0	0	0
Fluctuations in interest rates and exchange rates; and	0	15	0	7	0	3	0	7
Other market changes.	0	15	0	7	0	3	0	7
Recognising that certain financial products (including insurance) and processes (such as saving) can be used to manage and offset various risks (depending on different needs and circumstances):								
Understand the benefits of saving for unanticipated changes in circumstances;	0	0	0	0	0	0	0	0
Knowing how to assess whether certain insurance policies may be of benefit, and the level of cover needed.	0	0	0	0	0	0	0	0
Understanding the risk inherent in certain credit and investment products, such as risk of capital loss, variability of returns, and the implications of variable interest rates on loan repayments.	0	15	0	7	0	3	0	7
Understanding the benefits of contingency planning and diversification to limit the risk to personal capital.	0	0	0	0	0	0	0	0
Applying knowledge of the benefits of contingency planning, diversification and the dangers of default on payment of bills and credit agreements to decisions about:								
Various types of investment, savings and insurance products, where relevant; and	0	0	0	0	0	0	0	0
Various forms of credit, including informal and formal credit, unsecured and secured, rotating and fixed term, and those with fixed or variable interest rates.	0	0	0	0	0	0	0	0
Knowing and being cautious about the risks and rewards associated with substitutes for financial products, such as:								
Saving in cash or in unregulated digital financial instruments (which may include crypto-currencies, depending on national regulation), or buying property, livestock or gold as a store of wealth; and	0	0	0	0	0	0	0	0
Taking credit or borrowing money from informal lenders.	0	0	0	0	0	0	0	0
Knowing that there may be unidentified risks and rewards associated with new financial products (such as mobile payment products and online credit).	0	0	0	0	0	0	0	0

Table 6.12 contains the heat map for the **Content on** Financial Landscape to identify the FL competencies covered by any of the competencies in Grades 7 to 10. It shows that only one out of the 21 competencies or 4.76% are implicitly addressed in the Kto12 Mathematics Curriculum.

Table 6.12

Mapping of PISA Financial Literacy (Financial Landscape) vis-à-vis the Kto12 Mathematics Curriculum for Grades 7 to 10

PISA FL Content Domains/Competencies	Grade 7		Grade 8		Grade 9		Grade 10	
	E	I	E	I	E	I	E	I
CONTENT	**E=Explicit**				**I=Implicit**			
FINANCIAL LANDSCAPE:	N=21							
Awareness of the role of regulation and consumer protection	0	0	0	0	0	0	0	0
Knowledge of rights and responsibilities, and the ability to apply it to:								
Understand that buyers and sellers have rights, such as being able to apply for redress;	0	0	0	0	0	0	0	0
Understand that buyers and sellers have responsibilities, such as:								
Consumers/investors giving accurate information when applying for financial products;	0	0	0	0	0	0	0	0
Providers disclosing all material facts; and	0	0	0	0	0	0	0	0
Consumers/investors being aware of the implications of one of the parties not doing so.	0	0	0	0	0	0	0	0
Recognise the financial implications of contracts;	0	15	0	7	0	3	0	7
Recognise the importance of the legal documentation provided when purchasing financial products or services and the importance of understanding the content.	0	0	0	0	0	0	0	0
Knowledge and understanding of the financial environment, including:								
Understanding that different people and organisations may have incentives to provide certain financial information, products or services;	0	0	0	0	0	0	0	0
Being able to identify trusted sources of financial information and advice, and to distinguish marketing and ads from genuine and official information and educational messages;	0	0	0	0	0	0	0	0
Being alert to 'fake news' in the financial domain or with financial implications;	0	0	0	0	0	0	0	0
Identifying which providers are trustworthy, and which products and services are protected through regulation or consumer protection laws;	0	0	0	0	0	0	0	0

Identifying whom to ask for advice when choosing financial products, understanding that financial advice may be biased, and knowing where to go for help or guidance in relation to financial matters; and	0	0	0	0	0	0	0	0
Awareness of the financial risks and implications of sharing personal financial data, awareness that personal data may be used to create a person's digital profile which can be used by companies to offer products and services based on personal factors, and awareness of existing financial crimes such as identity theft and data theft;								
Applying an understanding of the financial risks of a lack of data protection to:								
Take appropriate precautions to protect personal data and avoid scams,	0	0	0	0	0	0	0	0
Conduct online transactions safely,	0	0	0	0	0	0	0	0
Know rights and responsibilities under the applicable regulation, including in the event of being a victim.	0	0	0	0	0	0	0	0
Knowledge and understanding of the (short- and long-term) impact of their own financial decisions on themselves, on others, and on the environment:								
Understand that individuals have choices in spending, saving and investing and each action can have consequences for the individual, for society and possibly for the environment; and	0	0	0	0	0	0	0	0
Recognise how personal financial habits, actions and decisions impact at an individual, community, national and international level	0	0	0	0	0	0	0	0
Understand the financial implications on society of ethics, sustainability and integrity and related behaviours (including for instance donations to non-profits/charities, green investments, corruption).	0	0	0	0	0	0	0	0
Knowledge of the influence of economic and external factors:								
Aware of the economic climate and understand the impact of policy changes such as reforms related to the funding of post-school training or compulsory savings for retirement;	0	0	0	0	0	0	0	0
Understand how the ability to build wealth or access credit depends on economic factors such as interest rates, inflation and credit scores; and	0	0	0	0	0	0	0	0
Understand that a range of external factors, such as advertising and pressure from family, friends and society, can affect individuals' financial choices and outcomes.	0	0	0	0	0	0	0	0

Table 6.13 shows that three out of the four **Process** competencies are addressed, and only one out of the four **Context** competencies is addressed in the Kto12 Mathematics Curriculum across all grade levels.

Table 6.13

Mapping of PISA Financial Literacy (Process and Context) vis-à-vis the Kto12 Mathematics Curriculum for Grades 7 to 10

PISA FL Content Domains/Competencies	Grade 7		Grade 8		Grade 9		Grade 10	
	E	I	E	I	E	I	E	I
PROCESS	E=Explicit				I=Implicit			
Identify financial information	0	15	0	7	0	3	0	7
Analyse financial information and situations	0	15	0	7	0	3	0	7
Evaluate financial issues	0	0	0	0	0	0	0	0
Apply financial knowledge and understanding	0	15	0	7	0	3	0	7
N= 4								
CONTEXTS								
Education and work	0	15	0	7	0	3	0	7
Home and Family	0	0	0	0	0	0	0	0
Individual	0	0	0	0	0	0	0	0
Societal	0	0	0	0	0	0	0	0
N= 4								

Data presented in Tables 6.9 -6.13 show us the specific PISA FL competencies addressed by the learning competencies in the Kto12 Mathematics Curriculum. Unfortunately, as observed in Table 8, the PISA FL competencies are only implicitly aligned with the Mathematics curriculum and are minimally addressed in Grades 7 to 10.

Moving forward, the challenge is for the teachers of Mathematics to incorporate FL topics into the curriculum. An authority on financial literacy could be consulted on what FL topics can be incorporated in the existing curriculum.

Also from Tables 6.9 to 6.13, it is evident that there are 15 competencies in Grade 7, seven competencies in Grade 8, three competencies in Grade 9, and seven competencies in Grade 10 that are implicitly aligned with PISA FL. They are identified and listed in Table 6.14 together with the suggested FL topics.

Table 6.14

Kto12 Mathematics Curriculum Competencies for Grades 7 to 10 with Suggested Financial Literacy Topics

#		Learning Competency	FL Topics
	Grade 7		
1	M7NS-Ib-2	Solves problems involving sets	
2	M7NS-Ii-2	Represents real-life situations which involve real numbers	
3	M7AL-IIc-1	Translates English phrases to mathematical phrases and vice versa	
4	M7AL-IIg-2	Solves problems involving algebraic equations	
5	M7AL-IIh-2	Translates English sentences to mathematical sentences and vice versa	
6	M7AL-IIj-2	Solves problems using equations and inequalities in one variable	
7	M7SP-IVa-1	Explains the importance of Statistics	
8	M7SP-IVa-2	Poses problems that can be solved using Statistics	
9	M7SP-IVb-1	Gathers statistical data	
10	M7SP-IVc-1	Organizes data in a frequency distribution table	
11	M7SP-IVd-e-1	Uses appropriate graphs to represent organized data: pie chart, bar graph, line graph, histogram, and ogive.	
12	M7SP-IVf-1	Illustrates the measures of central tendency (mean, median, and mode) of a statistical data	
13	M7SP-IVh-1	Illustrates the measures of variability (range,average deviation, variance, standard deviation) of a statistical data	
14	M7SP-IVj-1	Uses appropriate statistical measures in analyzing and interpreting statistical data	Differentiating between needs and wants Appreciation of everyday financial documents
15	M7SP-IVj-2	Draws conclusions from graphic and tabular data and measures of central tendency and variability	Basic Concepts on saving and spending Applying numerical operations (addition, subtraction, multiplication, division and percentages) in a financial context Computing for interest Preparation and use of a budget Preparation and use of financial plans
	Grade 8		
1	M8AL-Id-2	Solves problems involving rational algebraic equations	
2	M8AL-Ig-2	Solves problems involving linear equations in two variables	
3	M8AL-Ii-j-1	Solves a system of linear equations in two variables by (a) graphing; (b) substitution; (c) elimination	
4	M8AL-Ij-2	Solves problems involving systems of linear equations in two variables	
5	M8AL-IIb-2	Solves problems involving systems of linear equalities in two variables	
6	M8AL-IIe-2	Solves problems involving linear functions	
7	M8GE-IVi-j-1	Solves problems involving probabilities of simple events	
	Grade 9		
1	M9AL-Ii-2	Analyzes the effects of changing the values of a, h and k in the equation y=a(x-h) + k of a quadratic function on its graph	
2	M9AL-IIb-c-1	Solves problems involving variation	
3	M9AL-IIj-1	Solves problems involving radicals	
	Grade 10		
1	M10AL-If-2	Solves problems involving sequences	
2	M10SP-IIIb-1	Solves problems involving permutations	
3	M10SP-IIId-e-1	Solves problems involving permutations and combinations	
4	M10SP-IIId-e-1	Solves problems involving permutations and combinations	
5	M10SP-IIIi-j-1	Solves problems involving probability	
6	M10SP-IVf-g-1	Formulates statistical mini-research	
7	M10SP-IVh-j-1	Uses appropriate measures of position and other statistical methods in analyzing	

Based on the foregoing, the Kto12 Mathematics Curriculum for Grades 7 to 10 cannot address all the PISA FL competencies on its own. Any enhancement in the Kto12 Curriculum should also include financial literacy competencies in other subjects like Social Studies and/or English/Reading.

CONCLUSIONS AND RECOMMENDATIONS

Overall, the data revealed that the Kto12 Social Studies and Mathematics curricular programs from Grades 7 to 10 do not necessarily prepare the students to be proficient in financial literacy. It is important to note again that PISA has set Level 2 proficiency as the base level. It is not enough to identify only the gaps in the competencies, but more importantly there is also a need to identify the proficiency level to be targeted. As it is, the present Kto12 Social Studies Curriculum targets mastery of content but not how this content knowledge may be used to take on and overcome real-life challenges, which is what PISA is precisely designed to assess.

The importance of equipping the Filipino learners with financial literacy skills cannot be emphasized enough. The Social Studies curricular programs for Grades 7 to 10 are too focused on mastery of content, but the relevance of which to today's world is more putative than evident.

The challenge for the teachers of Mathematics, on the other hand, is to integrate FL topics into the competencies and to ensure that those competencies are taught and learned well.

In light of the above, the following recommendations are offered:

1. With the launching of the ***Sulong EduKalidad*** program by DepEd to transition the basic education system to be more responsive to 21st century education with achieving quality education as its central theme, the present study aims to support said program in its primary task to review and update the Kto12 curriculum. Given this, the results of this study clearly shows the need to need to reformulate the competencies in all levels of the Kto12 Curriculum to the extent practicable to integrate financial literacy knowledge and skills. In doing so, the curriculum consequently should be aligned with the corresponding PISA competencies.
2. As teachers' upskilling and reskilling is a key component of Sulong EduKalidad, both Mathematics and Social Studies teachers should be equipped with the requisite knowledge and skills to effectively make their students financially literate.
3. To continue the flow of steady supply of teachers with financial literacy knowledge, skills and experiences, there is a need to review the Teacher Education curriculum to ensure that both Social Studies and Mathematics in-service teachers are trained to demonstrate financial literacy competencies themselves.
4. The curriculum alone is not enough to make students financially literate and/or proficient. Parents and the community have to be financially literate as well. Engagement of stakeholders for support and collaboration is a vital component of a more holistic approach to financial literacy teaching.
5. Considering all of the above, a national financial literacy program needs to be designed and implemented targeting strategic stakeholders. Such a program will greatly help in developing a culturally-sensitive measure of financial literacy. These findings are recommended to be used as a baseline to develop a national financial literacy program.

REFERENCES:

Cifas (2018). *New data reveals young people increasingly at risk of fraud*. https://www.cifas.org.uk/newsroom/new-data-reveals-young-people-increasingly-risk-fraud (accessed on 5 April 2018).

Department of Education (2016). K to 12 Curriculum Guide in Mathematics. https://www.deped.gov.ph/wp-content/uploads/2019/01/Math-CG_with-tagged-math-equipment.pdf

Department of Education (2016). K to 12 Gabay Pangkurikulum sa Araling Panlipunan. https://www.deped.gov.ph/wp-content/uploads/2019/01/AP-CG.pdf

Gudmunson, C. & S. Danes (2011). Family Financial Socialization: Theory and Critical Review. *Journal of Family and Economic Issues*,*32*(4), 644-667. http://dx.doi.org/10.1007/s10834-011-9275-y.

OECD (2019). PISA 2021Financial Literacy Analytical and Assessment Framework, OECD Publishing,pp1-50. https://www.oecd.org/pisa/sitedocument/PISA-2021-Financial-Literacy-Framework.pdf

OECD (2019). *PISA 2018 Assessment and Analytical Framework*, PISA, OECD Publishing, Paris. *https://doi.org/10.1787/b25efab8-en*.

OECD (2017). *PISA 2015 Results (Volume IV): Students' Financial Literacy*, PISA, OECD Publishing, Paris. https://doi.org/10.1787/9789264270282-en.

OECD (2017). *G20/OECD INFE Report on Ensuring Financial Education and Consumer Protection for All in the Digital Age*, OECD. http://www.oecd.org/daf/fin/financial- education/G20-OECD-INFE-Report-Financial-Education-Consumer-Protection-Digital- Age.pdf (accessed on 9 January 2018).

OECD (2015). *OECD/INFE Core Competencies Framework on Financial Literacy for Youth*, OECD. http://www.oecd.org/daf/fin/financial-education/Core-Competencies-Framework- Youth.pdf (accessed on 9 January 2018).

OECD (2014). *Financial Education for Youth: the Role of Schools*, OECD Publishing. http://dx.doi.org/10.1787/9789264174825.

OECD (2014). *PISA 2012 Results: Students and Money (Volume VI): Financial Literacy Skills for the 21st Century*, OECD Publishing, Paris. http://dx.doi.org/10.1787/9789264208094-en.

OECD (2014). *PISA 2012 Technical report*, OECD Publishing. http://www.oecd.org/pisa/pisaproducts/pisa2012technicalreport.htm (accessed on 5 March 2018). [62] [1] [88]

OECD (2013). Financial Literacy Framework, in *PISA 2012 Assessment and Analytical Framework: Mathematics, Reading, Science, Problem Solving, and Financial Literacy, OECD* Publishing, Paris, pp139-166. http://dx.doi.org/10.1787/9789264190511-7-en.

OECD (2013). *The OECD Action Plan for Youth: Giving Youth a Better Start in the Labour Market*, OECD Publishing, Paris, https://www.oecd.org/newsroom/Action-plan-youth.pdf (accessed on 5 April 2018).

Squires, D. (2012). Curriculum Alignment Research Suggests That Alignment Can Improve Student Achievement. The Clearing House: A Journal of Educational Strategies, Issues and Ideas. 85. 129-135.

Webb, N.L. (1997). Determining alignment of expectations and assessment in mathematics and science education. http://archive.wceruw.org/nise/Publications/Briefs/Vol_1_No_2/NISE_Brief_Vol_1_No_2.pdf

About the Authors

Dr. Feliece I. Yeban teaches human rights and social science education at the Philippine Normal University. She has served PNU in various capacities such as VP for Finance and Administration, VP for University Relations, Dean of the College of Graduate Studies and Teacher Education Research, and Associate Dean of the Faculty of Behavioral and Social Sciences. She moderates "Buhay Guro" streamed on Teachers' Summit facebook group. It is an online meeting of teachers and education leaders to discuss educational issues from the teachers' perspective.

Prof. Joselito 'Joe' G. Florendo is currently the Deputy Director for Administration of the Southeast Asian Regional Center for Graduate Study and Research in Agriculture (SEARCA) and Associate Professor at the University of the Philippines Diliman. He was the former Vice President for Planning and Finance of the University of the Philippines System and Chair of the Department of Accounting and Finance. He finished his International Masters in Small and Medium Enterprises at the Asia-Europe Institute of the University of Malaya in Kuala Lumpur, Malaysia (with distinction), Bachelor of Science in Business Administration and Accountancy degree, Cum Laude, at University of the Philippines Diliman and ranked 15th in 1994 Certified Public Accountants Licensure Examination. He was chosen as the 2014-2015 Deloitte-FINEX Most Outstanding Finance Educator of the Philippines and received the 2016 Dangal ng Bayan Award from President Rodrigo R. Duterte during the Outstanding Government Workers Awards Rites in December 2016.

Chapter 7

PISA Collaborative Problem-Solving Framework *vis-à-vis* the Philippine Kto12 Mathematics, Social Studies and Values Education Curricula

Adonis P. David and Wilma S. Reyes
Philippine Normal University, Manila

Abstract

One of the current thrusts of the Philippine Department of Education (DepEd) is for the country to participate in various international assessment programs in order to determine how Filipino students compare with students from other countries with international standards as benchmarks. The Program for International Standards Assessment, more popularly known as PISA, is one international assessment that the country has recently participated in. An important competency that is measured by PISA is collaborative problem-solving (CPS) which the present study sought to analyze to see the alignment and gaps, if there are any, of the Philippine Kto12 Mathematics, Social Studies and Values Education Curricula in Grades 7 to 10 with the PISA CPS Framework. Using document analysis, it was found out that there is a limited alignment between the PISA CPS Framework and the competencies in the Kto12 Curriculum in the three subject areas examined. Conclusions and recommendations are offered to address the key results and gaps identified from the analysis to serve as inputs to future review of the Kto12 curriculum to capture the essential competencies on collaborative problem-solving emphasized in PISA.

Keywords: *Collaborative Problem-Solving, Mathematics Curriculum, PISA Framework, Social Studies Curriculum, Values Education Curriculum*

INTRODUCTION

International assessment programs are meant to provide opportunity for cross-country comparisons of student competencies in various subject areas. The Department of Education (DepEd) Order No. 29, series of 2017 (Department of Education, 2017) provides the policy guidelines on the Philippines' participation in international large-scale assessments as part of the system assessment of the Kto12 Basic Education Program. There are several international assessment programs such as the Programme for International Student Assessment (PISA) and Trends in International Mathematics and Science Study (TIMMS) targeted for countries to participate in. The Philippines, in 2018, participated in PISA, an international assessment supervised by the Organisation for Economic Co-operation and Development (OECD). PISA is designed to "evaluate education systems worldwide by testing the skills and knowledge of 15-year-old students, who are approaching the end of their compulsory education" and to "test" how students can apply their knowledge to real-life situations and problems" (Care, 2018, p. 41). PISA is conducted every three years and covers three core domains - **Reading Literacy**, **Mathematics Literacy**, and **Scientific Literacy**, and **one innovative domain** every test cycle. The Philippines' results presented in the PISA 2018 National Report of the Philippines (Department of Education, 2019) revealed that our country performed poorly as indicated by scores that are below the average and much lower than those of other participating countries across domains.

While international assessments differ from national assessments as the latter are designed to evaluate student progress against national curricular goals, and the former are designed to provide comparable data across countries which can be used for benchmarking (Care, 2018), participation in international assessments can provide an opportunity for a country to review its national curricula vis-a-vis the framework used by international assessment programs. Such a review can provide information to national curriculum developers on whether their country

is providing the educational opportunities that are being provided in other countries (Care, 2018). Thus, the results of international assessments like PISA can provide vital information on the congruence and relevance of the Philippine curriculum with global curriculum standards. Examining how "matched" or "aligned" the Philippine curriculum is with the PISA framework can provide important information that may serve as inputs to curriculum developers and implementers. This is important given that data from PISA are being used in education policy formation in a number of countries (Hopfenbeck et al., 2017). As discussed by Cheung et al. (2018), PISA's comparative education agenda aims that "(1) Education systems achieve excellence in educational quality; and (2) they demonstrate high level of educational equity concomitantly." (p.53).

One innovative domain that was previously assessed by PISA is collaborative problem-solving (CPS). OECD (2017) explains that in CPS individuals collaborate to solve problems, and that it has distinct advantages over individual problem-solving because it allows effective division of labor, incorporation of information from multiple perspectives, and enhanced creativity and quality of solutions. Thus, CPS is an integration of collaboration and problem solving. The CPS competency is defined as the capability of a person to work with other persons "to solve a problem by sharing the understanding and effort required to come to a solution and pooling their knowledge, skills and efforts to reach that solution" (OECD, 2017, p.134). Indeed, CPS is considered an important 21st century skill (Yuan et al., 2019).

The focus on CPS is based on the recognition that the ability of an individual to be successful in many modern situations involves group participation or collaboration (De Boeck & Scalise, 2019), and that much of the complex work in the modern world is performed by teams (Graesser et al., 2018). In the PISA assessment of CPS, an individual must be able to work with other individuals as part of a pair or group

and perform the problem-solving processes concurrently with the collaborative processes.

The importance of CPS competencies is highlighted in problems or conditions that merit collaboration in order to have more effective and efficient solutions or actions. This is especially true in cases where collaborative problem-solving between people from different backgrounds and/or different groups are critical in addressing a need or a problem of several stakeholders or communities. For instance, one recent situation where demonstration of CPS competencies seems imperative is the global health crisis brought about by the 2019 coronavirus disease (COVID-19) that started in China in December 2019 (Columbus et al., 2020). The risk assessment of COVID-19 was assessed by the World Health Organization (WHO) as high (Benvenuto et al., 2020) suggesting high risk of transmission which could lead to a significant number of fatalities. The Philippines is one of the ASEAN countries with the most number of COVID-19 cases during the time of this study, and a strict community quarantine was implemented in the National Capital Region (NCR) and selected provinces with high number of COVID-19 cases as part of the Philippine government's initial intervention to manage the pandemic. With the need for measures or interventions to control the transmission of the highly contagious COVID-19 in the country, and at the same time manage the impact of the pandemic and the community quarantine on the economy and the social welfare of the community, problem solving through collaboration is essential. Collaborative problem-solving between the different branches and agencies of the government, between the government and private sectors especially with the business groups, and between the government and private individuals should be strong and cohesive. Interestingly, the Inter-Agency Task Force on Emerging Infectious Diseases (IATF-EID), a task force organized by the executive branch of the Philippine government to manage all matters concerning any epidemic in the Philippines, consists of representatives from different government agencies/departments (e.g. Department of Health,

Department of the Interior and Local Government, Department of Labor and Employment). Needless to say, collaborative problem-solving is central to the tasks of the IATF-EID. Thus, while there are many factors that could influence the effectiveness and success of our government's response to the health crisis, the CPS competencies of our national and local leaders could be one critical component to ensure effective solutions are put in place through collaborative problem-solving.

Oliveri et al. (2017) made a literature review on CPS for college and workforce readiness where they provided a brief description of various frameworks of CPS. One is by Stevens and Campion (1994) who identified CPS as one of five transportable teamwork competencies. Another framework is by Oliveri et al. (2017) who proposed their own definition and framework for CPS for higher education readiness. They considered teamwork, communication, leadership, and problem solving the core components of CPS. On the other hand, Hesse et al. (2015) viewed CPS as a complex skill that links collaboration, critical thinking, decision making, and problem solving. Accordingly, there are studies that show CPS can be developed in the classroom. For instance, a study among Vietnamese students (Lien et al., 2018) provided evidence that students' CPS can improve through experiential learning. Still in a study involving Indonesian learners (Suhandri et al., 2019), it was demonstrated that learning CPS models is effective in improving students' problem solving abilities in mathematics.

While CPS can be developed in the classroom, it is a challenge to measure it using typical assessment methods like multiple choice or teacher observation (Harding et al., 2017). The 2017 PISA report on the assessment of CPS (Graesser et al., 2018) revealed that only 8% of all students who took the assessment performed at the highest level of proficiency, whereas 29% of students scored at the lowest level in all participating countries. Female students also had substantially higher CPS proficiencies than male students. Moreover, results suggested that participation in group school activities (e.g. sports, volunteer service

activities) was instrumental in developing CPS skills (Graeeser et al., 2018).

There is no data on Filipino students' performance in CPS as the Philippines did not participate in the 2015 PISA assessment when CPS was the focused innovative area. Nevertheless, given the international recognition of the importance of developing and assessing CPS skills or competencies, it is important to review the extent to which the current Philippines basic education curriculum considers CPS as an important competency or learning outcome. Determining the extent of alignment of PISA competencies like CPS with the current Philippine Kto12 Basic Education Curriculum can inform Philippine school leaders on how aligned the curriculum is with international standards. Given the relative recency of the current curriculum, identifying gaps in alignment can inform the Philippine government and relevant agencies on how to improve the curriculum to meet international standards while considering the contexts of Filipino learners. Furthermore, the present study can contribute in assessing the status of the Philippine basic education curriculum in particular, and Philippine education in general. The results of the study can inform educational leaders and policy makers on the current status of Philippine education in terms of the basic education curriculum. Moreover, a review of literature by the researchers did not yield any published Philippine study on collaborative problem-solving. Hence, the present study is an important step in forwarding research on CPS in the Philippine context.

Statement of the Problem

This study aimed to analyze the extent to which the collaborative problem-solving competencies of the PISA framework are reflected in the Philippine Kto12 Mathematics, Social Studies and Values Education Curricula for Grades 7 to 10. Specifically, it attempted to:

1. determine the degree of integration of the Kto12 competencies in the Mathematics, Social Studies, and Values Education Curricula for Grades 7 to 10 with the PISA Collaborative Problem-Solving (CPS) Framework; and
2. identify the gaps in the Kto12 Curriculum based on the PISA CPS Framework.

Conceptual Framework

The PISA 2015 CPS Framework (OECD, 2017) articulated three collaborative problem-solving competencies: (1) establishing and maintaining shared understanding; (2) taking appropriate action to solve the problem; and (3) establishing and maintaining team organization. These three major competencies are cross-matched with these four individual problem-solving processes: (A) exploring and understanding; (B) representing and formulating; (C) planning and executing; and (D) monitoring and reflecting. Moreover, the PISA 2015 CPS framework describes twelve (12) specific CPS skills as a result of the integration or cross-matching of the four (4) problem-solving processes and three (3) collaborative problem-solving processes. These specific skills define the competencies of the learners in terms of associated actions, processes, and strategies (OECD, 2017, p.137):

A1. Discovering perspectives and abilities of team members
A2. Discovering the type of collaborative interaction to solve the problem, along with goals
A3. Understanding roles to solve the problem

B1. Building a shared representation and negotiating the meaning of the problem (common ground)
B2. Identifying and describing tasks to be completed

B3. Describing roles and team organization (communication protocols/rules of engagement)

C1. Communicating with team members about the actions to be/being performed
C2. Enacting plans
C3. Following rules of engagement (e.g. prompting other team members to perform their tasks)

D1. Monitoring and repairing the shared understanding
D2. Monitoring results of actions and evaluating success in solving the problem
D3. Monitoring, providing feedback and adapting the team organization and rules

The aim of the present study was to determine the extent that the PISA CPS competencies are reflected in the Philippine Kto12 Grades 7 to 10 Mathematics, Social Studies and Values Education Curricula (Department of Education, 2016). Figure 7.1 shows the graphical representation of the conceptual framework of the study.

Figure 7. 1

Conceptual Framework of the Study

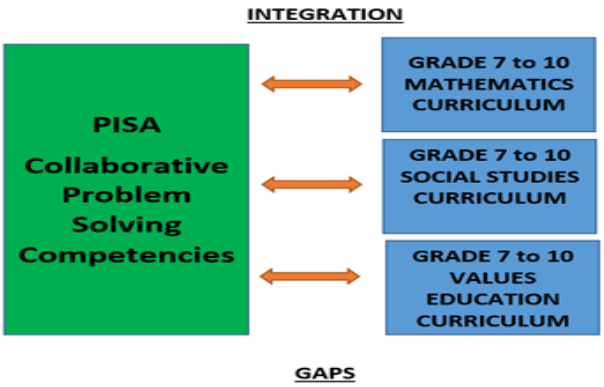


Figure 7.1 illustrates the focus of the study which is to determine the degree of integration of PISA 2015 CPS competencies/skills in the Mathematics, Social Studies, and Values Education (Edukasyon sa Pagpapakatao) Junior High School curricula (Grades 7 to Grade 10). In this study, integration means that a specific CPS skill or competency is explicitly or implicitly present or articulated in the Kto12 Curriculum list of competencies. After determining the integration, gaps in the curricula of the three subject areas were identified.

The study is exploratory and offers no hypothesis or assumption except for the argument that CPS competencies are important 21st century competencies that can be considered in the Philippine Kto12 Curriculum, especially in the three aforementioned subject areas. Since CPS is a 21st century skill and an innovative domain, it is assumed that CPS competencies should be integrated and developed across subject areas. However, the present study only sampled and determined the alignment of the CPS competencies with the three subject areas mentioned. The focus on Mathematics is due to its emphasis on problem-solving as a core competency that is developed and assessed among students. On the other hand, the focus on Social Studies and Values Education is based on the assumption that these two subject areas give emphasis on social or interpersonal relations where collaboration can be an important construct. Thus, it will be interesting to determine the extent to which problem-solving through collaboration is reflected in the Mathematics, Social Studies, and Values Education Curricula.

METHODOLOGY

The study is a qualitative investigation of curriculum documents to determine the degree of integration of the PISA competencies with the Philippine Kto12 Curriculum as input to the improvement of the quality of basic education in the country to ensure that Filipino learners become globally competitive. The two researchers are content specialists in

Social Studies and Values Education and have published empirical studies on Mathematics Education, Values Education, Social Sciences, and Curriculum. Through document analysis, the competencies in Mathematics, Social Studies, and Values Education for Grades 7 to 10 reflected in the Kto12 Curriculum Guide of the Department of Education (Department of Education, 2016a, 2016b, 2016c) were heat mapped against the 12 CPS skills indicated in the PISA CPS framework. Grade levels 7 to 10 are expected to cover the PISA competencies since the test was intended for 15-year old students. Degree of integration was assessed through coding to find out whether each of the 12 CPS competencies are present or not in the Kto12 Curriculum. To determine if a CPS competency is present, the competencies in the curriculum were reviewed if they articulate or are reflective of any of the 12 PISA CPS competencies. If present, it was determined and coded as to whether the integration is explicit or implied only. A CPS competency was deemed explicit (Exp) if it is directly stated in one or more Kto12 curriculum competencies. A CPS competency was deemed implicit (Imp) or implied if it was not directly stated, but can be realized in the classroom if contextualization of the competencies will be done by the teachers. The two researchers worked independently in reviewing the degree of integration and in performing the coding. Then comparison of the researchers' independent findings followed, and a consensus was arrived at on the final coding after a thorough discussion. Frequency counts and equivalent percentages of the coding were considered in the analysis of data according to categories (explicit or implicit) in each grade level for each of the three subject areas.

RESULTS AND DISCUSSION

Degree of Integration of the PISA CPS Framework with the Kto12 Mathematics, Social Studies and Values Education Curricula

The results of the analysis of the PISA framework on collaborative problem-solving vis-à-vis the competencies in the Kto12 Mathematics, Social Studies and Values Education Curricula for Grades 7 to 10 are presented in the succeeding tables. The heat mapping of the PISA CPS competencies for each grade level is categorized into two: competencies that are explicitly stated or covered by the curriculum (Exp), and the other category refers to the competencies that are implicitly stated (Imp).

Table 7.1 presents the summary results of the mapping of PISA collaborative problem solving competencies vis-à-vis the competencies in the Mathematics curriculum for Grades 7 to 10. Highlighted in Table 1 are the only two CPS competencies (17%) covered in the Kto12 Mathematics Curriculum (coded as A2 and B2). B2 which refers to *identifying and describing tasks to be completed* is highly integrated in the Mathematics Curriculum and explicitly stated across all levels (Grade 7 to 10) as reflected in the 32 identified competencies that were found to be aligned. This is expected given that problem-solving is a central competency in high school mathematics. However, it is important to note that the 32 identified competencies across all levels do not explicitly describe or include problem solving through collaboration as a competency. Meanwhile, only two competencies were identified to be aligned with A2 *(Discovering the type of collaborative interaction to solve the problem, along with goals)*, indicating the lack of emphasis on problem solving through collaboration in the Mathematics Curriculum. Overall, only 34 competencies in the Mathematics Curriculum are aligned with the CPS competencies in the 2015 PISA framework. The percentage

of CPS competencies integrated is equally distributed in all year levels - 23.53% in Grades 7, 9, 10 and a bit higher in Grade 8 with 29.41%.

Table 7.2 shows the summary results of PISA CPS competencies mapping vis-à-vis the Social Studies Curriculum for Grades 7 to 10. Five CPS competencies (42%) are integrated: *Building a shared representation and negotiating the meaning of the problem (common ground)* (B1); *Communicating with team members about the actions to be/being performed* (C1); *Discovering the type of collaborative interaction to solve the problem, along with goals* (A2); *Identifying and describing tasks to be completed* (B2); and *Enacting plans* (C2). All of the competencies aligned with the CPS competencies are found in the higher grade levels (Grades 9 and 10), and most of them are implicitly stated in the curriculum. Overall, only three CPS competencies are explicitly stated (Grade 9, A2; Grade 10, B2). By percentage, 42.11% of the CPS competencies are implicitly stated in Grades 9 and 10, but lower percentages for explicitly stated competencies in Grade 10 (10.52%) and in Grade 9 (5.26%). Thus, while there are a number of competencies in the Social Studies curriculum that are aligned with the PISA CPS competencies, most of these are only implicitly stated or implied.

Table 7.1

PISA CPS Competencies vis-à-vis the Kto12 Mathematics Curriculum

PISA Framework	Kto12 Curriculum (Code)								
(Code) Collaborative Problem-Solving Competencies	Grade 7		Grade 8		Grade 9		Grade 10		Total
	Exp	Impl	Exp	Imp	Exp	Imp	Exp	Imp	
(A1) Discovering perspectives and abilities of team members	0	0	0	0	0	0	0	0	0
(B1) Building a shared representation and negotiating the meaning of the problem (common ground)	0	0	0	0	0	0	0	0	0
(C1) Communicating with team members about the actions to be/being performed	0	0	0	0	0	0	0	0	0
(D1) Monitoring and repairing the shared understanding	0	0	0	0	0	0	0	0	0
(A2) Discovering the type of collaborative interaction to solve the problem, along with goals	1	0	1	0	0	0	0	0	2
(B2) Identifying and describing tasks to be completed	7	0	9	0	8	0	8	0	32
(C2) Enacting plans	0	0	0	0	0	0	0	0	0
(D2) Monitoring results of actions and evaluating success in solving the problem	0	0	0	0	0	0	0	0	0
(A3) Understanding roles to solve the problem	0	0	0	0	0	0	0	0	0
(B3) Describing roles and team organization (communication protocols/ rules of engagement)	0	0	0	0	0	0	0	0	0
(C3) Following rules of engagement (e.g. prompting other team members to perform their tasks)	0	0	0	0	0	0	0	0	0
(D3) Monitoring, providing feedback and adapting the team organization and roles	0	0	0	0	0	0	0	0	0
N	8	0	10	0	8	0	8	0	34
Percentage of Competencies covered	23.5	0	29.41	0	23.53		23.53		100%

n = indicates the no. of competencies in the K-12 Mathematics Curriculum aligned with the PISA competencies

Table 7.2

PISA CPS Competencies vis-à-vis the Kto12 Social Studies Curriculum

PISA Framework	Kto12 Curriculum (Code)								
(Code) Collaborative Problem-Solving Competencies	Grade 7		Grade 8		Grade 9		Grade 10		Total
	Exp	Imp	Exp	Imp	Exp	Imp	Exp	Imp	
(A1) Discovering perspectives and abilities members	0	0	0	0	0	0	0	0	0
(B1) Building a shared representation and negotiating the meaning of the problem (common ground)	0	0	0	0	0	1	0	0	1
(C1) Communicating with team members about the actions to be/being performed	0	0	0	0	0	2	0	4	6
(D1) Monitoring and repairing the shared understanding	0	0	0	0	0	0	0	0	0
(A2) Discovering the type of collaborative interaction to solve the problem, along with goals	0	0	0	0	1	0	0	0	1
(B2) Identifying and describing tasks to be completed	0	0	0	0	0	4	2	3	9
(C2) Enacting plans	0	0	0	0	0	1	0	1	2
(D2) Monitoring results of actions and evaluating success in solving the problem	0	0	0	0	0	0	0	0	0
(A3) Understanding roles to solve the problem	0	0	0	0	0	0	0	0	0
(B3) Describing roles and team organization (communication protocols /rules of engagement)	0	0	0	0	0	0	0	0	0
(C3) Following rules of engagement,(e.g. prompting other team members to perform their tasks)	0	0	0	0	0	0	0	0	0
(D3) Monitoring, providing feedback and adapting the team organization and roles	0	0	0	0	0	0	0	0	0
N	0	0	0	0	1	8	2	8	19
Percentage of Competencies Covered					5.26	42.11	10.52	42.11	100%

n = indicates the no. of competencies in the K-12 Social Studies Curriculum aligned with the PISA competencies

Table 7.3

PISA CPS Competencies vis-à-vis the Kto12 Values Education Curriculum

PISA Framework	Kto12 Curriculum (Code)								
(Code) Collaborative Problem-Solving Competencies	Grade 7 N=25		Grade 8 N=24		Grade 9 N=15		Grade 10 N=11		Total
	Exp	Imp	Exp	Imp	Exp	Imp	Exp	Imp	
(A1) Discovering perspectives and abilities of team members	0	7	0	9	0	3	0	0	19
(B1) Building a shared representation and negotiating the meaning of the problem (common ground)	0	0	1	0	1	0	2	0	4
(C1) Communicating with team members about the actions to be/being performed	0	0	1	0	1	0	0	0	2
(D1) Monitoring and repairing the shared understanding	0	0	0	0	0	0	0	0	0
(A2) Discovering the type of collaborative interaction to solve the problem, along with goals	0	0	0	0	0	0	0	0	0
(B2) Identifying and describing tasks to be com	0	0	0	0	0	0	0	0	0
(C2) Enacting plans	0	18	0	13	0	10	0	9	50
(D2) Monitoring results of actions and evaluating success in solving the problem	0	0	0	0	0	0	0	0	0
(A3) Understanding roles to solve the problem	0	0	0	0	0	0	0	0	0
(B3) Describing roles and team organization (communication protocols /rules of engagement)	0	0	0	0	0	0	0	0	0
(C3) Following rules of engagement,(e.g. prompting other team members to perform their tasks)	0	0	0	0	0	0	0	0	0
(D3) Monitoring, providing feedback and adapting the team organization and roles	0	0	0	0	0	0	0	0	0
N	0	25	2	22	2	13	2	9	75
Percentage of Covered Competencies		33.33	2.67	29.33	2.67	17.33	2.67	12.00	100%

n = indicates the no. of competencies in the K-12 Values Education Curriculum aligned with the PISA competencies

Table 7.3 shows the summary results for the Values Education Curriculum which indicate that it has the most number of competencies aligned with the PISA CPS competencies as compared with the Social

Studies and Mathematics Curricula. However, only four CPS competencies (33%) are integrated: *Discovering perspectives and abilities of team members* (A1); *Building a shared representation and negotiating the meaning of the problem (common ground)* (B1); and *Communicating with team members about the actions to be/being performed* (C1). These competencies are integrated in all the grade levels (Grades 7, 8, 9, 10) although no CPS competency is explicitly integrated with the competencies in Grade 7. There are at least two (2.67%) competencies in each of the other three grade levels (Grade 8-10) that are explicitly integrated. Most of the competencies integrated are implicitly stated and in descending order: 25 (33.33%) for Grade 7, 22 (29.33%) for Grade 8, 13 (17.33%) for Grade 9, and 9 (12%) for Grade 10. Notably, the highest frequency of integration for CPS competency was on *enacting plans* (C2, n=50) which is implicitly stated and in descending order from Grade 7 to Grade 10.

Table 7.4 and Figure 7.2 present the summary of the analysis of the degree of integration of the PISA collaborative problem solving (CPS) competencies in the Philippine Kto12 Mathematics, Social Studies and Values Education Curricula. Values Education has the most competencies aligned with CPS, followed by Mathematics, and the last is Social Studies which shows the least alignment. Overall, only six (50%) out of 12 CPS competencies are integrated across the three subject areas (i.e. A1, B1, C1, A2, B2, and C2). Although these PISA CPS competencies are reflected in the three subjects, most of the competencies are only implicitly stated or implied. Only the Mathematics curriculum has the most CPS competencies that are stated explicitly. Most of the Kto12 competencies covered are only in the collaborative problem-solving process on *establishing and maintaining shared understanding,* and at least two major competencies fall under the collaborative problem-solving process on *taking appropriate action to solve the* problem, particularly in the Values Education Curriculum.

Table 7.4

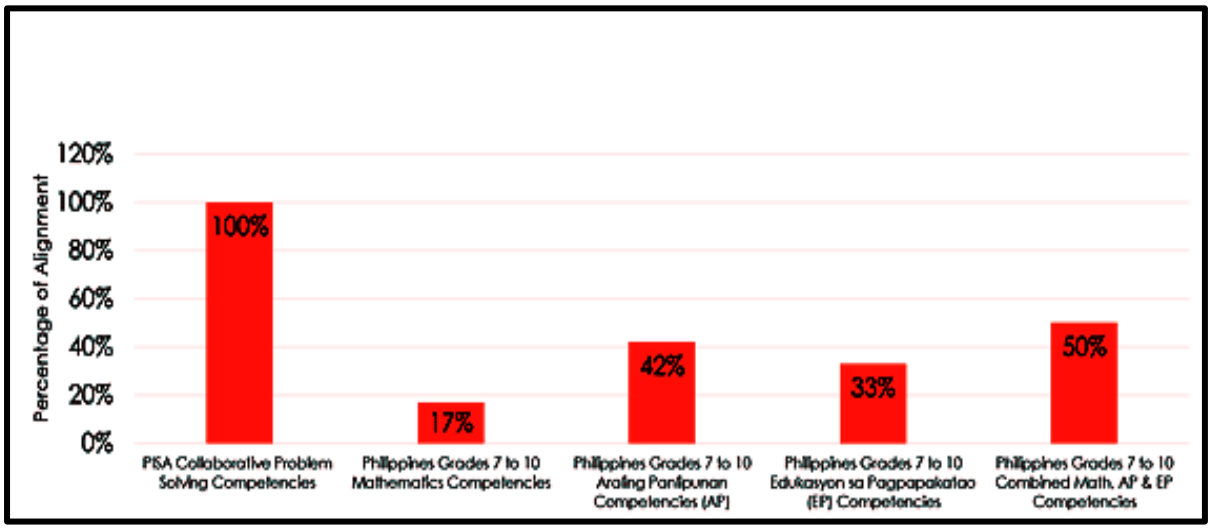
PISA Summary of CPS Competencies vis-à-vis the Kto12 Math, SS, and VE Curricula

PISA Framework	Kto12 Curriculum (Code)							
(Code) Collaborative Problem-Solving Competencies	Math N=34		Social Studies N=19		Values Ed. N=75		Total N=128	
	Exp	Imp	Exp	Imp	Exp	Imp	Exp	Imp
(A1) Discovering perspectives and abilities of team members	0	0	0	0	0	19	0	19
(B1) Building a shared representation and negotiating the meaning of the problem (common ground)	0	0	0	1	4	0	4	1
(C1) Communicating with team members about the actions to be/being performed	0	0	0	6	2	0	2	6
(D1) Monitoring and repairing the shared understanding	0	0	0	0	0	0	0	0
(A2) Discovering the type of collaborative interaction to solve the problem, along with goals	2	0	1	0	0	0	3	0
(B2) Identifying and describing tasks to be completed	32	0	2	7	0	0	2	39
(C2) Enacting plans	0	0	0	2	0	50	0	52
(D2) Monitoring results of actions and evaluating success in solving the problem	0	0	0	0	0	0	0	0
(A3) Understanding roles to solve the problem	0	0	0	0	0	0	0	0
(B3) Describing roles and team organization (communication protocols/rules of engagement)	0	0	0	0	0	0	0	0
(C3) Following rules of engagement,(e.g. prompting other team members to perform their tasks)	0	0	0	0	0	0	0	0
(D3) Monitoring, providing feedback and adapting the team organization and roles	0	0	0	0	0	0	0	0
N	34	0	3	16	6	69	11	117
Percentage of Covered Competencies	26.56		14.84		58.59		100%	

n = indicates the no. of competencies in the Kto12 Curriculum aligned with the PISA CPS competencies

Figure 7.2

Percentage of PISA CPS Competencies Mapped with the Kto12 Math, SS, and VE Curricula Competencies



In the analysis of the Kto12 competencies in the three subject areas, the totality of the competencies covered suggests limited alignment or integration with the PISA Framework on collaborative problem-solving. The problem-solving processes on *planning and implementing* and *monitoring and evaluating* within the context of collaboration are not even integrated in the competencies in Grades 7 to 10 for the three curricular programs. The following are the specific CPS competencies that were found to be not integrated with any of the competencies across all the three curricula: *monitoring and repairing the shared understanding*, *monitoring results of actions, evaluating success in solving the problem*, *understanding roles to solve the problem*, *describing roles and team organization (communication protocols/rules of engagement), following rules of engagement*, and *monitoring, providing feedback* and *adapting the team organization and roles*.

Gaps in the Kto12 Mathematics, Social Studies and Values Education Curricula based on the PISA CPS Framework

As observed from the key results in the analysis of the degree of attainment of the CPS competencies in the PISA Framework vis-a-vis the Kto12 Curriculum in Mathematics, Social Studies and Values Education for Grades 7 to 10, three major gaps were identified.

First, there is limited integration of the PISA CPS competencies with those in the three curricula examined, but more so in the Mathematics and Social Science curricula. This lack of integration is even more pronounced in terms of the problem-solving competencies on *planning and executing* and *monitoring and evaluating*. This gap seems to suggest that the Kto12 Curriculum for each subject area examined in this study was not designed to develop CPS competencies, even in Mathematics where problem solving is a central competency. While it is possible that the CPS competencies not covered in the Mathematics, Social Studies, and Values Education curricula are integrated in other Grade 7 to 10 subjects, the results suggest that problem solving by collaboration is not emphasized in these three subject areas.

Second, competencies in the Grade 7 to 10 Mathematics, Social Studies, and Values Education Curricula are focused more on individual problem-solving competencies rather than on problem solving through collaboration which the PISA CPS competencies emphasize. It is plausible that a similar trend will be found in the alignment of the PISA CPS competencies with those in the other subject areas in Grades 7 to 10. To confirm or disconfirm this assumption, the integration of the CPS competencies with those in the Kto12 Curriculum in the other subject areas (e.g. English, Science) should also be examined.

Third, the competencies in all of the three subjects reviewed do not have direct instruction on collaborative problem-solving as content.

While it is expected that CPS is an innovation area and a 21st century competency that is supposed to be developed across subjects, it seems important to at least review the possibility of integrating CPS as content in Values Education (Edukasyon sa Pagpapakatao).

All three gaps are critical given the importance of CPS competencies in the world of work (De Boeck & Scalise, 2019; Graesser et al., 2018; Yuan et al., 2019). For the Mathematics Curriculum, the competencies are mainly on problem-solving, but not necessarily on collaborative problem-solving. For both the Social Studies and Values Education Curricula, competencies are either on collaboration only or on problem-solving only, and even these are only implied or implicitly stated.

Recently, the Department of Education compressed the Kto12 Curriculum to the most essential learning competencies (MELCs) as a response to the impact of the COVID-19 pandemic to the education sector, where schools are forced to adopt remote teaching and learning as the pandemic continued to be a threat to the health and safety of teachers and learners. A quick review of the MELCs for Grade 7 to 10 Mathematics, Social Science, and Values Education (Edukasyon sa Pagpapakatao) Curricula indicates that only about half of the competencies from the original Kto12 competencies as reflected in the DepEd Curriculum Guide were retained. Obviously, it is probable that this will lead to even less alignment of the PISA CPS competencies with the Kto12 competencies in the Grades 7 to 10 Mathematics, Social Studies, and Values Education Curricula.

The identified gaps highlight that the CPS is a special set of skills that may not be explicitly covered in the Kto12 Curriculum, but nevertheless it is important to develop this among the Filipino learners. This is especially true given the literature indicating that CPS can be developed in the classroom (Lien et al., 2018; Suhandri et al., 2019). Indeed, it is either the CPS competencies are not viewed as essential

competencies, or it is a relatively recent set of competencies that has yet to be considered in the country's basic education curriculum. The latter could be a more plausible explanation for the lack of CPS competencies in the current curriculum, especially that CPS is an innovative domain, and PISA only introduced this in 2015.

CONCLUSIONS AND RECOMMENDATIONS

The results of the analyses made on the Philippine Kto12 Curriculum and the PISA 2015 CPS Framework informed the following conclusions and recommendations.

First, the Kto12 Curriculum of the Philippines was not designed to purposely address the development and assessment of collaborative problem-solving skills or competencies. While certain PISA CPS competencies are integrated with a number of competencies in the Kto12 Mathematics, Social Science, and Values Education Curricula, they are more implied or implicit; and those that are explicit are mainly on problem solving only or collaboration only, but not really on collaborative problem-solving the way the PISA framework defines CPS. While the MELCs will be used for the incoming school year due to the need for a more compressed curriculum in light of the COVID-19 pandemic, it was also a product of the need to decongest the curriculum in terms of the competencies and content covered. Hence, it is likely that a more compressed curriculum will be adopted in the future and beyond the COVID-19 pandemic. Curriculum review and update is one of the four pillars of aggressive reforms for quality of the Department of Education. The question now is whether or not CPS is an essential competency that should be considered in the basic education curriculum.

If we will use the PISA CPS Framework and the related literature as bases for introducing CPS in the basic education curriculum, it should be regarded as a critical 21st century skill needed by Filipino learners. This will not only ensure success in the future performance of Filipino

students in PISA, but it will also help our basic education curriculum to be at par with international standards. Moreover, the Filipino graduates will acquire the competencies required to work collaboratively with other people in addressing problems that require effective and efficient solutions. This is especially true for problems that necessitate collaborative problem-solving in a team or in an organization. In addition, CPS competencies are very important skills that national and local leaders in government and private sectors should demonstrate, especially during national emergencies that require critical decisions and actions as we have experienced in this time of the COVID-19 pandemic. Thus, a stronger or more explicit emphasis on developing CPS in the basic education curriculum may go a long way in preparing Filipino learners who will be our future leaders to address national or global crises. In future reviews of the Kto12 Curriculum, including the current MELCs, the Department of Education may at least consider the possibility of articulating CPS competencies more explicitly. Perhaps, it can start by reviewing if CPS can be considered or targeted explicitly in the Values Education curriculum and how this can be done. In addition, integration of CPS can be considered also in other subjects.

Second, collaborative problem-solving as content is absent in the Mathematics, Social Science, and Values Education curricula. While it is acceptable that CPS as content is not articulated in various subjects, it seems important to include it first and foremost in the Values Education Curriculum where affective learning outcomes are central as both content and competencies. Hence, in reviewing the Values Education Curriculum, the Department of Education may study the possibility of embedding CPS as content in various grade levels. Indeed, valuing collaboration and teamwork provides the grounding for the development and use of CPS in situations or problems that require it. And this seems to be true even in problems that are national or global in nature (e.g. national security, COVID-19 pandemic, national disasters).

Considering the foregoing conclusions and recommendations, it is further recommended that high school teachers be encouraged to actually take the initiative in facilitating the development of CPS competencies even without these competencies being explicit or evident in the curriculum. This can be done by facilitating students' learning using collaborative problem-solving activities whenever appropriate. Using CPS-oriented instruction can actually be done even in subjects other than the three subjects reviewed here. Therefore, improving teachers' pedagogical skills in facilitating students' learning of CPS can be one of the programs in the Department of Education's *Sulong Edukalidad Program*. Teachers can be trained on the different CPS competencies alongside being trained on pedagogical strategies for developing CPS among learners. Teacher Education Institutions (TEIs), like the Philippine Normal University (PNU) as the National Center for Teacher Education, may take the lead in providing training to in-service teachers on how they can facilitate the development and assessment of CPS competencies. Such initiative is also consistent with the Department of Education's quest for quality education through teachers' upskilling and reskilling and through various professional development programs on 21st century knowledge and skills.

In terms of recommendations for future research, it is important to determine the alignment of PISA CPS competencies with the competencies in the other subject areas not examined in the present study. It may also be important to examine how CPS is learned and assessed in Philippine higher education curricula. Further, it may also be important for future researchers to investigate how CPS competencies are explicitly or implicitly articulated in specific higher education curricular programs, including teacher education.

The present study ends with a call for action among relevant stakeholders to consider the importance of collaborative problem-solving competencies and its critical role in work performance and development

of our society. Curriculum review and updating can be one path to achieve this, but it is certainly not the only path.

REFERENCES

Benvenuto, D., et al. (2020). The global spread of 2019-nCoV: A molecular evolutionary analysis. *Pathogens and Global Health, 114* (2), 64-67. https://doi.org/10.1080/20477724.2020.1725339.

Care, E. (2018). Assessment in the Philippines formal educational system. In C. Magno, & A. David (Eds.), *Philippines and Global Perspectives on Educational Assessment* (pp. 30-52). PEMEA.

Cheung, K., Mak, S., Sit, P., & Ieong, M. (2018). Why Macao is commended as an economy of high-performance and high-equity amongst PISA 2015 participating economies? An explanation from an insider perspective. In C. Magno, & A. David (Eds.), *Philippines and Global Perspectives on Educational Assessment* (pp. 53-75). PEMEA.

Columbus, C., Brust, K., & Arroliga, A. (2020). 2019 coronavirus: An emerging global threat. *Baylor University Medical Center Proceedings*, *33* (2), 209-212. https://doi.org/10.1080/08998280.2020.1731272.

De Boeck, P., & Scalise, K. (2019). Collaborative problem solving: Processing actions, time, and performance. *Frontiers in Psychology*, *10*, 1-8.

Department of Education (2016). *K to 12 Curriculum Guide Grades 1 to 10 Subjects.* https://www.deped.gov.ph/k-to-12/about/k-to-12-basic-education-curriculum/grade-1-to-10-subjects/

Department of Education (2017). *Policy Guidelines on System Assessment in the K to 12 Basic Education Program (DepEd Oder No. 29, s. 2017).* https://www.deped.gov.ph/2017/06/05/do-29-s-2017-policy-guidelines-on-system-assessment-in-the-k-to-12-basic-education-program/

Department of Education (2019). *PISA 2018 National Report of the Philippines.* https://www.deped.gov.ph/wp-content/uploads/2019/12/PISA-2018-Philippine-National-Report.pdf

Graesser et al., (2018). Advancing the science of collaborative problem solving. *Psychological Science in the Public Interest, 19* (2), 59-92.

Harding, S., Griffin, P., Awwal, N., Alom, BM., & Scoular, C. (2017). Measuring collaborative problem solving using mathematics based-tasks. *AERA Open, 3* (3), 1-19.

Hasse, F., Care, E., Buder, J., Sassenberg, K., & Griffin, P. (2015). A framework for teachable collaborative problem solving skills. In P. Griffin, & E. Care (Eds.), *Assessment and Teaching of 21st Century Skills*. Educational Assessment in an Information Age. Springer.

Hopfenbeck, T., Lenkeit, J., El Masri, Y., Cantrell, K., Ryan, J., & Baird, J. (2018). Lessons learned from PISA: A systematic review of peer-reviewed articles on the Programme for International Student Assessment. *Scandinavian Journal of Educational Research, 62* (3), 333-353.

Lien, V., Trang, T., Ninh, T. (2018). Evaluate students' collaborative problem-solving skills through an experiential approach to teach non-metals (A case study in high school of education sciences and viet duc high school in Hanoi, Vietnam). *World Journal of Chemical Education, 6* (4), 190-199.

OECD (2017). "PISA 2015 collaborative problem-solving framework", in *PISA 2015 Assessment and Analytical Framework: Science, Reading, Mathematics, Financial Literacy, and Collaborative Problem Solving*, OECD Publishing, Pans.

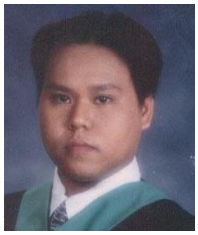
Oliveri, M., Lawless, R., & Molloy, H. (2017). *A literature review on collaborative problem solving for college and work readiness.* (GRE Board Report No. 17-03). Educational Testing Service. http://dx.doi.org/10.1002/ets2.12133

Stevens, M. J., & Campion, M. A. (1994). The knowledge, skills and ability requirements for teamwork: Implications for human resources management. *Journal of Management*, *20*(2), 502–528.

Suhandri, Juandi, D., & Kusumah, YS (2019). Effectiveness of the application of learning models collaborative problem solving against the ability to solve mathematical problems in middle school students. *Journal of Physics: Conference Series, 1315,* 1-7.

Yuan, J., Xiao, Y., & Liu, H. (2019). Assessment of collaborative problem solving based on process stream data: A new paradigm for extracting indicators and modeling dyad data. *Frontiers in Psychology, 10,* 1-14.

About the Authors



Dr. Adonis P. David is Full Professor of Psychology and Director of the Educational Policy Research and Development Center (EPRDC) of the Philippine Normal University (PNU). Prior to his current position, he served as Associate Dean of the Graduate Teacher Education Faculty (GTEF) and Director of the Graduate Research Office (GResO) in PNU. He is a registered guidance counselor and Fellow of the Philippine Educational Measurement and Evaluation Association (PEMEA). His current research interests center on the interplay of cognitive and motivation variables in shaping learners' academic and adjustment outcomes. He holds a PhD in Educational Psychology from De La Salle University.

Dr. Wilma S. Reyes is currently a Professor of Curriculum and Instruction and Values Education at the Faculty of Behavioral and Social Sciences (FBeSS) and College of Graduate Studies and Teacher Education Research (CGSTER) and formerly Vice President for Research, Planning and Quality Assurance of the Philippine Normal University. She finished her Doctorate Degree in Education (Curriculum and Instruction) and Master's Degree in Education by Research at Flinders University through the Australian Scholarship Awards. Her Master's degree in Values Education was obtained from the Philippine Normal University. Her research interests are in the fields of Values Education, Curriculum and Instruction, Pedagogy and Multicultural Education.