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Basic Education Curriculum under the Newly Implemented K to 10 (MATATAG) Curriculum in the Philippines: The Case of Science Education

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ABSTRACT

Curriculum reform is essential to address the current needs of the community, nation, and global demands. By doing this, community members are equipped with relevant skills and competencies that are timely and relevant in modern times. Thus, this study was conducted to determine the nature of the newly implemented K to 10 or MATATAG curriculum under basic education-science in the Philippines. Discussion of the topic revolves around understanding the reasons for curriculum reform and determining the new features and competencies of the new basic education-science curriculum. Moreover, document analysis was carried out to address the objectives of the study. Results revealed that there are four main reasons why curriculum reform is needed in basic education in the country. Reasons include poor performance of learners in national and international assessments, congested curriculum, insufficient time to teach, and mismatch of prerequisite skills and knowledge assumed by the learning competencies. In terms of new features of the basic education science curriculum, the addition of technology and engineering literacy is highlighted, along with an addition of theoretical foundations and approaches to teaching. The analysis further revealed that the highlighted competencies are aligned with the relevant skills and competencies needed in the 21st century, Industry 4.0 and Industry 5.0. Thus, it can be concluded that the newly implemented basic education science curriculum is responsive to global demand, thus making the country more resilient and adaptive to change.

INTRODUCTION

The education curriculum is dynamic and responsive to the needs of the community and states. Young (2014) states that curriculum is a social fact; its purpose is to create possibilities for the betterment of the community. Moreover, curriculum reform is crucial since society is dynamic (Campbel, 2020; Reis, 2018). Changes in the components of society can profoundly affect the members of the state (Newman, 2005; Snooks, 2002). Therefore, updating the community members' skills and competencies is crucial for sustainable development within the locality, states, and the globe (Jacobs, 2010). However, it is also crucial to understand the current and future needs of the community before implementing curriculum reform (Gouëdard *et al.*, 2020). Thus, this study was created to uncover the purpose of the recent curriculum reform in the Philippine basic education system under the science curriculum and how this reform addresses the modern demands of the workforce.

Evidence of curriculum reform in basic education shows a dynamic and rigorous process. This is conducted to ensure that the developed curriculum is responsive to the needs of society (Pate *et al.*, 2001) without compromising future demands (Vreuls *et al.*, 2022). Although implementing the new curriculum is challenging primarily due to adjustments by different groups (e.g., teachers, administrators, stakeholders, learners, etc.…) (Assunção Flores, 2005; Bennie & Newstead, 1999; Nuraeni *et al.*, 2020), this can be overridden with enough training and support on the side of educators and administrators (Echols *et al.*, 2018; LaChausse *et al.*, 2014). In addition, informing the general public regarding the nature of the newly implemented curriculum is also crucial since this diverse group of people will directly benefit from the educational reform (Craig, 2009; Warren, 2005).

The study of Campbel (2020) on curriculum reform in science education indicated how crucial change is in uplifting learners' skills. In addition, Eilks (2015) and Ekamilasari & Pursitasari (2021) acknowledge the importance of science education in transforming the community and ensuring sustainable development. This suggests the crucial role of education institutions in shaping the present and future of the community by creating a sustainable curriculum responsive to the needs of future generations, thus eliminating different forms of discrimination (Gay, 2015; Kieran & Anderson, 2019; Mayfield & Garrison-Wade, 2015). Therefore, ensuring that the curriculum in science education effectively addresses current issues is a must in curriculum reform.

In the Philippines, the former K to 12 curriculum implemented in 2012 offers a major reform in basic education by adding two years in the secondary level (refers to senior high school - Grade 11 and 12). In this curriculum, it is mandated by the state that the senior high school level is also compulsory in the basic education system (Republic of the Philippines, 2013). In addition, another feature of this curriculum is the implementation of the "mother language or regional/native language"

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as part of the instruction in kindergarten and the first three years of elementary education (Republic of the Philippines, 2013). This feature was added to ensure that learners have the best learning using their first language. Aside from that, the curriculum also ensures the delivery of quality education that is responsive to the global market's needs, highlighting the essential learning competencies to produce globally competent individuals. Under the K to 12 curriculum, the science discipline in the enhanced basic education also offers a wider array of opportunities for learners to become globally competent. The science curriculum highlighted the embodiment of scientific, technological, and environmental competency to produce highly competent individuals necessary for sustainable development (Department of Education, 2016). Moreover, to accomplish these goals, the Department of Education released a curriculum guide containing the necessary learning competencies and other crucial information to effectively deliver the science discipline in the newly implemented curriculum (Department of Education, 2016). In the said document, various approaches are also given for educators to effectively carry out the curriculum and cater to the needs of learners.

However, despite the preparation and proper implementation made by the Philippine government to uplift the standards of science education in the country, still the country has achieved a low performance in scientific literacy. This assumption is based on various assessments conducted in the country, such as the Programme for International Student Assessment (PISA) 2018 results (taken by 15-year-olds) by the Organization for Economic Cooperation (OECD), wherein the Philippines scored 357 in science, which scored below the average performance of all participating countries (OECD, 2019). A follow-up test result of PISA 2022 has yielded a score of 373 in science (OECD, 2023), gaining a minimal increase from the PISA 2018 result. In addition, the result of the Trends in Mathematics and Science Study (TIMSS) in 2019 conducted on Grade 4 learners by the International Association for the Evaluation of Educational Achievement (IEA) resulted in a 247 score in science (low performance) (Mullis *et al.*, 2020).

The findings of the international assessments on basic education scientific concepts among learners in the country served as baseline data on how to approach science education. Local studies have also expressed concerns regarding the status of science education and learners in the country, such as the study of Bernardo *et al.* (2023) and De La Cruz (2022). The findings of these studies have recommended what priority areas should be considered and needed to be integrated into science education in the country to achieve desirable outcomes (e.g., the role of Industry 4.0, personal and contextual learning, etc.). Thus, with the outgoing K to 12 Curriculum, it is very crucial to understand the critical issues that the former curriculum has and use these issues as a stepping stone in creating a new curriculum that is responsive to the needs of society.

On January 30, 2023, the Vice-President (VP) of the Philippines and former Department of Education (DepEd) Secretary Sara Z. Duterte announced the new curriculum of basic education in the country (Department of Education, 2023b). Following this announcement, DepEd issued DepEd Memorandum No. 054, s 2023, which indicated the pilot implementation of the new curriculum in the country (Department of Education, 2023a). This move by the Department of Education was created to ensure the smooth transition of the new curriculum following its gradual implementation in the School Year (SY) 2024 - 2025.

Thus, following the discussions, this study examined the new MATATAG or K to10 curriculum in basic education in the Philippines, specifically in science education, to uncover how responsive this new curriculum in the modern demands. Specifically, this study aims to address the following questions: (1) What is/are the underlying reason/s for the curriculum reform in the Philippines (MATATAG/ K to 10 Curriculum)?; (2) What are the new features highlighted in the newly implemented MATATAG Science curriculum in the Philippines? and (3) What are the lifelong competencies highlighted in the MATATAG curriculum and its alignment to the global competencies needed in the 21st century, industry 4.0 and industry 5.0?

LITERATURE REVIEW

K to 12 Curriculum in the Philippines

The Republic Act 10533, or the Enhanced Basic Education Act of 2013 was implemented in the Philippines to improve the overall basic education system in the country (Republic of the Philippines, 2013). This curriculum is called the K to12 curriculum following the major reforms in the Department of Education. The new feature of this curriculum is the additional two years in the secondary level, which is referred to as Senior High School (SHS) (Grade 11 and Grade 12), thus allowing learners to choose tracks as their field of expertise (Republic of the Philippines, 2013). Another main feature of this curriculum is the use of a spiral progression approach wherein topics are introduced at the early grade level and then relearned at higher grade levels with varying difficulty of concepts (Tirol, 2022).

In the basic education science under the K to12 curriculum, the discipline of chemistry - matter (1st quarter), living things and their environment (2nd Quarter), Physics - Force, Motion, and Energy (3rd Quarter), and Earth and Space (4th Quarter) were the main components and arranged in the same order in the elementary education (Grade 3 to Grade 6). The same science disciplines were used in the secondary level Junior High School (JHS) (Grade 7 to Grade 10) but were arranged in different orders (Department of Education, 2016). The science curriculum in the SHS differs depending on the learners' chosen track. The science curriculum in elementary and JHS was framed based on the spiral progression

approach, aiming to have the best possible outcomes of scientific learning among learners.

Challenges in the K to 12 Curriculum

Despite the initiatives, the K-12 curriculum in general, has faced several challenges, including learners not attaining the necessary skills and knowledge at the desirable grade level, difficulty in teaching and implementing the intended curriculum by teachers (Robertson, Kheang, *et al.*, 2021; Robertson, Rickards, *et al.*, 2021as cited in Second Congressional Commission on Education, 2023), "teachers are not prepared to deliver the K-12 curriculum specifically in Filipino, Mathematics, and Science in Grades 6, 8, and 10" (Philippine National Research Center for Teacher Quality, 2017 as cited in Second Congressional Commission on Education, 2024), high cognitive demand in learner's side due to high volume of competencies of learned (Department of Education, 2022) to name a few.

However, the above-mentioned challenges are just one of many challenges experienced by the country. The arrival of the COVID-19 pandemic significantly impacted the country, especially in the education sector. Schools are forced to close due to lockdowns implemented by the state to minimize the spread of the virus, and learners are forced to learn using different modalities (modules, online learning, etc...) (UNICEF, 2020). Educators and administrators are forced to adapt to the new learning modalities to deliver instruction despite problems encountered (e.g., ICT problems, preparedness to teach in an online setting, mental health, etc…) (Oducado *et al.*, 2021; Samifanni & Gumanit, 2021; Tria, 2020). This new learning modality has impacted the education sector, and the issue of "learning gaps among learners" arises in the Philippines and other countries (UNESCO, 2021). These ongoing problems have become the center of attention in the education sector, and various initiatives have been drawn to alleviate these problems.

The K to 10 or MATATAG Curriculum

On August 10, 2023, Former Vice President Sarah Z. Duterte officially announced the launching of a new curriculum to be implemented in the Philippines (Office of the Vice President, 2023). In the announcement, VP Sarah Z. Duterte mentioned that the new curriculum is named the MATATAG Curriculum or K to 10 curriculum, which will now be the heart of basic education under the Department of Education in the country. Under the new curriculum, the MATATAG curriculum has four critical components, these are: (1) MAke the curriculum relevant to produce competent and job-ready, active, and responsible citizens; (2) TAke steps to accelerate delivery of basic education facilities and services; (3) TAke good care of learners by promoting learner well-being, inclusive education, and a positive learning environment; and (4) Give support to teachers to teach better (Bureau of Curriculum Development, n.d.).

Moreover, prior to the full implementation of the curriculum starting SY 2024-2025, the Department of Education released a statement through DepEd Memorandum No. 054, s. 2023 that the Department will conduct a pilot implementation of the said curriculum in different regions in the country (Department of Education, 2023a). Among the selected regions are Regions 1, II, VII, and XII, the CARAGA region, the National Capital Region (NCR), and the Cordillera Administrative Region (CAR). In addition, the new curriculum will be implemented first in Kindergarten, Grades 1, 4, and 7 for the SY 2024-2025, then followed by implementation in Grades 2, 5, and 8 for SY 2025-2026, Grades 3, 6, and 9 for SY 2026-2027, and finally Grade 10 for SY 2027-2028. (Department of Education, 2023a). The Department of Education carried out plans and Preparations to make this curriculum relevant and responsive to local and global demands.

METHODOLOGY

This study employs qualitative research utilizing reviews from literature, documents, and reports from reliable sources. Qualitative research, as mentioned by Busetto *et al.* (2020), is a form of research that deals with studying the nature of phenomena and focuses on the question "why"?. In this study, the researcher aims to uncover the nature of the newly implemented curriculum in the Philippines and provide a new perspective to the global and scientific communities regarding the topic.

Moreover, Busetto *et al.* (2020) added that in this method of inquiry, the most common data collection method is document study, semi-structured interviews, focus group discussions, and observation. Thus, in this study, the researcher used document study as a data collection method to examine the nature of the new curriculum. This selection is based on Karppinen & Moe (2019) that documents (private or public institutions) have rich data and, therefore, are usable. In this study, the researcher used only electronic copies (either from private or public institutions) of documents since these documents are accessible on the databases or posted on the government or private entities' websites (with proper citations).

To ensure the reliability of the study, the researcher followed several protocols in including documents to be included in the study. These include; (1) the document must be related to curriculum, MATATAG or K to10 curriculum, emerging competencies, 21st century, industry 4.0, and industry 5.0; and (2) the document must be either published in a peer-reviewed journal (for article), government documents, private industries reports and reports from reliable media sources (blogs, commentaries, and social media posts are not included). These criteria ensure that this study undergoes a rigorous process, thus ensuring that the textual data obtained are reliable.

Moreover, the following procedures were carried out in this study: (1) the researcher developed the objectives of the study and wrote the background of the study; (2) the researcher then curated existing documents on the main

topic of the study, which is the MATATAG curriculum. In this stage, the researcher carefully plans how to extract the necessary documents based on Bowen's (2009) evidence evaluation suggestion. These include listing all the necessary documents to be included based on the keywords, examining the authenticity of the documents based on the inclusion criteria, and finally, evaluating the overall relevance of the documents to the study. (3) After gathering the necessary documents, the researcher then reads the document thoroughly and takes notes on the crucial information based on the study's objectives; and (4) finally the researcher then writes the findings of the study.

Further, this study uses document analysis to analyze the gathered documents. The researcher followed the suggestion of Bowen (2009) in analyzing documents. These include skimming (superficial examination), reading (through examination), and interpretation. In addition, as Bowen (2009) suggested, document analysis can further use content and thematic analysis. Thus, following this suggestion, the researcher uses content analysis as part of the analysis, especially in addressing objective three of the study.

RESULTS AND DISCUSSION

This section discusses the major findings of the study with supporting literature to make the discussion more relevant in different settings:

Reason/s for the Curriculum Reform in the Philippines (MATATAG/K to 10 Curriculum)

After carefully reading the announcement of the Department of Education (DepEd Memorandum No. 054, s. 2023 (Department of Education, 2023), General Shaping Paper (Bureau of Curriculum Development, 2023), VP Sara-Speech (Aug. 10, 2023), and News Reports from national news outlets (Inquirer.net (Abarca, 2023), Manila Bulletin (Hernando-Malipot, 2024) and Philstar Global (Servallos, 2023)) the findings were drawn on the reasons of curriculum reform in the Philippines.

Table 1 shows the reasons for the curriculum reform in the country based on the analyzed documents and reports. Based on the analysis, the reasons are (1) Poor performance of learners in national and international assessments; (2) the Curriculum is congested and needs to decongest; (3) Insufficient time to teach the given competencies of the current curriculum (K-12 curriculum) by the teachers; and (4) Mismatch between prerequisite skills and knowledge assumed by the learning competencies. These reasons allow the Department of Education to revisit the K to12 curriculum and create a new curriculum that is responsive to the challenges and problems associated with the outgoing curriculum. By doing this, the country can produce competent learners in various fields who are experts, resilient, and adaptive to the current and future global market without compromising the country's development.

Table 1: Reasons for Curriculum Reform in the Philippines

Reason (Statement)	Source
"Poor performance of learners in national and international assessment"	1. VP Sara Speech (Aug. 10, 2023)
	2. General Shaping Paper (Bureau of Curriculum Development, 2023)
"Curriculum is congested and needs to decongest"	1. VP Sara Speech (Aug. 10, 2023)
	2. Inquirer.net (Abarca, 2023)
	3. Manila Bulletin (Hernando-Malipot, 2024)
	4. Philstar Global (Servallos, 2023)
	5. General Shaping Paper (Bureau of Curriculum Development, 2023)
	6. DepEd Memorandum Order. No. 054, s. 2023 (Department of Education, 2023)
"Insufficient time to teach the given competencies of the current curriculum (K-12 curriculum)"	1. VP Sara Speech (Aug. 10, 2023)
	2. General Shaping Paper (Bureau of Curriculum Development, 2023)
"Mismatch between prerequisite skills and knowledge assumed by the learning competencies"	1. General Shaping Paper (Bureau of Curriculum Development, 2023)

New Features in the K to 10 / MATATAG Curriculum (Science)

The Department of Education prepared the new MATATAG or K to10 Curriculum to be responsive to change brought by different factors such as the 21st Century, the rise of Industry 4.0, and the needs of the country and global market. The given science education curriculum under the MATATAG or K to 10 curriculum for Grades 4 and 7 outlines the goals, theoretical, and philosophical foundations behind the new science curriculum (Department of Education, 2024). Based on the MATATAG Curriculum Science Grade 4 and 7 published by the Department of Education (2024), the new science curriculum has new features drawn on the goals of the 2016 Science K to 12 Curriculum. These include (a.) Technology and engineering literacy;

(b.) Articulate expectations of what learners should be capable of doing at each key stage and grade level; and (c.) Developmental sequence of content in consideration of the prior learning of students and the cognitive and language demands of learning new science ideas.

Table 2 shows the comparison of the K to 12 Science Curriculum (Department of Education, 2016) and the K to 10 Science Curriculum (Department of Education, 2024) conceptual framework (except for theories). Based on the comparison, the new curriculum has several improvements to the K to 12 science curriculum framework. The overall goal of the new curriculum has added engineering literacy from technological literacy in the K to 12 curriculum, creating technology and engineering literacy. This new goal expands the application of engineering in modern and future society. The opportunities that this additional goal encompasses the quality of life that is crucial as the world progresses (Wilson-Lopez *et al.*, 2017; Wilson &Lopez & Minichiello, 2017). In addition, according to Hamka *et al.* (2024) embedding technological and engineering literacy can improve students' critical thinking and problem-solving abilities. These findings are also aligned with the 21st-century skills that the Department of Education highlighted in the new curriculum.

Moreover, the K to 10 curriculum adapted the K to 12 curriculum's interrelated content standards and general competencies based on the comparison in Table 2. As mentioned in the MATATAG Curriculum Science Grade 4 and Grade 7, these interrelated content standards are the central features of the science curriculum. In addition, the general competencies are also drawn based on the nature of the interrelated competencies of the new science curriculum. These alignments are designed and organized to promote the overall goal of basic education science under the K to 10 curriculum (Department of Education, 2024).

Table 2: Comparison of K to 12 and K to 10 Science Curriculum Conceptual Framework

Indicators	**K to 12 Science Curriculum Features**	**K to 10 Science Curriculum** New Features
Goal	Scientific, Technological, and Environmental Literacy	Scientific, Environmental, and Technology and Engineering Literacy
Interrelated Content Standards	1. Demonstrating scientific inquiry skills;	1. Performing scientific inquiry skills;
	2. Understanding and applying scientific knowledge;	2. Understanding and applying scientific knowledge;
	3. Developing and demonstrating scientific attitudes and values.	3. Developing and demonstrating scientific attitudes and values.
General Competencies	1. Critical/ Creative problem solver;	1. Critical and creative problem solvers;
	2. Responsible steward of nature;	2. Responsible stewards of nature;
	3. Innovative/Inventive thinker;	3. Innovative/Inventive thinkers;
	4. Informed decision maker;	4. Informed decision makers;
	5. Effective communicator.	5. Effective communicators.
Theoretical Bases	1. Constructivism	1. Constructivism and Experiential Learning
	2. Social Cognition Learning Model	2. Social Cognition Learning Model
	3. Learning Style Theory	3. Brain-based Learning
	4. Brain-based Learning	4. Vygotsky's ZPD
Approaches	1. Multi/Interdisciplinary Approach	1. Inquiry-Based Approach
	2. Science Technology-Society Approach/ Contextual Learning	2. Transdisciplinary Approach
	3. Problem/Issue-Based Learning	3. Science Technology-Society Approach/ Contextual Learning
	4. Inquiry-Based Approach	4. Problem/Issue Design-Based Learning
		5. Application-Led Approach

In terms of the theoretical foundation of the new curriculum, the addition of Constructivism and experiential learning and Vygotsky's ZPD were emphasized. Constructivism and experiential learning highlight the promotion of building meaningful understanding or learning based on the learner's experience in the topics or classroom (Department of Education, 2024). Evidence suggests that by applying these theories in the classroom, learners develop a more positive attitude toward the topics (Matriano, 2020), enhance learning achievements, environmental attitude, efficacy, and problem-solving competence (Cheng *et al.*, 2019). In addition, Vygotsky's ZPD was added to emphasize the role of teachers in molding learners to attain the desired competencies (Department of Education, 2024). Pertaining to this theory, Taber (2020) mentioned that, " capabilities of learners are best judged

in terms of support extended in the teaching context and effective teaching (with scaffolding)".

In terms of the approaches, the transdisciplinary approach (from multidisciplinary approach) and application-led approach are added to the new basic education science curriculum. A transdisciplinary approach is an approach that incorporates many school subjects or topics, allowing learners to be immersed in different situations, thus creating meaningful learning (Chowdhury *et al.*, 2023; Jurgena *et al.*, 2018). The application-led approach focuses on the applications of science concepts from real life, not on the logic of science concepts themselves (Department of Education, 2024). The addition of these new approaches makes basic science education responsive to the call for 21st-century education, creating authentic learning experiences.

Overall, the new basic education science curriculum offers new features that is responsive to the country's needs and global demands. It emphasizes the crucial role of hands-on experiences, experiential learning, and problem-based learning to promote authentic learning experiences. This way, concepts are not just being learned through memorization (rote learning) but rather with a deep understanding of how these concepts can be useful in learners' daily lives. Moreover, the emphasis on scaffolding is also crucial in basic science education, considering the diverse groups of learners. In addition, the new basic education science curriculum is also responsive to the call of 21st-century education and how the competencies can be useful in promoting lifelong learning among learners.

Global Competencies Highlighted in the MATATAG or K to 10 Science Curriculum

The highlighted competencies of the basic education science curriculum under the MATATAG or K to 10 curriculum were supported by different literature based on different philosophical concepts of world transitions, innovations, and current directions. The general competencies that the new curriculum offers in basic education science in the Philippines are (1) critical and creative problem solvers, (2) responsible stewards of nature, (3) innovative thinkers, (4) informed decision makers, and (5) effective communicators. These five general competencies are crucial to attaining the overall goal of the new curriculum, which is Scientific, Technological, and Environmental Literacy. In addition, the Department of Education meticulously planned these competencies, which are aligned with the current and future demands of the workforce (whether belonging to the STEM track or not) to achieve global preparedness among future graduates.

Table 3: MATATAG or K to 10 Competencies and their Alignment to 21st Century, Industry 4.0 and Industry 5.0

No.	Competency	21st Century	Industry 4.0	Industry 5.0
1	Critical and Creative Problem Solvers	(Bao & Koenig, 2019; Binkley *et al.*, 2012; Häkkinen *et al.*, 2017; Hesse *et al.*, 2015; Ince, 2018; Rahman, 2019; Yadav *et al.*, 2016)	(Lee *et al.*, 2018; Schwab, 2017)	(Suganya *et al.*, 2024; Zizic *et al.*, 2022)
2	Responsible Stewards of Nature	(Amundson *et al.*, 2015; Harahap *et al.*, 2020; Mathevet *et al.*, 2018)	(González-Pérez & Ramírez-Montoya, 2022; Schwab, 2017 Liu & Tobias, 2024)	(Ghobakhloo *et al.*, 2022)
3	Innovative/Inventive Thinkers	(Abdullah & Osman, 2010; Guo & Woulfin, 2016; Thornhill-Miller *et al.*, 2023; ŽivkoviĿ, 2016)	(González-Pérez & Ramírez-Montoya, 2022; Schwab, 2017)	(Suganya *et al.*, 2024; Kumar & Kukreja, 2024)
4	Informed Decision Makers	(Jackson & Davis, 200 C.E.; Merad & Trump, 2020; Trilling & Fadel, 2012)	(González-Pérez & Ramírez-Montoya, 2022)	(Adel, 2022; Rinat *et al.*, 2024)
5	Effective Communicators	Binkley *et al.*, 2012; Trilling & Fadel, 2012	(Sisinni *et al.*, 2018; Wollschlaeger *et al.*, 2017)	(Suganya *et al.*, 2024)

The 21st century is a century that began on January 1, 2001 and will continue on December 31, 2100, marking an additional 100 years of Earth's existence. This century is also often called the digital age, wherein many technological innovations were created to make work easier and production faster (Denning, 2022). Though there are many opportunities that this age brings in global supply and demand, but still preparedness and readiness remain a challenge. That is why it is very important to prepare community members in transcending to the 21st century by investing in the relevant skills crucial in this digital age (Trilling & Fadel, 2012).

Industry 4.0 or Fourth Industrial Revolution, is a philosophical concept that highlights the use of intelligent digital technologies in industrial and manufacturing processes for sustainable production (Schwab, 2017). The rise of this concept brings different things, from the use of augmented reality, industrial internet of things, big data analytics, autonomous robots, virtual system integration, and many more, to improving the quality of production

in current society (Schwab, 2017). In addition, another characteristic of Industry 4.0 is the rise of automation, making industries rely on technology in production (Ghobakhloo, 2020). Thus, it is very important for community members to develop skills essential in the age of automation. Moreover, Industry 5.0 is another philosophical concept highlighting the importance of humans working with the technologies (products of technologies) in the modern world (Nahavandi, 2019). In addition, this concept rises because of the emergence of automation brought by the Industry 4.0. With this philosophical concept, personalized results and production processes become efficient with humans and technologies working together. Developing competencies related to Industry 5.0 allows learners to become more adaptive and prepared in handling the challenges and opportunities brought by this philosophical concept.

Furthermore, the new MATATAG or K to 10 curriculum in basic science education offers relevant competencies for graduates to develop attributes crucial in the 21st century, Industry 4.0 and Industry 5.0. This assumption is based on the relevant literature supporting the competencies highlighted in the new curriculum (see Table 3). By investing on these, the Department of Education can produce globally competent and prepared individuals that are adaptive and resilient to change. Thus, it is worth noting that the new curriculum set by the Department of Education is responsive to the current demands in the local, national, and international arena.

CONCLUSION

K to 10 or MATATAG Curriculum in the Philippines is the newly implemented curriculum in the country. The aim of this reform revolved around producing competent learners that is responsive to global demands and resilient and adaptive to change. This reform is crucial for the country, especially since the world is now in the digital era and rapidly changing brought by different innovations and inventions. With this, the Department of Education carefully plans what life-long competencies should be included in the new curriculum in response to the changes in modern society. In the context of science education under the newly implemented curriculum in basic education, it is evident that the competencies are responsive to the call of the 21st - century, Industry 4.0 and Industry 5.0. The general aim of this reform revolves around uplifting the scientific, environmental, technological, and engineering literacy of learners in the country. By focusing on these literacies, the Philippines aims to attain a world-class science education. Although this new basic education science curriculum is still young and may undergo a series of reforms, still this new curriculum offers a promising result that is beneficial to the country in general.

REFERENCES

Abarca, C. (2023). DepEd launches recalibrated K to 10 curriculum, to start in SY 2024-2025. Inquirer.Net. Https://Newsinfo.Inquirer.Net/1814963/Deped-Launches-Recalibrated-k-to-10-Curriculum-to-Start-in-Sy-2024-2025.

Abdullah, M., & Osman, K. (2010). 21st century inventive thinking skills among primary students in Malaysia and Brunei. Procedia - *Social and Behavioral Sciences, 9,* 1646–1651. https://doi.org/10.1016/j.sbspro.2010.12.380

Adel, A. (2022). Future of industry 5.0 in society: human-centric solutions, challenges and prospective research areas. *Journal of Cloud Computing, 11*(1), 40. https://doi.org/10.1186/s13677-022-00314-5

Amundson, R., Berhe, A. A., Hopmans, J. W., Olson, C., Sztein, A. E., & Sparks, D. L. (2015). Soil and human security in the 21st century. *Science, 348*(6235). https://doi.org/10.1126/science.1261071

Assunção Flores, M. (2005). Teachers' views on recent curriculum changes: tensions and challenges. *The Curriculum Journal, 16*(3), 401–413. https://doi.org/10.1080/09585170500256479

Bao, L., & Koenig, K. (2019). Physics education research for 21st century learning. *Disciplinary and Interdisciplinary Science Education Research, 1*(1), 2. https://doi.org/10.1186/s43031-019-0007-8

Bennie, K., & Newstead, K. (1999). Obstacles to Implementing a New Curriculum. In *Proceedings of the National Subject Didactics Symposium ,* 150–157.

Bernardo, A. B. I., Cordel, M. O., Calleja, M. O., Teves, J. M. M., Yap, S. A., & Chua, U. C. (2023). Profiling low-proficiency science students in the Philippines using machine learning. *Humanities and Social Sciences Communications, 10(*1), 192. https://doi.org/10.1057/s41599-023-01705-y

Binkley, M., Erstad, O., Herman, J., Raizen, S., Ripley, M., Miller-Ricci, M., & Rumble, M. (2012). Defining Twenty-First Century Skills. In *Assessment and Teaching of 21st Century Skills* (pp. 17–66). Springer Netherlands. https://doi.org/10.1007/978-94-007-2324-5_2

Bowen, G. A. (2009). Document Analysis as a Qualitative Research Method. *Qualitative Research Journal, 9*(2), 27–40. https://doi.org/10.3316/QRJ0902027

Bureau of Curriculum, D. of E. (n.d.). General Shaping Paper. Https://Www.Deped.Gov.Ph/Wp-Content/Uploads/GENERAL-SHAPING-PAPER-2023.Pdf.

Campbel, S. (2020). Education and Curriculum Reform: The Impact They Have On Learning. Budapest *International Research and Critics in Linguistics and Education (BirLE) Journal, 3*(2), 1074–1082. https://doi.org/10.33258/birle.v3i2.1036

Cheng, S., Hwang, G., & Chen, C. (2019). From reflective observation to active learning: A mobile experiential learning approach for environmental science education. *British Journal of Educational Technology, 50*(5), 2251–2270. https://doi.org/10.1111/bjet.12845

Chowdhury, T. B. M., Holbrook, J., & Rannikmäe, M. (2023). A model conceptualising trans-disciplinarity within school science education based on a systematic literature review. *International Journal of Science*

Education, 1–23. https://doi.org/10.1080/09500693.2023.2281007

Craig, C. J. (2009). Research in the Midst of Organized School Reform: Versions of Teacher Community in Tension. *American Educational Research Journal, 46*(2), 598–619. https://doi.org/10.3102/0002831208330213

De La Cruz, R. J. D. (2022). Science Education in the Philippines (pp. 331–345). https://doi.org/10.1007/978-981-16-6955-2_20

Denning, S. (2022). What Is The Digital Age And What Does It Mean? Forbes. Https://Www.Forbes.Com/Sites/Stevedenning/2022/02/09/What-Is-the-Digital-Age-and-What-Does-It-Mean/.

Department of Education. (2016). K to 12 Curriculum Guide Science (Grade 3 to Grade 10). Https://Www.Deped.Gov.Ph/Wp-Content/Uploads/2019/01/Science-CG_with-Tagged-Sci-Equipment_revised.Pdf.

Department of Education. (2022). DepEd Order No. 024, s. 2022: Adoption of the Basic Education Plan 2030. Https://Www.Deped.Gov.Ph/Wp-Content/Uploads/2022/05/DO_s2022_024.Pdf.

Department of Education. (2023a). DepEd Memorandum No. 054, s. 2023 (Pilot Implementation of the MATATAG Curriculum). Https://Www.Deped.Gov.Ph/Wp-Content/Uploads/DM_s2023_054.Pdf.

Department of Education. (2023b). MATATAG: DepEd's new agenda to resolve basic education woes. Https://Www.Deped.Gov.Ph/2023/01/30/Matatag-Depeds-New-Agenda-to-Resolve-Basic-Education-Woes/.

Department of Education. (2024). MATATAG Curriculum Science Grades 4 and 7. Republic of the Philippines, Department of Education. Https://Www.Deped.Gov.Ph/Wp-Content/Uploads/MATATAG-Science-CG-Grade-4-and-7.Pdf.

Echols, D. G., Neely, P. W., & Dusick, D. (2018). Understanding faculty training in competency-based curriculum development. *The Journal of Competency-Based Education, 3*(2). https://doi.org/10.1002/cbe2.1162

Eilks, I. (2015). Science Education and Education for Sustainable Development – Justifications, Models, Practices and Perspectives. *EURASIA Journal of Mathematics, Science and Technology Education, 11*(1). https://doi.org/10.12973/eurasia.2015.1313a

Ekamilasari, E., & Pursitasari, I. D. (2021). Students' Critical Thinking Skills and Sustainability Awareness in Science Learning for Implementation Education for Sustainable Development. *Indonesian Journal of Multidiciplinary Research, 1*(1), 121–124. https://doi.org/10.17509/ijomr.v1i1.33792

Gay, G. (2015). The what, why, and how of culturally responsive teaching: international mandates, challenges, and opportunities. *Multicultural Education Review, 7*(3), 123–139. https://doi.org/10.1080/2005615X.2015.1072079

Ghobakhloo, M. (2020). Industry 4.0, digitization, and opportunities for sustainability. *Journal of Cleaner Production*, 252, 119869. https://doi.org/10.1016/j.jclepro.2019.119869

Ghobakhloo, M., Iranmanesh, M., Mubarak, M. F., Mubarik, M., Rejeb, A., & Nilashi, M. (2022). Identifying industry 5.0 contributions to sustainable development: A strategy roadmap for delivering sustainability values. *Sustainable Production and Consumption, 33,* 716–737. https://doi.org/10.1016/j.spc.2022.08.003

González-Pérez, L. I., & Ramírez-Montoya, M. S. (2022). Components of Education 4.0 in 21st Century Skills Frameworks: Systematic Review. *Sustainability, 14*(3), 1493. https://doi.org/10.3390/su14031493

Gouëdard, P., Pont, B., Hyttinen, S., & Huang, P. (2020). Curriculum reform: A literature review to support effective implementation.

Guo, J., & Woulfin, S. (2016). Twenty-First Century Creativity: An Investigation of How the Partnership for 21st Century Instructional Framework Reflects the Principles of Creativity. *Roeper Review, 38*(3), 153–161. https://doi.org/10.1080/02783193.2016.1183741

Häkkinen, P., Järvelä, S., Mäkitalo-Siegl, K., Ahonen, A., Näykki, P., & Valtonen, T. (2017). Preparing teacher-students for twenty-first-century learning practices (PREP 21): a framework for enhancing collaborative problem-solving and strategic learning skills. *Teachers and Teaching, 23*(1), 25–41. https://doi.org/10.1080/13540602.2016.1203772

Hamka, D., Riandi, R., & Suwarma, I. R. (2024). Exploring Student Technology and Engineering Literacy in Science Learning: an Overview of the Initial Study. *Jurnal Penelitian Pendidikan IPA, 10*(3), 1188–1194. https://doi.org/10.29303/jppipa.v10i3.6872

Harahap, L. J., Komala, R., & Ristanto, R. H. (2020). Assesing Critical Thinking Skills and Mastery Concepts: The Case of Ecosystem. *EDUSAINS, 12*(2), 223–232. https://doi.org/10.15408/es.v12i2.16544

Hernando-Malipot, M. (2024). DepEd gears up for implementation of MATATAG Curriculum starting this year. Manila Bulletin. Retrieved on June 2024 from Https://Mb.Com.Ph/2024/5/8/Dep-Ed-Gears-up-for-Implementation-of-Matatag-Curriculum-Starting-This-Year.

Hesse, F., Care, E., Buder, J., Sassenberg, K., & Griffin, P. (2015). A Framework for Teachable Collaborative Problem Solving Skills. In *Assessment and Teaching of 21st Century Skills* (pp. 37–56). Springer Netherlands. https://doi.org/10.1007/978-94-017-9395-7_2

Ince, E. (2018). An Overview of Problem Solving Studies in Physics Education. *Journal of Education and Learning, 7*(4), 191. https://doi.org/10.5539/jel.v7n4p191

Jackson, A. W., & Davis, G. A. (200 C.E.). Turning Points 2000: Educating Adolescents in the 21st Century. Teachers College Press.

Jacobs, H. H. (2010). Curriculum 21: Essential Education

for a Changing World. ASCD.

Jurgena, I., Cēdere, D., & Keviša, I. (2018). The Prospects of Transdisciplinary Approach to Promote Learners' Cognitive Interest in Natural Science for Sustainable Development. *Journal of Teacher Education for Sustainability, 20*(1), 5–19. https://doi.org/10.2478/jtes-2018-0001

Karppinen, K., & Moe, H. (2019). Texts as Data I: Document Analysis. In *The Palgrave Handbook of Methods for Media Policy Research* (pp. 249–262). Springer International Publishing. https://doi.org/10.1007/978-3-030-16065-4_14

Kieran, L., & Anderson, C. (2019). Connecting Universal Design for Learning With Culturally Responsive Teaching. *Education and Urban Society, 51*(9), 1202–1216. https://doi.org/10.1177/0013124518785012

Kumar, R., & Kukreja, R. (2024). Ready-made solution to face 5th Industrial Revolution- acquiring 4Cs skills. 2024 *4th International Conference on Innovative Practices in Technology and Management (ICIPTM),* 1–6. https://doi.org/10.1109/ICIPTM59628.2024.10563807

LaChausse, R. G., Clark, K. R., & Chapple, S. (2014). Beyond Teacher Training: The Critical Role of Professional Development in Maintaining Curriculum Fidelity. *Journal of Adolescent Health, 54*(3), S53–S58. https://doi.org/10.1016/j.jadohealth.2013.12.029

Lee, M., Yun, J. J., Pyka, A., Won, D., Kodama, F., Schiuma, G., Park, H., Jeon, J., Park, K., Jung, K., Yan, M.-R., Lee, S., & Zhao, X. (2018). How to Respond to the Fourth Industrial Revolution, or the Second Information Technology Revolution? Dynamic New Combinations between Technology, Market, and Society through Open Innovation. *Journal of Open Innovation: Technology, Market, and Complexity, 4*(3), 21. https://doi.org/10.3390/joitmc4030021

Liu, L., & Tobias, G. R. (2024). The impact of environmental literacy on residents' green consumption-Experimental evidence from China. *Cleaner and Responsible Consumption, 12*, 100165. https://doi.org/10.1016/j.clrc.2023.100165

Mathevet, R., Bousquet, F., & Raymond, C. M. (2018). The concept of stewardship in sustainability science and conservation biology. *Biological Conservation, 217,* 363–370. https://doi.org/10.1016/j.biocon.2017.10.015

Matriano, E. A. (2020). Ensuring student-centered constructivist and project-based experiential learning applying the Exploration, Research, Interaction and Creation (ERIC) Learning Model. *International Online Journal of Education and Teaching (IOJET), 7*(1), 214–227.

Mayfield, V. M., & Garrison-Wade, D. (2015). Culturally responsive practices as whole school reform. *Journal of Instructional Pedagogies, 16*. https://files.eric.ed.gov/fulltext/EJ1069396.pdf

Rahman, M.M. (2019). 21st Century Skill "Problem Solving": Defining the Concept. *Asian Journal of Interdisciplinary Research,* 64–74. https://doi.org/10.34256/ajir1917

Merad, M., & Trump, B. D. (2020). Navigating a River of Doubt: Making Decisions in a 21st Century World (pp. 147–152). https://doi.org/10.1007/978-3-030-20532-4_8

Mullis, I. V., Martin, M. O., Foy, P., Kelly, D. L., & Fishbein, B. (2020). *TIMSS 2019 International Results in Mathematics and Science. . . TIMSS & PIRLS International Study Center, Boston College*. Retrieved on June 2024 from Https://Www.Iea.Nl/Sites/Default/Fles/2020-12/TIMSS%202019-Inter National-Results-in-Mathematics-and-Science.Pdf.

Newman, L. (2005). Uncertainty, innovation, and dynamic sustainable development. *Sustainability: Science, Practice and Policy, 1*(2), 25–31. https://doi.org/10.1080/15487733.2005.11907970

Nuraeni, Y., MS, Z., & Boeriswati, E. (2020). A Case Study of Curriculum Implementation and K-13 Challenges in Indonesia. *International Journal for Educational and Vocational Studies, 1*(8), 14. https://doi.org/10.29103/ijevs.v2i1.2263

Oducado, R. M., Rabacal, J., Moralista, R., & Tamdang, K. (2021). Perceived Stress Due to COVID-19 Pandemic Among Employed Professional Teachers. SSRN Electronic Journal. https://doi.org/10.2139/ssrn.3743860

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

OECD. (2023). PISA 2022 Results (Volume I): The State of Learning and Equity in Education (Vol. 1). PISA, OECD Publishing. https://doi.org/10.1787/53f23881-en

Office of the Vice President, R. of the P. (2023). VPSD Speech for the Launch of the MATATAG K to 10 Curriculum. Https://Www.Ovp.Gov.Ph/Post/Vpsd-Speech-Launch-Matatag-k-10-Curriculum.

Philippine National Research Center for Teacher Quality. (2017). Teacher development needs study (TDNS): Findings and recommendations [Policy note]. Research Center for Teacher Quality (RCTQ). from Https://Www.Ritq.Ph/Files/Policy-Notes/No.2017-001.Pdf.

Reis, S. (2018). Curriculum reform: Why? What? How? and how will we know it works? *Israel Journal of Health Policy Research, 7*(1), 30. https://doi.org/10.1186/s13584-018-0221-4

Republic of the Philippines. (2013). Republic Act No. 10533 "Enhanced Basic Education Act of 2013". Https://Www.Officialgazette.Gov.Ph/2013/05/15/Republic-Act-No-10533/.

Rinat, K., Koli, S., Sobti, R., Ledalla, S., & Arora, R. (2024). *Data-Driven Decision Making: Real-world Effectiveness in Industry 5.0 – An Experimental Approach. BIO Web of Conferences, 86,* 01061. https://doi.org/10.1051/bioconf/20248601061

Robertson, P., Kheang, T., Bustos, T., Rickards, F., Ferido, M., Cagasan, L., & Dela Cruz, J. (2021). Review of the Attained Curriculum. Assessment Curriculum and Technology Research Centre (ACTRC).

Robertson, P., Rickards, F., Kheang, T., Bustos, T., & Ferido, M. (2021). The Curriculum Review Project and Policy Implications: a summary. Assessment Curriculum and Technology Research Centre (ACTRC).

Samifanni, F., & Gumanit, R. L. R. (2021). Survival with Technology: Elderly Teachers' Perspective Towards Emergency Online Learning During the COVID-19 Pandemic in the Philippines. *Studies in Learning and Teaching, 2*(3), 98–114. https://doi.org/10.46627/silet.v2i3.87

Schwab, K. (2017). The Fourth Industrial Revolution. Crown Publishing Group.

Second Congressional Commission on Education. (2023). Basic Education (Curriculum and Instruction). Second Congressional Commission on Education. Https://Edcom2.Gov.Ph/Media/2023/06/EDCOM2_Green-Paper_07-BASIC-ED-Curriculum-and-Instruction_230615.Pdf.

Second Congressional Commission on Education. (2024). Miseducation: The Failed System of Philippine Education Edcom Ii Year One Report. Second Congressional Commission on Education.

Servallos, N. J. (2023). Teachers' group wants MATATAG curriculum implementation stopped. Philstar Global. from Https://Www.Philstar.Com/Headlines/2023/09/26/2299031/Teachers-Group-Wants-Matatag-Curriculum-Implementation-Stopped.

Sisinni, E., Saifullah, A., Han, S., Jennehag, U., & Gidlund, M. (2018). Industrial Internet of Things: Challenges, Opportunities, and Directions. *IEEE Transactions on Industrial Informatics, 14*(11), 4724–4734. https://doi.org/10.1109/TII.2018.2852491

Snooks, G. (2002). *The Dynamic Society*. Routledge. https://doi.org/10.4324/9780203029176

Suganya, G., Joshua Selvakumar, J., Varadharajan, P., & Pachiyappan, S. (2024). Skill Sets Required to Meet a Human-Centered Industry 5.0 (pp. 231–252). https://doi.org/10.4018/979-8-3693-0782-3.ch014

Taber, K. S. (2020). Mediated Learning Leading Development—The Social Development Theory of Lev Vygotsky (pp. 277–291). https://doi.org/10.1007/978-3-030-43620-9_19

Thornhill-Miller, B., Camarda, A., Mercier, M., Burkhardt, J.-M., Morisseau, T., Bourgeois-Bougrine, S., Vinchon, F., El Hayek, S., Augereau-Landais, M., Mourey, F., Feybesse, C., Sundquist, D., & Lubart, T. (2023). Creativity, Critical Thinking, Communication, and Collaboration: Assessment, Certification, and Promotion of 21st Century Skills for the Future of Work and Education. *Journal of Intelligence, 11*(3), 54. https://doi.org/10.3390/jintelligence11030054

Tirol, S. L. (2022). Spiral Progression Approach in the K to 12 Science Curriculum: A Literature *Review. International Journal of Education (IJE), 10*(4), 29–44. https://doi.org/10.5121/ije.2022.10403

Tria, J. Z. (2020). The COVID-19 Pandemic through the Lens of Education in the Philippines: The New Normal. *International Journal of Pedagogical Development and Lifelong Learning, 1*(1), ep2001. https://doi.org/10.30935/ijpdll/8311

Trilling, B., & Fadel, C. (2012). 21st Century Skills: Learning for Life in Our Times. John Wiley & Sons.

UNESCO. (2021). One year into COVID-19 education disruption: Where do we stand? Retrieved on June 2024 from Https://Www.Unesco.Org/En/Articles/One-Year-Covid-19-Education-Disruption-Where-Do-We-Stand.

UNICEF. (2020). UNICEF Philippines statement on COVID-19. Https://Www.Unicef.Org/Philippines/Press-Releases/Unicef-Philippines-Statement-Covid-19.

Vreuls, J., Koeslag-Kreunen, M., van der Klink, M., Nieuwenhuis, L., & Boshuizen, H. (2022). Responsive curriculum development for professional education: Different teams, different tales. *The Curriculum Journal, 33*(4), 636–659. https://doi.org/10.1002/curj.155

Warren, M. (2005). Communities and Schools: A New View of Urban Education Reform. *Harvard Educational Review, 75*(2), 133–173. https://doi.org/10.17763/haer.75.2.m718151032167438

Wilson-Lopez, A., & Minichiello, A. (2017). Disciplinary Literacy in Engineering. *Journal of Adolescent & Adult Literacy, 61*(1), 7–14. https://doi.org/10.1002/jaal.658

Wilson-Lopez, A., Strong, K., & Sias, C. (2017). Critical Literacy, Disciplinary Literacy: Reading the Engineering-Designed World. *Theory Into Practice, 56*(4), 238–245. https://doi.org/10.1080/00405841.2017.1389219

Wollschlaeger, M., Sauter, T., & Jasperneite, J. (2017). The Future of Industrial Communication: Automation Networks in the Era of the Internet of Things and Industry 4.0. *IEEE Industrial Electronics Magazine, 11*(1), 17–27. https://doi.org/10.1109/MIE.2017.2649104

Yadav, A., Hong, H., & Stephenson, C. (2016). Computational Thinking for All: Pedagogical Approaches to Embedding 21st Century Problem Solving in K-12 Classrooms. *TechTrends, 60*(6), 565–568. https://doi.org/10.1007/s11528-016-0087-7

ŽivkoviĿ, S. (2016). A Model of Critical Thinking as an Important Attribute for Success in the 21st Century. *Procedia - Social and Behavioral Sciences, 232,* 102–108. https://doi.org/10.1016/j.sbspro.2016.10.034

Zizic, M. C., Mladineo, M., Gjeldum, N., & Celent, L. (2022). From Industry 4.0 towards Industry 5.0: A Review and Analysis of Paradigm Shift for the People, Organization and Technology. *Energies, 15*(14), 5221. https://doi.org/10.3390/en15145221