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Exploring Teachers' Beliefs and Science Curricular Alignment: Cases of Senior High School Philippine STEM Teachers

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Abstract

This study determined the efficacy beliefs of completely enumerated STEM (Science, Technology, Engineering and Mathematics) teachers in a government-owned school in Rizal Province, Philippines and their role in the alignment of the intended, enacted and received Grade 11 science curriculum during the AY 2017-2018. Descriptive case study (qualitative research design) utilizing both qualitative and quantitative strategies, thoroughly examined the STEM curriculum and the teacher participants' teaching efficacy beliefs. Proper alignment of the intended and teacher efficacy beliefs-influenced enacted curriculum confirmed from the class interaction and students' engagement, resulted to a high passing rate of students in their final examination and a high percentage of students who obtained passing grades (received curriculum). These high level of efficacy beliefs helped the teacher cases come up with a better enacted curriculum consistent with the intended curriculum, which stimulated the received curriculum. These results may inform STEM teacher-trainings and in-service programs curricular assessment and evaluation as well, for improved implementation of the curricular reform. Furthermore, identification of congruence and gaps within the intended, enacted and received curriculum can be done to analyze the current status of the curriculum. Significantly, results may improve enacting the new curriculum (K to 12) that may better highlight the spiral progression of content standards and learning competencies for each grade level and emphasize connections and inter-relations in STEM to better prepare our Generation Z learners for the new industrial era.

Keywords: *Efficacy beliefs; Outcome expectancy beliefs; Philippine K to 12 Senior High School Program*

Introduction

Vast revolution and innovation in the industry, significant to global growth and economies, dictate knowledge creation, dissemination, and sustainability. In fact, Industry 4.0 [described by Xing (2017) as the new world of cyber-physical systems run by skilled human resource and smart machines] require a new education paradigm to reskill the workforce and train a new breed of STEM (Science, Technology, Engineering & Mathematics) human resource. A leapfrog to such framework emphasizes the vision of Education 4.0—innovation society and knowledge economy—an imperative for the success of Industrial Revolution 4.0 (IR4) that features cyber-physical systems (Van Durren, 2017; Renjen, 2018). This new education perspective, known as Education 4.0 drives the teaching and learning process to aim for the 21st century skills emphasizing learner

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attributes such as being a problem-solver, a critical thinker, exhibiting creative and design thinking, and emotional intelligence among others. Drivers to the goals of Education 4.0 may include STEM learning, learning by doing, rote to rigor, and team learning. Apparently, this global bandwagon propels STEM education requiring quality STEM teaching.

STEM education stimulates creativity, productivity, and economic growth making it very essential for those who pursue STEM professions and for every 21st century citizen (Albion, 2014). In fact, STEM education propels the development and security of quality of human life, thus, has a serious role in modern civilization (Petroski, 2010). Apparently, the strong connection between quality science education and 21st century skills drives a new breed of human resource suited to the skills requirement of IR 4.0 (National Science Teachers Association, 2009; Windschitl, 2009). This connection works by developing the skills that concentrate broadly on enhancing the citizens' capabilities and habits of mind, while science education paradigm focuses on nurturing learning competencies by engaging learners to varied activities facilitated through diverse pedagogies (National Academy of Sciences, Engineering and Medicine, 2016; Windschitl, 2009). Accordingly, improved and quality science education propels scientific literacy of the citizens and prepares them to learn the necessary skills for the jobs-of-the-future (Gluckman, 2011). Multifaceted STEM classes may bring about a learning environment capable of nurturing the 21st century skills dictating the need for quality science teaching. The standards of quality science teaching argue that teachers of science exhibit the desired skills and standards. Such standards may derive the four basics principles of science learning which should reflect the intellectual traditions of culture, leading to quality science education (Xanthoudaki, 2010).

In its current form, STEM education is viewed globally as an integrated system of courses to explain and justify a certain scientific occurrence. In fact, Sanders (2009) described integrated STEM education as "an approach that explore teaching and learning between/among any two or more of the STEM subject areas, and/or between a STEM subject and one or more other school subjects". This STEM education paradigm requires a unique set of teaching skills for STEM teachers to be able to pick the most appropriate instruction or pedagogy to achieve an integrated STEM education in the classroom. Educators of the STEM strand should deliver learning that is intended for the curriculum and that should be properly received by the students no matter what STEM subject it is (Fairweather, 2008). In fact, the teaching and learning of each STEM subject like science greatly depends on how well the STEM teacher enacts the STEM curriculum to achieve the intended learning outcomes (Fairweather, 2008). Connectedly, self-efficacy beliefs helps plan activities to attain the required product or outcome as a consequence of their strong beliefs of their own abilities. The whole teaching and learning process is both affected by the teachers' actions and the learners' outcome, hence, personal or self-efficacy and teaching or teacher efficacy should be considered inside the learning environment. Raleigh (2012) further classified efficacy beliefs as teaching outcome expectancy beliefs and personal teaching efficacy beliefs. Both efficacy beliefs are considered to have an effect on the teaching and learning process, thus may influence how STEM teachers enact the intended curriculum.

In specifics, intended curriculum, also known as written curriculum is the officially implemented curriculum often contained in a state or government policy and represents what students are expected to learn. The implementation of this written curriculum is known as enacted curriculum and shows the decisions a teacher makes during execution and covers the informal and formal instructions and activities, as well as the teachers'

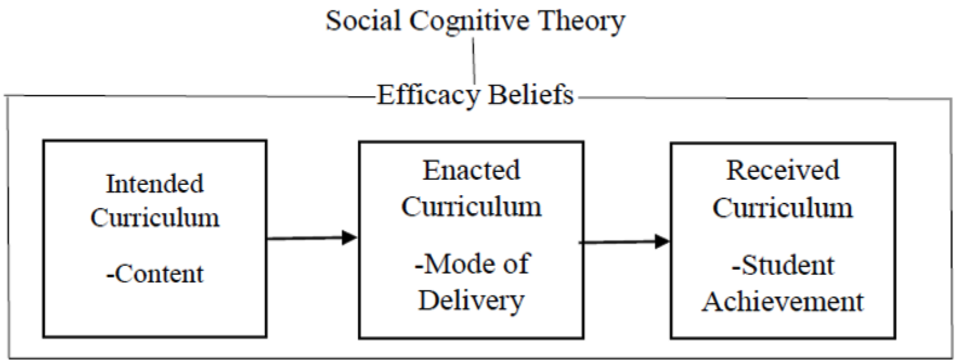

Figure 1. *Framework of the study*

performances, management approaches and principles (Nolet & McLaughlin, 2000). The received curriculum is the learned curriculum which is the consequence of being in the classroom and interacting with the intended and enacted curriculum. Exploring the alignment on the STEM intended, enacted and received curriculum could help improve STEM education.

Restructuring the Philippine education system to shift from 10-year education to 12-year learning cycle is a Philippine initiative to prepare Filipinos for advanced education, labor market, and global standards (Yap, 2011). This initiative emphasized the inclusion of Senior High School in the basic education curriculum targeting the development of graduates and human resource who are globally competitive, and whose credentials are globally recognized (Luistro, 2010).

Apparently, the intended curriculum for each of these tracks gear toward the goals of the SHS program that would require appropriate teacher enactment to achieve the desired results. In the STEM field, we aim for STEM-driven human capital to better our knowledge economic stance, thus requires an intensive effort to provide curricular alignment that matches the intentions of the program with properly and appropriately teacher enacted curriculum. We see, however that determinations to proper enactment may be highly influenced by many factors such as teacher efficacy belief (Teaching and Learning International Survey, 2013; Thompson, 2016). Thus, our investigation focused on exploring curricular alignment of the STEM track of the SHS program (on its second year of implementation) and STEM teacher efficacy beliefs.

Thus, the purpose of this study is to describe the role of teachers' efficacy beliefs on the alignment of the K to 12 Grade 11 STEM intended, enacted and received curriculum of three STEM teacher cases in a government-owned school. Specifically, the study seeks to determine the extent of alignment of the intended, enacted, and received curricula and identify the teaching efficacy beliefs of the STEM teachers in three Grade 11 STEM teaching cases. Consequently, the study will further describe the teaching efficacy beliefs of the three Grade 11 STEM teachers and how these beliefs contribute to the alignment of the intended, enacted and received curriculum.

Framework of the Study

Whenever teacher gives instruction and direct learning, teaching efficacy is observed which is considered important in the teaching-learning process. Teacher efficacy is a simple idea with significant implications. A teacher's efficacy belief is a judgment of his or her capabilities to bring about desired outcomes of student engagement and learning. Thus, this study explores the role of the efficacy beliefs of three STEM teachers on the alignment of the intended, enacted and received curriculum.

Social cognitive theory suggests that efficacy beliefs of teachers' increases through interactions with students and colleagues, teaching and training experiences and observing others. These efficacy beliefs help the teachers to accomplish their task. Teachers with higher efficacy beliefs are more likely to design and come up with more reliable lesson plans for the delivery of the intended curriculum. Teachers with high self-efficacy show more willingness to experiment with new methods and also exhibit better planning and organizational skills. Furthermore, teachers with higher efficacy beliefs are more competent in delivering the lesson enacting the curriculum. Teachers' who are more knowledgeable and skilled have higher efficacy beliefs which in turns allow them to structure and implement their lessons better and provide better strategies to reach the students (White, 2009). Accordingly, this high efficacy enables the teacher to stimulate the learning environment, which could lead to higher student achievement or receive curriculum. Pan (2012) found out that efficacy beliefs could positively influence learning motivation, learning atmosphere, and learning satisfactory of the students which all play a key role in the students' learning process and environment. Hence, teachers with higher efficacy beliefs could provide better learning environment that would stimulate the received curriculum which is consistent with the intended curriculum.

Methodology

The study utilized descriptive case study which is a qualitative research design that allowed us to get close to the data sources through interviews and observations for more detailed descriptions of the participants' perspectives and experiences on the STEM intended, enacted and received curriculum, and teaching efficacy beliefs. We determined the details on the curricular alignment in the STEM track of the SHS program implemented by a government-owned school in the province of Rizal, and explored the teaching efficacy beliefs of their SHS STEM teachers through qualitative and quantitative techniques. Accordingly, purposive sampling technique identified four STEM teachers who are teaching for more than ten years and have master's degree of science. Since one of the proponents is one of the four STEM teachers, we only included the three others as primary participants. Secondary participants included students from selected class of each teacher-participant. For convenience, the proponents chose the classes of each STEM teacher for observation purposes. Table 1 shows the demographic profile of the teacher in each STEM teaching cases.

As gleaned from Table 1, each STEM teacher teaches the same subject in their observed classes (classes have different number of students). Each STEM teacher was observed in a different day of a week with a total of ten observation per teacher.

Data collection started in the first quarter of the first semester of the academic year 2017 - 2018. Included in the sources of data were documentary evidences and data sources from the three STEM teachers (e.g. syllabi, science curriculum guide, lesson logs, and activity sheets). From these documents, we mapped and matched the competencies of the science curriculum from level 3 to level 12 with the teacher intended objectives specified in their respective learning logs to identify curricular alignment with teachers' intention to deliver the grade 11 competencies.

We conducted a once a week class observation within a 10-week period (one quarter of a school year). The assigned proponent sat in the classroom together with one research teacher as class observation validator to observe the identified classes of each teacher-participant for a period of an hour noting all items in Reform Teacher Observation Protocol (RTOP). RTOP uses a Likert scale rating, on the quality of

Table 1. Demographic profile of the three STEM teachers

Cases	Age	Gender	Academic Rank	Subject Taught	No. of Students in the Observed Class	Day and Time of Observation	No. of Observations
STEM Teacher 1	56	Female	With PhD Units	Earth and Life Science	35	Monday, 12:20 to 1:20	10
STEM Teacher 2	40	Female	Master's Degree Graduate	Earth and Life Science	49	Wednesday, 1:20 to 2:20	10
STEM Teacher 3	38	Female	PhD Graduate	Earth and Life Science	50	Thursday, 12:20 to 1:20	10

the lesson based on lesson design and implementation; content (propositional and procedural knowledge; and classroom culture (communicative and student-teacher relationship). We videotaped all class observations upon the consent of the teacher-participants. We showed the videotaped lessons to another science teacher to validate all recorded class observations. After the last week of classroom observation (after class hours), we conducted a 30-minute to an hour interview with the teacher-participants. Furthermore, as part of the post classroom observation, the STEM teachers took the Science Teaching Efficacy Beliefs Instrument (STEBI). This instrument is a 25-item instrument that uses a 5-point Likert scale, where the items focused on the description of two efficacy factors: (1) personal teaching efficacy and (2) science teaching outcome expectancy. Simultaneously, their respective students took Students Motivation towards Science Learning (SMTSL). This instrument is an 8-item questionnaire that also uses a 5-point Likert scale that identify the learning environment stimulation of students in two domains: (1) based on physical space and (2) cognitive space in the last week of observations which served as significant data set for triangulation purposes.

We also collected the teachers mean profile that reflects the student mastery level and their computed grades for each class observed after the final examination of the quarter. Document analyses initiated the cross mapping of competencies sourced from the curriculum guide and the objectives from the teachers' daily lesson log. We used these mapped competencies and teachers' objectives per competencies as the standard bases in determining of teachers' enactment of the intended curriculum. The results from each section of the observation tool (RTOP) identified the most frequently observed characteristics of STEM teachers in terms of lesson design and implementation, and propositional and procedural knowledge. We also observed that the alignment of the intended curriculum and enacted curriculum to the received curriculum through the generated SMTSL results, mean profile of the students, and our interview transcriptions.

Results and Discussion

Curriculum Alignment

We referenced the curriculum alignment with the identified match of the intended, enacted and received curriculum. Table 2 shows how we match the three curricular constructs of the three STEM cases.

Table 2. Demographic profile of the three STEM teachers

Intended Curriculum	Enacted Curriculum	Received Curriculum
The learners demonstrate an understanding of: • Formation of the universe and the solar system • Origin and environment of common minerals and rocks • Folding and faulting of rocks • How photosyntheti c organisms capture light energy to form sugar molecules	**Lesson Design and Implementation:** • Consideration for students' prior knowledge and preconceptions (ST1 and ST2) • Engages the students as members of the learning community (*) • Letting students' ideas direct the lesson (ST1 and ST2) • Good communicative interaction and relationship (*) • Encouraging alternative modes of investigation or of problem solving (ST2) • Lesson, student exploration preceded formal presentation (ST3) **Propositional and Procedural Knowledge:** • Provide lessons that promote strongly coherent conceptual understanding (*) • Solid grasp of the subject matter content inherent in the lesson (*) • Providing students with fundamental concepts of the lesson (*) and allowing them to use elements of abstraction (ST1 and ST2) and connecting the lesson with other disciplines and real world phenomena (ST1 and ST3) • Students were actively engaged in thought-provoking activities that often involved the critical assessment of procedures (ST1) • Students made predictions, estimations and/or hypotheses and devised means for testing them (*) • Values intellectual rigor, constructive criticism, and the challenging of ideas. (ST2) • Students were allowed to reflect about their learning (ST2 and ST3) • Students models, drawings, graphs, symbols, concrete materials, manipulatives, etc.) to represent phenomena (ST2) ***Observed strategies:*** • Lecture and Discussion (*) • Inquiry Approach (*) • Group Dynamics (*) • Collaborative Learning (*) • Use of technology (*) • Use of different assessment methods (*) • Discovery approach and rubrics (ST2) • Role Playing (ST3)	***Mastery of Students (ST1):*** • 20% within non-mastery. • 74% within nearing mastery. • 28.57% within mastery. ***Students First Quarter Grades (ST1):*** • 28% failed (65-74) • 72% passed (75 to 100) ***Mastery of Students (ST2):*** • 12.24% non-mastery. • 59.18% nearing mastery. • 28.57% mastery. ***Students First Quarter Grades (ST2):*** • 12.24% failed. • 87.76% passed ***Mastery of Students (ST3):*** • 10% non-mastery. • 76% nearing mastery. • 14% mastery. ***Students First Quarter Grades (ST3):*** • 6% failed • 94% passed ***Student Motivation*:** • Science subject is challenging. (*) • Content of the subject is exciting and changeable. (ST1 and ST2) • Student discussion involvement (ST1 and ST3) • Relevant learning activities (ST1 and ST2) • The teacher pays attention to them. (ST2 and ST3) • The teacher does not put a lot of pressure on them. (ST2 and ST3) • The teacher uses a variety of teaching methods. (ST3)

(*)- observed/occurred to all the teachers, ST1- STEM Teacher 1, ST2- STEM Teacher 2, ST3- STEM Teacher 3

The progression of the intended curriculum provides room for the learners to demonstrate scientific inquiry skills, understand and apply scientific knowledge, and develop and demonstrate scientific values and attitudes, reflecting the core objectives of K to 12 science curriculum. All, if not the majority of cases (STEM teachers) positively exhibit almost all characteristics expected in lesson design and implementation, though only ST2 focused on encouraging students to explore alternative modes of problem solving and ST3 emphasizes student exploration preceding formal presentations. In fact, ST2 explicitly shows value for students' intellectual rigor, the concept of challenging ideas and use of variety of ways to represent phenomena thus, employing discovery approach and rubrics. Accordingly, propositional and procedural knowledge develops through these employed methods that showcase hierarchical learning of skills, strategies, and processes (Marzano, 2010). While all cases practice inquiry learning, ST3 provides an avenue for simulated practice of skills through role play activities. ST3 uniquely exhibits the most observed characteristics in terms of propositional knowledge that include teaching strategies resulting to students being able to build a solid grasp of the concept (Marzano, 2015). Furthermore, ST3 utilized the skills of abstraction as reflected to the students that were able to connect lessons with other concepts and real-life situations. Apparently, STEM teachers enact the intended K to 12 science curriculum competencies using various pedagogical approaches that feature more learner-centered approaches. The use of various learner-centered pedagogical approaches are anchored to the K to 12 science curriculum.

ST2 frequently designs lessons for more enjoyable communicative interaction and positive student-teacher relationship—a characteristic different from ST1. However, they both lead their lessons to good communicative interaction and student-teacher relationship. Their strategy allows the students to explore even before the lesson is formally presented to them, and this scheme encourages them to formulate their hypothesis and devise their own means of testing or investigating the concepts of lessons. These characteristics further engage the students as members of the learning community giving them the feeling of being part of the community, through their involvement in activities and discussions. They do not put any pressure on them, and even employ rubrics in performance-based assessment and evaluation to communicate what the outcome really implies towards their awareness of their performance resulting to better achievement (Allen, 2014). Certainly, all cases show engaging students' active participation with patience which resulted to a good student-teacher relationship and creates a more positive learning environment (Bullock, 2015; Ciascai & Vlad, 2014). Additionally, all cases promote student-centered classroom and constructivist approach to STEM teaching identified from the teachers' curricular (enacted curriculum for content), instructional (enacted curriculum for practices), and assessment practices (enacted curriculum for assessment) (Paek et al., 2005).

Almost all STEM teacher cases positively exhibit most, if not all, characteristics expected in lesson design and implementation, and propositional and procedural knowledge. All STEM cases show fluency in a number of learner –centered pedagogical approaches that develops student propositional and procedural knowledge, which reveals how they enact the intended curriculum to engage students to actively participate towards the directed goals and objectives of the K to 12 Senior High School Science program. It seems that they appreciate the framework of the new science curriculum and believe that this new curriculum will be able to equip Filipino learners with 21 century skills for Industry 4.0.

STEM Teachers' Efficacy Beliefs

The construct of self-efficacy refers to an individual's belief in his or her capability "to organize and execute the course of action required to manage prospective situations" (Bandura, 1997, p. 38). Personal teaching efficacy belief is the confidence related to teaching a certain subject matter and the belief that the teacher is able to reach all students (Summer et al., 2016).

Teaching Efficacy Beliefs of the Three STEM Teachers

ST1 and ST3 agree that they possess personal teaching efficacy beliefs while ST2 strongly agree that she possesses personal teaching efficacy beliefs which shows that all STEM teacher cases showcase positive personal teaching efficacy beliefs. However, differences which these STEM cases exhibit may be due to factors that may include their training and exposure affecting their confidence in teaching (Summer et al., 2016). ST2 and ST3 seem to demonstrate confidence in all efficacy items compared with ST1 who thinks with uncertainty in three of 13 personal efficacy belief items and who disagrees that s/he is capable of monitoring science experiments. ST2, however, believes that she knows the necessary steps in teaching science and understands science concepts well to be able to teach effectively. She is uncertain, though, if she has enough skills in teaching science. This uncertainty may be attributed to their novelty to the curriculum (Senior High School Curriculum [SHS]), new environment provided by the curriculum, and the new set and age range of learners (International Education Advisory Board, 2014). ST2 claims that Earth and life science, and physical science are two core subjects for the different strands and tracks in the senior high school level. In fact, ST2 mentioned that *"changes in the strategies were done because of the different strands, for example, students in the General Academic Strand (GAS) strand do more activities since they were able to explain the lesson while in Shielded Metal Arc Welding (SMAW), it is more on discussion on how to apply the concepts."*

ST3 sources her confidence from her high personal efficacy beliefs. She explains that she understands science concepts well enough, knows the necessary steps in teaching science and possesses skills to teach science making her believe that she teaches science well and effectively. She also believes that she can monitor science experiments and answer students' questions about science concepts and experiments. ST3 even stated, *"I feel confident in teaching when I know the lesson,"* confirming that mastery of the science concept relatively contributes to personal teaching efficacy (Pfitzner-Eden, 2016).

While self-efficacy ratifies the teacher's confidence to teach, outcome-expectancy is the degree to which one believes that a particular outcome will occur (Brown et al., 2014). Table 3 presents the STEM teacher cases outcome expectancy beliefs.

Outcome Expectancy Beliefs of STEM Teachers

STEM teachers in each case agree that they possess outcome expectancy beliefs. Furthermore, all, if not most STEM teacher cases believe that student learning may be influenced by their actions (Wyatt, 2010). In fact, ST1 and ST2 positively responded to all items of outcome expectancy belief showing that they firmly trust their capabilities in bringing about students' learning. However, ST1 was not that confident on certain aspects of self-efficacy although she still trusts that her general efficacy belief system will get her through and be able to extract student learning. It may seem that the low science achievement of some students could be attributed to other factors that might influence students learning and cannot be generally blamed to their teachers. This result may imply that outcome expectancy belief may not always stream from teaching efficacy or level of confidence of the teacher (Wyatt, 2010). In fact ST3 shows contradictory beliefs in terms of teaching confidence and some uncertainties on outcome expectancy beliefs ("students' achievement in science is directly related to teacher's effectiveness in science teaching", "even teachers with good science teaching abilities cannot help some kids learn science").The case may be differently viewed for ST2 who coherently shows both confidence in enacting the curriculum that may consequently result to positively received curriculum (Domenech-Betoret, 2017).

Teachers Efficacy Beliefs and IER (Intended-Enacted-Received) Curriculum Alignment

STEM cases in this study provide a peek at how teacher's belief system (self-efficacy and outcome expectancy) may influence curricular alignment in terms of match in the intended, enacted and received curriculum. Table 3 shows a summary of salient data for such contention.

All STEM cases seem to enact the intended curriculum in a way suited to the learners to generate student learning in science. In all cases, we observe high percentages of students on the mastery level and who passed the first quarter examination in science, conjoined by high student motivation (based on a 5-point Likert scale). Corresponding efficacy belief and outcome expectancy belief seem to match the aforementioned high ratings. We also note that STEM cases (ST2 and ST3), with high ratings in the belief system (teacher efficacy belief and outcome expectance belief), seem to project high rating (by average) in enacted curriculum consequently generating high grades and percentage of mastery with highly rated and motivated students. Comparatively, we observe that ST1's lower belief system rating influences the lower percentage of students with mastery, lower percentage of those who passed the first quarter examination and lower student motivation rating. Our observations confirm that teacher's competence sourced from their belief system (self-efficacy and outcome expectancy) necessarily bring about successful teaching and learning performance (Morris, 2017).

All STEM cases show positive belief systems (self-efficacy and outcome expectancy), though with uncertainties on some cases. Each STEM case seems to have a unique match of both belief systems that directs how they enact the intended SHS science curriculum suited to their respective learners to generate student learning and understanding of science. In fact, we observed high percentages of students on the mastery level and who passed the first quarter examination in science conjoined with high motivation self-rating of the learners. We note that in all STEM cases corresponding efficacy belief and outcome expectancy beliefs match these high ratings, which may mean that STEM teachers' belief systems contribute to a more proper aligned intended, enacted, and received curricula. Their beliefs together with their appreciation of the new curriculum seem to drive them to make some adjustments to cope with their uncertainties brought about by curricular novelty, new preparation for the new courses inclusive of new learning resources acquisition, and new age range of learners. Their adjustments may be sourced from the paradigm of reflective practice through the lens of intended-enacted-received curriculum. In fact, their efficacy beliefs may facilitate transition of the intended curriculum to their prepared lesson plans and as the process continues, their beliefs transpire in connecting the content and delivery of the lesson. However, we sourced all our observations and insights from three STEM cases (qualitative research design), which may not be enough to deduce general statements on beliefs and curricular alignment.

A national survey of gaps in the curricular alignment correlated with belief system may do the job for generalized statements on efficacy and curricular alignment. Furthermore,

Table 3. STEM Cases Belief Systems and IER Curricular Alignment

STEM Case	Enacted		Received		Teacher Efficacy Belief	Outcome Expectancy Belief
	Lesson Design	Knowledge	Grades*	Student Motivation		
ST1	2.00	2.38	28.5% | 72%	3.95	3.69	3.50
ST2	2.94	2.97	28.5% | 94%	4.2	4.85	4.08
ST3	3.14	3.1	28.5% | 88%	4.2	4.46	3.67

* Percentages of class in mastery level and who passed the first quarter test

framework of reflective practice in the SHS through I-E-R may be part of the pedagogical framework including future efforts in in-service and pre-service trainings to generate teacher 4.0 to facilitate quality STEM education to prepare the learners for an innovative and knowledge-driven future.

Conclusion

The study determined the efficacy beliefs of STEM teachers and their role in the alignment of intended, enacted and received grade 11 science curriculum. We found a high degree of alignment between the enacted and intended curriculum, and the received curriculum as implemented by the STEM teachers. In fact, all STEM cases reveal how they enact the intended curriculum to engage students to actively participate towards the directed goals and objectives of the K to 12 Senior High School Science program. It seems that they appreciate the framework of the new science curriculum and believe that this new curriculum will be able to equip Filipino learners with 21st century skills for industry 4.0.

Their personal teaching efficacy beliefs seem to play a significant role in the alignment of the intended, enacted and received curriculum. Each STEM case seems to have a unique match of both belief systems that directs how they enact the intended SHS science curriculum suited to their respective learners to generate students learning and understanding of science. Additionally, STEM teachers' belief systems contribute to a more proper aligned intended, enacted, and received curricula. Their beliefs together with their appreciation of the new curriculum seem to drive them to make some adjustments to cope with their uncertainties brought about by curricular novelty, new preparation for the new courses inclusive of new learning resources acquisition, and new age range of learners. Their adjustments may be sourced from the paradigm of reflective practice through the lens of intended-enacted-received curriculum. In fact, their efficacy beliefs may facilitate transition of the intended curriculum to their prepared lesson plans and as the process continues their beliefs transpire in connecting the content and delivery of the lesson.

As far as the presented cases are concerned, teachers with high level of efficacy beliefs are likely to be able to have a more congruent alignment of the intended, enacted and received curriculum. Additionally, a significant stance of this study is the ability of the analysis of the intended, enacted and received curriculum to assess and probably monitor coherence and curriculum alignment for proper outcomes of learning as envisioned by the reformed curriculum. Analysis of the curriculum could be done by identifying the congruence and gaps within the intended, enacted and received curriculum. Moreover, successive analysis of the curriculum using the triangulated intended-enacted-received curriculum may be used to assess the coherence and alignment of the Philippine curriculum.

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