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Key Elements of Relevant Pre-service Training from the Perspectives of Science Education Graduates

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Abstract The challenges in schooling brought by a pandemic point to the importance of relevant practices responsive to the dynamics in the workplace and suggest rethinking the pre-service training in higher education. The study used the triangulation in mixed methods research among the 24 purposely selected science education graduates. The qualitative data was gathered through interviews, and the contexts of narratives were analyzed thematically. The survey results on attaining professional standards represent the quantitative data, and the two data sets were merged for analysis and comparison. The merging of the identified themes and quantitative results revealed that the key elements relevant in pre-service training are procedural and pedagogical content knowledge that facilitates learning, skills for lifelong learning, behaviors for self-regulation, and behaviors supporting effective teaching. These fundamental elements in teaching are recommended as the basis for determining pre-service teachers' readiness toward actual teaching practice.

Keywords: mixed-methods, pre-service training, teacher readiness

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Introduction

The Sustainable Development Goals Report of 2021 (SDG-R, 2021) by the United Nations Secretary-General, António Guterres, expressed the potential wiping out of two decades of education gains and predicted the risk of a generational catastrophe regarding schooling as the global population suffers from the pandemic. The report also highlighted the significance of developing a labor force that is resilient to economic shocks and adaptable to technological change through continuing education and training as the key to improved livelihood and recovery from challenges. Moreover, vital to the attainment of the sustainable development goal (SDG 4) on inclusive and equitable quality education is raising teacher quality (Temmerman, 2020, "Raising Teacher Quality," para. 12, 16-17). Teacher quality refers to having teachers who can effectively provide quality learning opportunities through sound pedagogical knowledge.

Teacher quality that emanates from knowledge of pedagogy, content, and the development of skills and attitudes necessary for professional teaching are well expressed in the country's curricular programs for teacher education. However, the actual work environment holds varied situations that challenge the quality of pre-service training. The unexpected class disruptions brought by calamities, transport strikes, and disease epidemics are some situations that challenge teachers to maintain learning engagement and effective teaching. These situations are not normally simulated in the pre-service training but exist in the workplace. This illustrates a mismatch between training and actual practice. This means mismatch still exists and is considered a common issue as society continues to evolve into a different character driven by environmental challenges. A mismatch is determined by an employee's educational training and attributes compared with what is required for the job (Somers et al., 2019).

Hence, this study underlines the need to improve the quality of education-job matching as suggested by Sam (2018) and reinforced by the job-environment fit theory proposed by Kim and Choi (2018).

On Mismatch and Person-Environment Fit

Kim and Choi (2018) argued that it is crucial to achieve an outstanding workforce considering job-mismatch toward excellent and highly educated human resources in the right place grounded on job-environment fit and the person-environment fit theory (Sutton, 2023) that are geared on the reciprocal relationship between people and environments. Consequently, Sam (2018) suggested the need to focus on all forms and dimensions of mismatches when considering the impacts on the work environment because counter-productive behaviors due to mismatched training may affect productivity and limit employee and organization development. This is why the study aimed to explore the attributes of pre-service teacher training relevant to the actual work environment.

On Teaching Competence and Professional Standards

Hammond et al. (2020) explained that schools must focus on authentic learning and harnessing the knowledge of human development, including knowledge of learning and effective teaching. The Philippine Professional Standards for Teachers (PPST) established the necessary competence of teachers in managing teaching and learning, categorized into four career stages. The first is the beginning teacher stage where, the pre-service training needs to target minimum standards along the seven important domains (National Research Center for Teacher Quality [NRCTQ], n.d.). Teaching competence was questioned after the Philippines participated in the Program for International Student Assessment (PISA) in 2018 and 2022, consistently placing the country at the bottom of the list in Science, Mathematics, and Reading Literacy (OECD,

2019; OECD 2023). Science education training has likewise become an area of attention in identifying relevant attributes in delivering quality science instruction (Department of Education, 2020; Menon & Azam, 2020). The literature sources reviewed focused on reforms in science teaching and learning but were limited to identifying the relevant elements in pre-service training that teacher education institutions must provide to ensure education training and job matching. Hence, it is the concern the present study sought to address.

Statement of Purpose

The study documented the job relevance of the pre-service training of the newly hired graduates in science education and their attainment of the professional standards for beginning teachers. The study specifically sought to realize the following objectives:

- To determine the key elements in pre-service training relevant to actual professional science teaching;
- To describe the level of attainment of beginning teachers to the professional standards for teachers; and
- To formulate an audit checklist on readiness for professional science teaching.

Framework of the Study

This study contends that when pre-service training can prepare graduates to fit into the work environment, they become productive in professional practice. Debates on the future of jobs that are at risk of automation have been studied by Arntz et al. (2016), Frey and Osborne (2017), McKinsey (2017), and PwC (2017), which likely influences the needed reforms in pre-service training. Sam (2018) and Kim and

Choi (2018) suggested that job mismatches must be avoided by examining their impacts on the employee and outcomes in the labor market. Accordingly, Darling-Hammond et al. (2019) investigated the implications of educational practice toward rethinking how schools can be organized around developmentally supportive work environments. Hence, this study described how pre-service training had become relevant to in-service teaching by exploring the essential elements of teacher training in minimizing the gap in education training and work environment-fit mismatch.

Knowledge Important to Educators

Conceptual, factual, metacognition, and procedural knowledge, according to Alrajeh (2021), are considered the main knowledge that educators should pay attention to when designing a curriculum. These types of knowledge facilitate the application of learning as they are used in planning, observing, developing arguments and justifications, and in putting together related ideas from different disciplines to gain usable knowledge. These forms of knowledge acquired in pre-service teacher training prepare the fresh graduates for actual teaching practice. In addition, the expected skill sets in the workplace have been explored by Fragat (2021) among pre-service and in-service science teachers and found key elements presented in themes as content knowledge, pedagogical knowledge, pedagogical content knowledge, personality traits, and working conditions Thus, Fragat (2021) recommended more research to be conducted on how these elements can be successfully included in pre-service and in-service science teacher education.

Skills and Behaviors of Workforce

The 21st-century skills have become the focus of attention in the education sector in preparing the workforce for global economic competition. If skills adjustments are considered to

match the global educational demands, the higher education sector has to rethink a suitable model to address these adjustments. In that case, higher education institutions are expected to focus on critical elements of relevant pre-service training and emphasize applying the skills during teacher training (Alahmad et al., 2021). Bakhshi et al. (2017) mapped out the employment and skills likely in greater demand in 2030 in different parts of the labor market. These future skills include interpersonal, higher-order cognitive, and systems skills. Teachers' interpersonal behavior can create supportive environments that enable powerful student learning. Moreover, Darling-Hammond et al. (2019) explained that schools built around developmentally supportive relationships with well-scaffolded instruction can support academic skills and social and emotional development.

Professional Standards and Self-efficacy in Teaching

Ene (2021) and Menon and Azam (2020) projected the importance of self-efficacy in teaching, which essentially determines one's extent of ability to perform a particular task. The pre-service training should also build around honing one's belief system and the ability and facility to perform the tasks expected of professional teaching. With this context, the Self-Efficacy Metric for the Attainment of Professional Standards for Teachers (SEMAST), intended for beginning teachers (Balagtas, 2020), is a good match for the present study. Teacher training institutions are geared towards rethinking university education to continually look for viable new models that bridge the gap and attain a balance between theory and actual teaching practice. The desired context of pre-service training to counter the problematic context of education-job mismatch is presented in Figure 1.

Figure 1

The Desired Context of Pre-Service Training that Counters Education-Job Mismatch

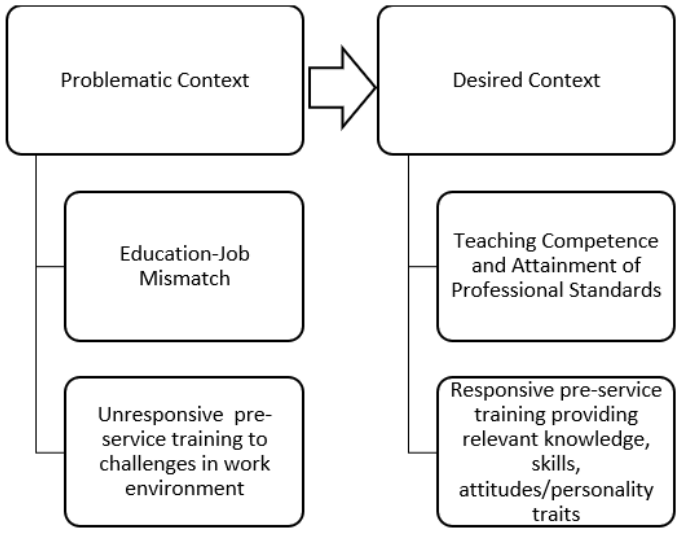


Figure 1 depicts the desired context in pre-service teacher training providing relevant knowledge, skills, and personality traits that are relevant in the actual professional teaching practice toward the attainment of professional standards in teaching competence in the target career stage. The scale that could measure the relevance of the pre-service training is the attainment of the indicators for the beginning teacher stage in the PPST.

Methodology

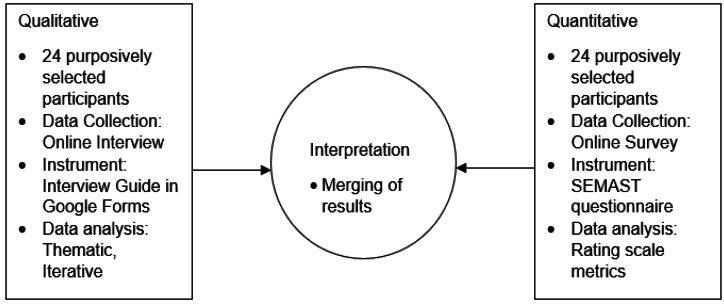
The Research Method

The triangulation in mixed research methods (JCU, 2023) was employed in this study. The qualitative data gathered through an interview was analyzed thematically according

to the contexts of the narratives. In contrast, the quantitative data gathered using the SEMAST questionnaire was analyzed on the scale of attaining the standards of a professional teacher. The resulting themes from the qualitative data and the attainment of professional standards from quantitative data were incorporated through narrative for analysis and comparison at the interpretation and reporting levels. The weaving together of the qualitative and quantitative results was done theme by theme or concept by concept. The interpretation of these two data sets was guided by the works of Creswell and Plano Clark (2017), Gogo and Musonda (2022), JCU (2023), and Fetters et al. (2013). This triangulation in mixed methods research is illustrated in Figure 2.

Figure 2

The Triangulation in Mixed-Methods of Research



The triangulation in mixed-methods research used the qualitative and quantitative results that were merged to validate and reinforce the research results. This data integration occurred in the interpretation and reporting levels of the study.

Participants and Sampling

The respondents were the first two batches of science education graduates in a state university specializing in

Biology class 2018, with 18 and 52 graduates in class 2019. There were no graduates two years after that due to K to 12 transitions (RA 10533 s. 2013). There were 41 of them employed in 2021 at the time of data gathering. The inclusion and exclusion criteria were used in the purposive selection of the participants. The inclusion criteria require that participants are program graduates employed as teachers in either public or private schools. There were 17 underemployed and categorized on the exclusion criteria. Hence, twenty-four (24) newly employed science teacher participants qualified and freely signified their informed consent before the online interviews and surveys were conducted.

Instruments

The qualitative data were gathered using an interview guide through Google Forms. The questions were: In self-assessment about professional practice as a teacher, what do you consider most essential in teaching Science? Please describe the knowledge and skills you feel are essential in teaching and what made them essential in science teaching. Have you any apprehensions in your teaching because of inadequacies? If there are, what are they; if none, why? Probing questions were likewise asked to determine which elements in teaching science they are well equipped for, how the essential elements in teaching were acquired, and how they are helpful in their teaching of science. Mobile phone calls and Facebook Messenger video calls were also used as media in the validation of the interview responses. The quantitative data was gathered using the questionnaire Self-Efficacy Metric for the Attainment of the Standards for Teachers (SEMAST) by Balagtas (2020), who developed and validated it for use through an online modality. This instrument underwent content validity by experts, and the reliability index using Cronbach Alpha was at least .85.

Data Collection

The qualitative data was gathered through online interviews using Google Forms, which were emailed to the purposely selected participants. Mobile phone calls and Facebook Messenger video calls were also used to validate responses. The quantitative data was gathered using the Self-Efficacy Metric for the Attainment of the Standards for Teachers (SEMAST) questionnaire by Balagtas (2020). This was also emailed to the participants who signed their free prior consent to join the study.

Data Analysis

First, the qualitative data from the interview responses were coded and categorized by themes and presented to the respondents and school administrators for validation. Second, the quantitative data from the SEMAST questionnaire was analyzed according to the standards' attainment level for professional teachers. Third, the qualitative and quantitative data were integrated at the interpretation and reporting levels using narratives woven together theme by theme or concept by concept toward finding key elements relevant to pre-service training. The key elements derived from the merging of data analyses and interpretations formed the factors in an audit checklist that aims to assess the readiness of pre-service science teachers for actual teaching.

Ethical Considerations

The study bears no sensitive topics that may make the respondents and the researchers vulnerable to danger. The researchers obtained the participant's informed consent before the data gathering, and the research process disclosed to the respondents made them aware of the needed data gathered. The interviews were conducted in a friendly, permissive atmosphere that allowed the participants to disclose their

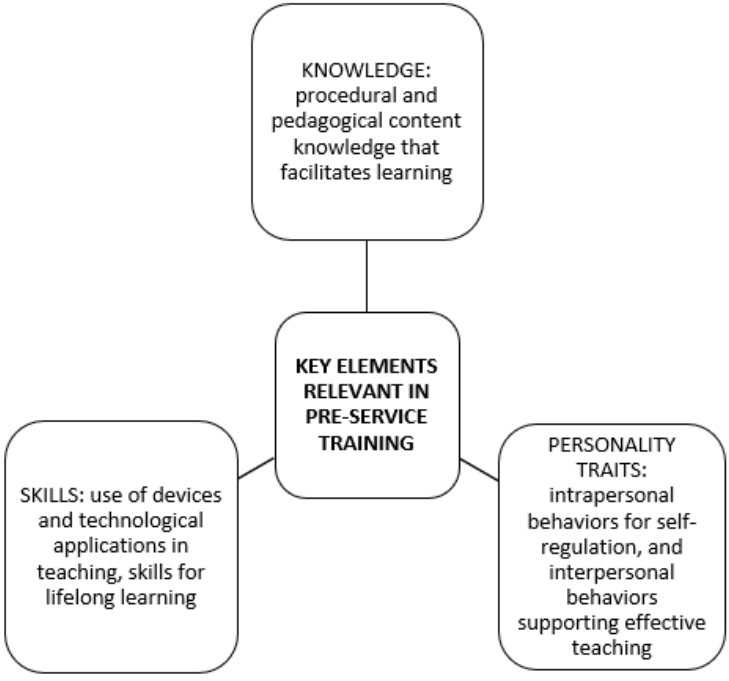
desire to equip themselves with the necessary knowledge and skills for continuing professional development willingly. The identity of the participants and the data gathered from them were handled with utmost confidentiality. Notably, the study bears no conflict of interest with the university policies in enhancing curricular programs.

Results and Discussion

The Key Elements in Pre-Service Training Relevant to Actual Professional Science Teaching

Figure 3

The Themes Determined Through Coding and Thematic Data Analysis of Interview Narratives



The essential attributes gained in pre-service training identified by the participants as relevant in their present teaching were generally categorized as knowledge, skills, and personality traits as shown in Figure 3 as a result of the thematic analysis.

Table 1 presents the knowledge category of the essential elements in pre-service training, showing the quoted responses coded and analyzed by themes. First is procedural knowledge, which facilitates learning. This involves preparing learning materials and classroom management. Second is the pedagogical content knowledge that includes metacognition, mastery of the science lessons, and knowledge of the selection and application of appropriate methods and techniques in teaching.

Table 1

Coding for Essential Knowledge

Strands of Participant (P) Responses	Data Code	Theme
• Preparing curriculum plan, lesson plan/log, teaching materials, making interactive learning materials like ESIMS, brochures, and Modules (P11, P14, P16) • Preparing activities and questions that help students relate to a lesson (P4) • It is important to have methods like giving activities and assignments (P19) • Providing activities for the acquisition of skills stated in the lesson objectives (P6) • Providing Hands-On Activities with Follow-Up (P18, P19) • Assessment of performance (P4, P10)	• Preparing instructional materials • Classroom management	• Procedural knowledge that facilitates learning,

• Learning first the context of the lesson…you cannot teach what you don't know (P11) • Teaching the standards-based science lesson (P17) • Ability to plan and organize (P24)		
• Application of science concepts in real life, how they are connected to the lesson, • Bringing the lesson into life with real-world application (P1, P4, P6, P7, P8, P15, P18, P22) • Applying many strategies which I learned in school that the students enjoyed and were having fun with during the discussion make the learning process meaningful and engaging (P5, P12). • Mastery of the lesson is essential in teaching science; learning the context/ contextualizing the lesson (P5, P8, P9, P11, P12, P16, P18) • knowledge about the contents of science and pedagogy on how to teach those contents (P9, P12, P21) • arrangements and choosing between varied techniques for imparting lessons to students (P23) • The most essential practice in teaching science for me is the use of the scientific method (P24).	• Metacognition • Mastery of the lesson • Use of methods and techniques in teaching	• Pedagogical content knowledge

These sets of knowledge (Table 1) are considered essential in practicing one's teaching task as a couple of the teacher respondents recall their struggles teaching lessons not within their area of specialization and quoted, (P16) *"Since our specialization in college is biology, I*

have trouble in teaching General Chemistry," another participant supported this statement saying, (P9) *"science contents that are beyond the corner of biology like topics in chemistry and physics that I considered higher level."* The respondents (P5, P6, P8) disclosed other similar comments as they wanted to highlight the importance of content knowledge and teaching procedures, emphasizing the crucial role of pre-service training on professional education and specialization courses in meeting the challenges in their profession (Ibad, 2018).

Table 2 presents the two other categories, the skills and personality traits. The essential skills had two themes: one is the use of devices and technological applications in teaching, and the second, is skills for lifelong learning manifested by the ability to demonstrate 21st-century skills and science process skills. The latter category (personality traits) had themes of intrapersonal behaviors for self-regulation and interpersonal behaviors supporting effective teaching.

Table 2

Coding for Essential Skills and Personality Traits

Strands of Participant (P) Responses	Data Code	Theme
Essential Skills		
• Use of computer in online teaching (P3, P11, P12, P19) • Doing simple experiments, handling laboratory apparatus (P4)	• Integrating technology in teaching	• Use of devices and technological applications in teaching
• Critical thinking (P1, P17, P18, P22) • Communication, discuss fluently while applying the different levels of inquiry; collaboration (P8, P12, P13, P22, P23)	• Demonstrating the 21st-century skills • Science Process skills	• Skills for lifelong learning

• Being creative, curious, and a problem solver (P13, P15) • Observation (P7, P22)		
Personality Traits		
• Enjoying what you're doing "always teach from the heart" and be passionate about teaching (P11, P17, P23) • Being resilient, persistence (P2, P17) • Time management (P2, P22)	• Self-regulation	• Intrapersonal behaviors for self-regulation
• Ability to remain calm in stressful situations (P13) • Being resourceful (P3, P16) • Being flexible, adaptable, efficient, and effective teacher; adapt my teaching to learners need, sensitive and responsive to your working environment (P1, P7, P14, P20) • Dedication and patience toward the learners and determination to impart knowledge (P13, P17, P19)	• Self-efficacy	• Interpersonal behaviors supporting effective teaching

The essential personality traits of beginning teachers shown in Table 2 reflect their excitement to perform their profession and their willingness to give their best for their students. Notably, the teacher-participants also mentioned some traits that are responsive to the demand in actual teaching, being resourceful, patient, flexible, adaptable, loving for teaching, and persistent. The teacher respondents, however, recognize the pressure to be more engaged in their careers , as they have mentioned their need to be passionate about their teaching and that they need to show more dedication, interest, and compassion for the work. Equally important to these personality traits is being resilient during stressful situations as Beltman (2021) explained, teacher resilience comes in four dimensions: profession-related, emotional, motivational, and

social, and the nature and sustainability of teacher resilience are embedded in the contextual influences of teachers' work and lives. Indeed, teaching is not a mechanical task but a social responsibility that requires a proper attitude to perform as a professional teacher (Ibad, 2018).

The nature of the pedagogical knowledge described by the teacher-respondents represents the metacognitive knowledge in terms of relating the lesson to real-life situations, employing teaching strategies aided with electronic gadgets and educational digital applications. Metacognitive knowledge is about learning, which plays a vital role in cognitive activities that promote a sense of independence (Biscocho, 2021; Yanyan,2010), just like how knowledge about the contents of science and pedagogy are blended for effective instruction. Also crucial to beginning teachers is the knowledge of various teaching techniques and methods. Participant numbers 5 and 12 emphasized the need to apply many strategies learned in school that students enjoy and have fun during class discussions to make the learning process meaningful and engaging. They also claim to possess other essential pedagogical knowledge of providing their students with differentiated tasks and applying different inquiry levels with diverse learners. Interestingly, the participants considered that their pre-service training made them feel ready to face the demands of their professional teaching. Reflecting on how they got equipped with the needed skills, they recognized how their pre-service training prepared them for their career, as could be deduced from the quoted statement of participant number 18 *"Because the university shaped me to be a professional teacher and gave me all the things I needed to learn and acquire to be used in the field of teaching."*

The context of knowledge revolved around course content, the ability to select and perform appropriate pedagogy for a particular lesson, and knowledge of the nature of the

curricular design of science in the K-12 program. The content knowledge covering factual and conceptual understanding had been considered vital in delivering lessons in class. Alrajeh (2021) describes this as the ability to plan, observe, develop arguments, justify, and connect concepts and ideas from different disciplines. Having sufficient knowledge of these key areas guarantees the skillful delivery of effective instruction that boils down to a positive attitude toward work. Hence, pre-service training founded on strong disciplinal content develops self-efficacy for the teaching job. However, when the workload given to a biology teacher is out of one's field, for instance, in physics or chemistry, the limited content knowledge follows having limited pedagogical knowledge as well, and, in such cases, the pre-service training and actual work assignments do not match. A biology teacher cannot be an expert in other fields, which could result in frustrations about work and burnout caused by the stressful teaching, not knowing how each session in the class may start and end with fruitful learning engagement. This psychological state, according to Prilleltensky et al. (2016, pp. 104-111) and Ugwuanyi et al. (2020, pp. 492-501), explains that one's ability to perform a particular task is related to self-efficacy while stressful and frustrating conditions erodes it and can cause feelings of dissatisfaction with jobs and more likely to blame their pre-service training (Somers et al., 2019).

Moreover, the skills are highly needed as the infusion of global standards for economic competitiveness into the education system becomes inevitable. Due to the pandemic, these skills have likewise been considered the way of life in the new normal education. The new teachers are digital natives and can comfortably work with gadgets, computer software wares, and applications. The other is focused on the importance of science teachers' critical thinking, problem-solving, communication, collaboration, creativity, and science process skills as they perform their tasks in actual teaching.

Level of Self-efficacy in the Attainment of the Beginning Teachers to the Philippine Professional Standards for Teachers (PPST)

The quantitative data represent the standards' attainment level for professional teachers aimed to validate the qualitative results. Table 3 shows the seven domains of the Philippine Professional Standards for Teachers (PPST) in the SEMAST. This tool assesses self-efficacy in meeting the beginning teacher career stage standards . The overall average attainment of 3.45, as shown in Table 3, indicates that the beginning teachers' self-efficacy demonstrates to a certain degree that they are attaining some competencies for the next career stage, which is becoming a proficient teacher. The career stage is interpreted as *developing proficient teachers.* This result means the respondents exceeded, to some degree, meeting the standards of the beginning teacher stage.

Table 3

The Level of Self-efficacy of the Beginning Teachers in the Attainment of the Philippine Professional Standards for Teachers

PPST Domain	Mean Rating (level of attainment)	Rank
Content knowledge and pedagogy	3.47	4
Learning environment	3.52	2.5
Diversity of learners	3.12	7
Curriculum and planning	3.64	1
Assessing and Reporting	3.52	2.5
Community linkages and professional engagement	3.43	6
Personal growth and professional development	3.44	5
The overall average level of attainment 3.45 *(developing proficient teacher)*		

Rating Scale: (1-3 for beginning teacher indicators) *1- demonstrate to a little extent*; 2- *can readily demonstrate to a moderate extent; 3- can readily demonstrate to a great extent;* (4-6 for Proficient teacher) *4-can readily demonstrate to a little extent; 5- can readily demonstrate to a moderate extent; 6-can readily demonstrate to a great extent*

Furthermore, the domains *Curriculum and Planning* (rank 1), *Assessment and Reporting*, and *Learning Environment* (rank 2.5) are the competencies rated by many respondents to the level of attainment for the proficient teacher. This result could imply that the pre-service training employed among the respondents during their schooling is responsive to the attainment of the standards of the PPST. The themes and concepts drawn from qualitative data, which are focused on knowledge of content and pedagogy, are comparable in scope with the results from the quantitative data specified in the domains *Curriculum and Planning, Assessment and Reporting*, *Learning Environment, Content Knowledge, and Pedagogy* (PPST Support Material, n.d.). The skills category has a similarity in scope with the domain *Diversity of Learners,* requiring the beginning teacher-participants to focus their attention on the teaching and learning processes, implementing learning with relevance to the needs of learners, using appropriate teaching and learning resources, and teaching-aided with technology enhancements. The teacher-participants also showed concerns about developing activities for appropriate assessment and securing a learning environment that enhances and motivates learning engagement through non-violent discipline. The themes under the category of personality traits involving self-regulation and teaching effectiveness are akin to professional engagement and development. Integrating the analyses of qualitative and quantitative data on the key elements relevant to pre-service training strengthens the necessity of cultivating them toward the attainment of the desired context of teaching competence and professional standards and ensuring the elimination of gaps between education-job mismatch (Kim & Choi, 2018).

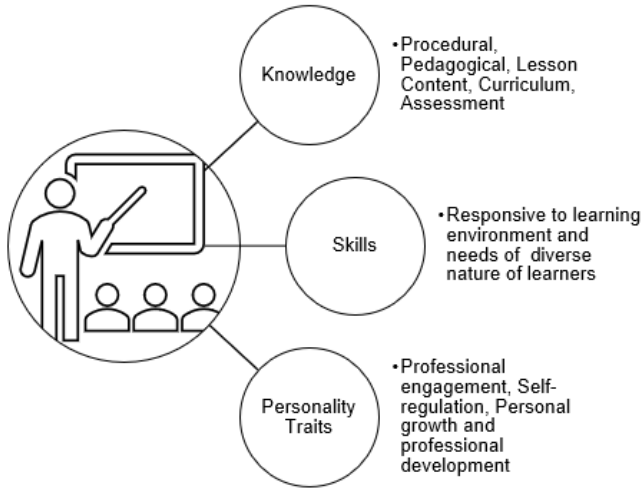
The Audit Checklist on Readiness for Professional Science Teaching

The key elements derived from the merging of data analyses and interpretations embodied in the qualitative and

quantitative data are illustrated in Figure 4, which formed the factors in an audit checklist that aims to assess the readiness of pre-service science teachers for actual teaching.

Figure 4

A Schematic Diagram of an Audit Checklist Assessing the Readiness of Pre-service Teachers for Actual Teaching



The identified key elements in pre-service training provide activity inputs on field study and student teaching courses for the science education program. Hence, one significant activity is determining entry-level readiness through self-assessment or audit describing how the attributes stated in Tables 1, 2, and 3 are demonstrated.

The level of attainment of the parameters of the seven domains of the PPST contained in the SEMAST instrument denotes the level of self-efficacy in teaching (Balagtas, 2020). It is the rating of one's belief in demonstrating the competencies of a beginning teacher primarily attained during pre-service training. Fortunately, the participants trained under OBTEC claimed to have

attained even beyond the minimum requirements for the beginning teacher career stage of the national standards for professional teachers. The entire package of OBTEC for science education undoubtedly addressed the teaching needs of science instruction in the workplace.

The OBTEC, as a possible model in pre-service training for teachers, also includes finishing school courses that allow program auditing in the three main areas as General Education courses, Professional Education, and Specialization courses (Ruscoe, 2015) through intervention activities to ensure the readiness of its graduates for the actual teaching practice. It is in this particular aspect that a self-audit using the pre-service audit checklist in assessing the readiness of the pre-service science teachers to challenges that await them in the actual workplace is necessary.

Conclusion and Recommendations

The key elements of knowledge, skills, and personality traits relevant to pre-service training identified in this study are deemed to promote teaching competence for beginning teachers. The fulfillment of these key elements, as complemented by the attainment of professional standards for beginning teachers, primarily elevates the confidence level of pre-service teachers in performing the expected job in the actual work environment. The relevance of the pre-service training rests on providing desirable knowledge, skills, and personality traits that capacitate pre-service teachers to overcome challenges in the dynamic work environment, reducing the disparity in education job mismatch.

The attainment of key elements such as procedural, pedagogical, and content knowledge and how to use devices and technological applications are essential for metacognition, where one can figure out the nature of a task that promotes a sense of independence. The skills for lifelong learning

characterized by effective communication, critical thinking, process skills, and 21st-century skills manifest future readiness for whatever challenges the work environment may offer. Equally important are the intrapersonal behaviors for self-regulation and interpersonal behaviors supporting effective teaching that are complemented by the attainment of professional teacher standards and serve as motivation to strive better as a professional teacher.

The pre-service training provided opportunities and experiences in capacitating the pre-service teachers to achieve teaching competence along the key elements, which enabled them to be responsive to the actual job requirements at par with the professional standards for beginning teachers. The attainment of professional standards for beginning teachers ensures their readiness to perform the job across the domains of professional teaching.

The overall interpretation of narratives and the level of attainment of professional standards for beginning teachers imply the responsiveness of the pre-service training provided to the participants of the study who obtained their science education degree under the Outcomes-Based Teacher Education Curriculum (OBTEC) model. These findings serve as evidence of the effectiveness of the pre-service training model that other teacher training institutions in the country can adapt.

The study, however, was limited to science teacher education training, and a similar study may be undertaken in other fields to compare the gaps between theory and practice further. It is also recommended that teacher training institutions adapt the key elements determined in this study in courses related to pre-service training for teachers, such as field study, course audit, and student teaching experiences.

This research focused on the narratives of newly hired science teachers; hence, future research directions may

consider 1) attributes of future-proof teachers in the career development stages and 2) policy research on the conduct of student teaching practicum courses.

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