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Juxtaposing Design-Based Thinking Practices of Secondary Student-Teachers During the Internship Program: Input for an Improved Pre-Service Training

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Abstract: Student-teachers need help with creating and evaluating learning resources once deployed in schools. To provide a responsive approach to deal with their situations, the present study examines the design-based thinking practices among secondary student-teachers during their internship program in various secondary schools in the divisions of Bataan and Balanga City, Province of Bataan, Philippines, as input for the improved pre-service training. The design-based thinking practices of student-teachers are examined in terms of understanding (empathizing and defining), exploring (ideating and prototyping), and materializing (testing and implementing). Likewise, the study ascertains if there are significant differences in the design-based thinking practices of student-teachers. Using the descriptive-survey design of quantitative research, the data are gathered from 172 out of 199 student-teachers under the College of Education (COEd) who are randomly selected. The primary data-gathering tool used in the study is an adopted survey questionnaire. The quantitative data gathered from the study will be analyzed using descriptive statistics (i.e., mean and standard deviation) and inferential statistics (i.e., F-test/ANOVA). Results indicate that student-teachers excelled in understanding and exploring phases of design-based thinking but lagged in 'Materializing.' To improve, pre-service training should emphasize practical design thinking applications, workshops, mentorship, technology integration, reflection, collaboration, feedback, and continuous development. At the outset, the study proposes improvements in pre-service training to guide student-teachers in their meaningful integration of design-based thinking in their internship program.

Keywords: Design-Based Thinking, Student-Teachers, Instructional Design, Secondary Schools

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INTRODUCTION

Student-teachers, as future educators, face numerous challenges when deployed to their respective cooperating schools. Many need help with strenuous tasks, particularly in selecting, designing, developing, and evaluating learning resources (Jimenez & Csee, 2020; Ogbu, 2015). Teachers, in general, need to improve the availability and quality of learning resources to ensure effective utilization (Ogbu, 2015). Moreover, educators face challenges in implementing design-based learning (DBL) and project-based learning, which can be a significant shift in the teaching and learning process (Chiu et al., 2021; Bain, 2020).

Design Thinking (DT) has emerged as a practical pedagogical approach to address these challenges. As a human-centered, iterative process, DT helps students solve real-world problems using empathy, creativity, and radical collaboration (Bene & McNeilly, 2020). DT is widely recognized as a valuable route to human-centered innovation and creative problem-solving (Kelley & Kelley, 2013). In education, DT can help future educators adopt a problem-solving mindset, uncover problems, and harness the ideas and energy of students and other stakeholders to create unique, effective solutions (Nash, 2019). Furthermore, DT can enrich teacher education by allowing students with little prior teaching experience to explore their agency as inventors in the classroom, fostering excitement and appreciation for the art of teaching (Harth & Panke, 2019).

While DT and DBL offer opportunities to support students' content understanding and improve critical thinking and problem-solving skills (Delen & Sen, 2022; Geeks for Geeks, 2022; Shanta & Wells, 2022), there are still areas that need further investigation. These include how students transfer their content gains to other situations (Delen & Sen, 2022), which dimensions of DT mindsets support conceptual learning (Ladachart et al., 2022), and the impact of DT tools on the development of creativity skills and motivation (Balakrishnan, 2022). Additionally, more research is needed to explore students' thought processes while engaging in highly complex design activities (Aranda et al., 2020). Despite these questions, design-based research is uniquely positioned to address the need to design effective learning environments (Lyon & Magana, 2021).

Moreover, the study also aimed to contribute to the United Nations' Sustainable Development Goal (SDG) No. 4: Quality Education. This goal focused on promoting lifelong learning, improving literacy and numeracy skills, and enhancing the overall quality of education globally. By examining how student-teachers used design-based thinking, the study helped develop more effective instructional design methods. This aligned with SDG 4's objective to enhance educational quality by providing strategies that empower educators to create engaging and inclusive learning environments, ultimately leading to better educational outcomes and progress toward achieving SDG 4.

Motivated by these educational realities, the researchers sought to explore design-based thinking practices among secondary student-teachers in their actual student-teaching program to inform and improve in-service training. With that, the study sought answers to the following objectives: to examine the profile of student-teachers in terms of sex, area of specialization, and location of cooperating school; to determine the design-based thinking practices of student-teachers in terms of

understanding (empathizing and defining), exploring (ideating and prototyping), and materializing (testing and implementing); to ascertain significant differences in the design-based thinking practices of student-teachers when grouped according to their profile; and to propose improvements to better provide in-service training to them.

METHODS

The study utilized the descriptive survey design of quantitative research to analyze the design-based thinking practices of secondary student-teachers during their deployment at various secondary schools in the Bataan and Balanga City divisions. The Raosoft Sampling Calculator was used to identify the exact sample among the target student-teachers. The sample size for the study is 172 out of 199 student-teachers who were randomly selected using a randomizer to participate in the study. Meanwhile, the primary data-gathering tool in the study was an adopted survey questionnaire (Pecson & Romero, 2023) with a reliability index of 0.9759, making it highly reliable among the target respondents. It contained the design-based thinking practices of student-teachers in terms of understanding (empathizing and defining), exploring (ideating and prototyping), and materializing (testing and implementing). The quantitative data gathered from the study were analyzed using descriptive statistics (i.e., mean and standard deviation) and inferential statistics (i.e., F-test/ANOVA).

RESULT AND DISCUSSION

Design-Based Thinking Practices among Student-Teachers During the Internship Program

As reflected in the results above in Table 1, student-teachers demonstrated a very high level of proficiency in design-based thinking across all domains. Specifically, they excelled in understanding (empathizing and defining), exploring (ideating and prototyping), and materializing (testing and implementing) phases, with mean scores ranging from 3.70 to 3.80 on a scale where scores above 3.5 were considered 'Very High.' The consistency in mean scores and low standard deviations (ranging from 0.48 to 0.53) indicate that the student-teachers collectively possessed strong design-based thinking skills.

TABLE 1. Design-based thinking practices among student-teachers during the internship program

Domains	Design-Based Thinking Practices		
	Mean	Std. Dev.	Interpretation
A. Understanding	3.77	0.50	Very High
A.1 Empathizing	3.74	0.51	Very High
A.2 Defining	3.80	0.48	Very High
B. Exploring	3.77	0.50	Very High
B.1 Ideating	3.77	0.50	Very High
B.2 Prototyping	3.77	0.51	Very High
C. Materializing	3.70	0.52	Very High
C.1 Testing	3.71	0.52	Very High
C.2 Implementing	3.70	0.53	Very High
Composite	**3.75**	**0.51**	**Very High**

In general, the results suggest that student-teachers have a strong practice engagement in design-based thinking and put their intention into practice. The results also suggest that the integration of design thinking in their training has been effective and that these future educators are well-equipped to create innovative, human-centered solutions in their classrooms, aligning with the goals of quality education as outlined in SDG 4.

The findings of this study align with existing literature that highlights the potential of design thinking in education. The high proficiency in design-based thinking domains among student-teachers echoes the assertions of Lyon and Magana (2021), who noted that design-based thinking can address the need to create effective learning environments. The student-teachers strong performance in understanding, exploring, and materializing phases indicates that they are well-prepared to develop innovative and human-centered

solutions, a key aspect emphasized by design thinking proponents (Kelley & Kelley, 2013).

Significant Difference in Design-Based Thinking Practices of Student-Teachers During the Internship Program

TABLE 2. Significant difference in design-based thinking practices of student-teachers during the internship program

Domains	Mean	SD	F-value	p-value	Remarks | Decision
Understanding	3.77	0.50			
Exploring	3.77	0.50	5.35	0.02	Significant Reject H_0
Materializing	3.70	0.52			

Based on the data presented in Table 2, a significant difference was found in the design-based thinking practices among student-teachers. With a t-value of 5.35 and a p-value of 0.02, given that the p-value is less than the typical alpha level of 0.05, the null hypothesis (H_0) was rejected. The student-teachers are observed to perform more highly in the domains of "Understanding" and "Exploring" than "Materializing." This finding suggests that while student-teachers excel in empathizing, defining, ideating, and prototyping, they may require additional support and training in the areas of testing and implementing their ideas. Enhancing their skills in the "Materializing" domain could further empower them to create more effective and impactful educational solutions, ultimately contributing to the overall improvement of educational quality.

These differences may exist because there is still a need to determine which dimensions of design thinking practices support conceptual learning, as noted by Ladachart et al. (2022). This is consistent with the observations of Aranda et al. (2020), who noted the need for further research to understand students' thought processes during complex design activities. Addressing these areas can help refine pre-service training programs to better prepare future educators for the demands of their roles.

Proposed Improvements in Pre-Service Training

Considering the findings of the study, the following improvements are presented for the pre-service training to prepare student-teachers better to excel in their roles as future educators, ultimately enhancing the quality of education.

Strengthen Design Thinking Integration. Enhance the curriculum to include more practical and real-world applications of design thinking, ensuring student-teachers are well-versed in all phases, particularly 'Materializing.'

Resource Development Workshops. Conduct workshops focused on selecting, designing, developing, and evaluating learning resources better to prepare student-teachers for the demands of their future roles.

Mentorship Programs. Establish mentorship programs that pair student-teachers with experienced educators, providing guidance and support as they navigate their initial teaching experiences.

Technological Integration. Incorporate training on leveraging technology for instructional design, ensuring student-teachers are equipped to create innovative and engaging learning environments.

Reflective Practice Sessions. Implement regular reflective practice sessions to encourage student-teachers to critically evaluate their teaching methods and continuously improve their instructional strategies.

Collaborative Projects. Foster collaborative projects among student-teachers to promote teamwork, creativity, and the sharing of best practices in design-based thinking.

Feedback Mechanisms. Develop meaningful feedback mechanisms that allow student-teachers to receive constructive criticism and support from both peers and instructors, aiding in their professional growth.

Continuous Professional Development. Encourage ongoing

professional development opportunities, including workshops, seminars, and online courses, to keep student-teachers updated with the latest educational trends and practices.

CONCLUSION

Student-teachers demonstrated a very high level of proficiency in design-based thinking across all domains, with notable strengths in understanding and exploring phases. However, a significant difference was found in their practices, with the 'Materializing' domain lagging slightly behind. This indicates a need for additional support and training in testing and implementing ideas. To better prepare student-teachers, pre-service training should emphasize practical applications of design thinking, resource development workshops, mentorship programs, technological integration, reflective practice sessions, collaborative projects, meaningful feedback mechanisms, and continuous professional development opportunities.

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