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CONTEXT-BASED MODULAR LEARNING AND MATHEMATICS SELF-EFFICACY: EVIDENCE FROM THE RREEDE INSTRUCTIONAL MODEL IN THE OPEN HIGH SCHOOL PROGRAM

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Abstract

The effect of a developed and used instructional module integrating a context-based instructional model on the mathematics self-efficacy of grade eight students in the Open High School Program (OHSP) was investigated in this study. Modules were designed using the RREEDE model: Review, Real-life Context Activity, Examine, Engage, Derive, and Evaluation, to promote meaningful and reflective learning experiences. Employing a quasi-experimental one-group pretest–posttest design, 30 OHSP students participated in the study. In measuring students' confidence in learning mathematics, the Mathematics Self-Efficacy Scale (MSES) established by Pajares and Usher (2009) was used. Self-efficacy scores increased considerably after exposure to the RREEDE-based module, going from the mean (M) of 2.43 and standard deviation (SD) of 0.60 in the pretest to M equals 3.72 and SD equal to 0.48 in the posttest ($p < .001$). The large computed effect size of Cohen's *d,* which is equal to 2.38, indicates that the RREEDE-based model of instruction increased the mathematical self-efficacy of grade 8 OHSP students. It is possible to successfully increase students' enthusiasm and confidence in mathematics through context-based modular learning. More and a wider range of respondents should be the target of future studies exploring the impact of the RREEDE model in various educational contexts.

Key Words and Phrases: Open High School Program, modular education, context-based learning, RREEDE model, and mathematical self-efficacy.

Introduction

For a long time, when you asked students about mathematics, they would always say that it is difficult and one of the toughest subjects taught in schools. This subject implies analytical problem-solving, critical reasoning, and logical thinking. Its content extends beyond the confines of the classroom and integrates into real-world situations. Mostly, students in math feel anxious, not confident, and unmotivated. In the Philippines, an Open High School Program (OHSP) is offered as a substitute program for students who cannot attend the regular school program. In flexible school systems like the OHSP, students' difficulties in dealing with math become more apparent. Through modules, OHSP enables students to learn on their own with little teacher intervention. In these situations, students'

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self-efficacy, or the confidence that they can learn, is of great importance because it will determine their success.

Self-efficacy is defined as an individual's confidence in his or her ability to organize and accomplish the required tasks to achieve certain goals (Bandura, 1997). As Lunenburg (2011) said, self-efficacy impacts how students respond to challenges, how hard they strive to persevere, and how they tackle math problems positively. There is a direct connection between instances, as low self-efficacy results in avoidance and disengagement, and consequently, high self-efficacy results in persistence and involvement. Therefore, the meaning and essence of effective teaching and learning is to enhance students' mathematical self-efficacy, especially in self-directed learning contexts such as in the OHSP. Studies and research show that teaching strategies that emphasize context, reflection, and student independence are of tremendous help for enhancing self-efficacy. Contextual learning makes abstract and intangible mathematical principles relevant in everyday situations so that students can see the application (Ulusoy & Önen, 2014). Hasanah, Purwanto, and Lestari (2022) demonstrated that contextualized instruction enhances students' confidence in their abilities, while Tran and Vu (2020) identified that modular instruction incorporating reflection boosts motivation and confidence. Likewise, Zulnaidi and Zakaria (2019) illustrated that the infusion of real-world applications and interactive procedures encourages an eminent feeling of mathematical capability.

Based on these discoveries, this research developed and implemented an instructional module using the RREEDE model, which stands for Review, Real-life Context Activity, Examine, Engage, Derive, and Evaluation. The RREEDE model incorporates contextualized instruction and reflective engagement to foster understanding and self-efficacy. Through real-life contexts and scaffolded reflection, it seeks to empower learners to see mathematics as relevant and possible.

Although there has been work on context-based and modular learning, their interaction in influencing the self-efficacy of students in flexible learning systems such as the OHSP has not been widely studied. This study aims to fill in the gap by examining the influence of an RREEDE-based module on the mathematics self-efficacy of OHSP grade eight learners. The outcomes should augment the existing works on the instructional design for self-paced learners and provide mathematics teachers with insights into how they can support confidence in learning.

Review of Related Literature and Conceptual Framework

Context-Based Instruction in Mathematics

Context-based learning in mathematics is a method of teaching that relates mathematical principles to real-life situations to make learning more meaningful, significant, and applicable. The study of Ulusoy and Önen (2014) posits that context-based learning enhances learners' enthusiasm and self-confidence by connecting abstract concepts with real-world experiences. Current studies (Hasanah, Purwanto, & Lestari, 2022; Tran & Vu, 2020) have indicated that

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contextual learning improves students' problem-solving skills, self-efficacy, and motivation towards mathematics. Students tend to put in effort and persist in the learning process when they see that the learning contents are relevant and practical (Zulnaidi & Zakaria, 2019).

In the Philippine setting, the OHSP under the Department of Education is specifically designed for students who have special considerations and prefer a flexible learning pathway. In OHSP, the mode of learning is that students usually learn as independent individuals through modular instruction. It can therefore be inferred that the presence of context-based activities becomes even more important to maintain motivation and comprehension of concepts for the students. To be of help to this pressing need, modules that are designed with context-based learning around real-life applications, like the RREEDE model, provide room for students to actively relate mathematical concepts to real-life situations, thus improving comprehension as well as self-confidence.

Modular Instruction and Self-Paced Learning

In modular instruction, students are expected to learn concepts and ideas at their own pace and on their own time, since the method promotes self-directed and personalized learning. Modular instruction allows room for the quick thinkers and those who take some time. According to Lim (2016), this teaching approach helps learners to better comprehend lessons and solve problems more effectively once teachers guide students with useful feedback. Also, Ambayon (2020) found that using modules encourages students to take charge of their learning. Still, since math lessons often build on what came before, it works best when teachers can offer enough feedback and support. Moreover, how the modules are written and organized becomes vital in sustaining students' interest and helping them master each topic, especially for those enrolled in OHSP, since face-to-face meetings are limited.

Mathematics Self-Efficacy

According to Bandura's (1997) Social Cognitive Theory, self-efficacy denotes a person's belief in his or her capability to do tasks well and perform efficiently. Self-efficacy in mathematics is considered important to learners' academic success, persistence, and recovery from failure (Lunenburg, 2011). Learners with a high mark of mathematics self-efficacy view challenging tasks as an opportunity to deploy problem-solving strategies and are resilient in the face of failure. The studies of Hasanah et al. (2022) and Tran & Vu (2020) further indicate an increase in positive self-beliefs and confidence while working with models of instruction that integrate reflection and real-life contexts. When mathematical ideas are related to something with which students are more familiar and are applied in real-life situations, then they become less anxious and feel capable of success in doing the tasks (Zulnaidi & Zakaria, 2019).

Development of self-efficacy is even more important in the Open High School Program, as most of the learning is modular and self-paced. In this respect, modules with reflective activities, such as "sharing of thoughts" or "finding a secret message," in the RREEDE model, can allow learners to express themselves and reflect on their progress so that they feel more confident but less stressed.

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Evidence from research continues to support the notion that teaching strategies that emphasize context and reflection bear the potential to enhance not only mathematics performance but also students' self-efficacy. Context-based instruction lets the learners relate theory to real-life applications, while modular learning allows flexibility in the pace for learners. According to the RREEDE model, each of those features is representative of present trends within education toward more learner-centered and contextualized instruction. It is with this theoretical and empirical background that this present study investigates changes in mathematics self-efficacy among grade eight OHSP students after a context-based modular intervention.

Conceptual Framework

This research is supported by Bandura's Social Cognitive Theory, 1997, especially the self-efficacy theory, which states that one's confidence in her or his capability in doing something influences effort, persistence, and achievement. The students' self-efficacy controls their coping strategies and motivation during learning. Contextualized and structured learning experiences successfully strengthen students' self-efficacy, which will lead to better performance.

In this study, the teaching approach is the RREEDE model, embedding features such as context-based learning with reflective practice and performance-based assessment. The model starts by recalling previous knowledge, then provides a real-world context to ignite learning, proceeds to exploration and involvement through activities, and ends with reflection and evaluation. This methodical yet adaptive process aims to foster conceptual knowledge and positive approaches to learning.

The model for study input–process–output is as follows: Input: Developed RREEDE-based learning modules on mathematics, i.e., Triangle Congruence; baseline data on students' self-efficacy. Process: Modular instruction implementation using the modules in the OHSP setting is emphasized, focusing on contextual and reflective learning activities. Output: Improved and enhanced self-efficacy among grade eight OHSP students.

This conceptual connection presupposes that contact with the RREEDE-based module will result in quantifiably improved mathematics self-efficacy.

Methodology

Research Design

A quasi-experimental one-group pretest–posttest design was applied to identify the effect of the constructed instructional module incorporating the RREEDE model on the self-efficacy of grade eight learners enrolled in the OHSP. This type of design was considered suitable because participants were already members of an intact group, and random assignment was impractical in the school environment. The design enabled the researcher to measure the changes in the dependent variables, students' mathematics self-efficacy, pre- and post-exposure to the designed module.

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In this design, the pretest was directed to see the students' baseline level of mathematics self-efficacy before the intervention. The treatment phase involved implementing the developed RREEDE-based modules in lecturing on the Triangle Congruence topic. After the intervention, a posttest was conducted to assess any change in the measured variables. The posttest data were compared to the pretest data using paired sample t-tests to determine whether the observed changes were significant.

The one-group pretest–posttest quasi-experimental design was applicable in this research because it enabled the assessment of the immediate impact of the module developed on the same cohort of students across time. According to Dulock (1993), this design is useful in capturing change and assessing the effect of an intervention when there is no practicable or ethical option for control groups. In addition, this method is consistent with the kind of research on educational development that tends to prioritize practical classroom application and successive testing of teaching materials over rigorous experimental control. The design also supports the qualitative part of the study, where students' answers and comments were examined to account for how the module helped them develop their enhanced self-efficacy.

Participants

The participants of this study were the grade eight OHSP students who enrolled for the school year 2020- 2021 at Bukidnon National School of Home Industries (BNSHI), District of Maramag 2, Bukidnon, Philippines. These students are between fourteen to sixteen years old. Some are working students who are assigned to look after their younger siblings and cannot go to school every day. The houses of some students are far away from school, and they cannot afford the daily fare. Within twenty-two (22) barangays in the municipality of Maramag, only in BNSHI is the OHSP being delivered. Therefore, these students participate in the OHSP because this program is more manageable and better suited to their needs.

Instruments

The Mathematics Self-Efficacy Scale (MSES) of Usher and Pajares (2009) was utilized to assess students' beliefs about themselves. Permission to utilize the tool was granted by Ms. Ellen Usher. There are 24 items in the MSES, each represented on a five-point Likert scale: 1 for strongly disagree, 2 for disagree, 3 for undecided, 4 for agree, and 5 for strongly agree. The tool had previously been pilot tested by Saligumba and Tan (2018) with grade nine students, obtaining a Cronbach's alpha value of 0.87, which reflects high reliability. Gay, Mills, and Airasian (2012) and Creswell and Creswell (2018) stated that instruments that were validated in the previous five to ten years can be reused without re-pilot testing, as long as the population and setting are similar. Therefore, due to the similarity of participants and setting, the MSES was considered valid for application in this research.

Data Analysis Procedures

The information collected with the MSES was coded, organized, and examined with the use of both descriptive and inferential statistical analysis. The mean and standard deviation were

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analyzed as descriptive statistics to identify the levels of mathematics self-efficacy of the students prior to and following the use of the RREEDE-based module. The mean scores were interpreted using the predetermined scale ranges: 4.50 to 5.00 as very high, 3.50 to 4.49 as high, 2.50 to 3.49 as moderate, 1.50 to 2.49 as low, and 1.00 to 1.49 as very low. These descriptive statistics gave a general indication of the students' self-confidence in carrying out mathematical tasks before and after the intervention.

To test if there was a statistically substantial difference between the posttest from the pretest data of self-efficacy, the researcher used the paired sample t-test at a 0.05 significance level. This test was apt since the same participants were measured on two occasions, pre-exposure to and post-exposure to the treatment, making it possible to test for change over time (Creswell & Creswell, 2018). The t-test also compared the mean scores of the posttest and pretest to see if the improvement in mathematics self-efficacy was statistically significant and not by chance.

Consequently, using the Cohen's (1988) reference, with the following descriptors such as 0.20 as small, 0.50 as medium, and 0.80 as large, the effect size was calculated and interpreted to measure the size of the difference in the pretest and posttest means. To deliver an additional comprehensive assessment of the practical significance of the RREEDE-based module on participants' mathematics self-efficacy, both significance and effect size were reported.

In addition, qualitative feedback was also collected, which complemented the quantitative data from the “reflection” and “sharing” parts of the module. It is worth noting that the qualitative data exposed how the context-based and reflective learning activities contributed to the mathematical self-efficacy of the students. Through the combination of both statistical and qualitative analyses, the development in students' self-confidence and views on their mathematical capabilities was explained.

Results and Discussion

Table 1 below reveals that students’ mathematics self-efficacy improved markedly after using the RREEDE-based module.

Table 1: Descriptive Statistics of the Pretest and Posttest Self-efficacy Scores

Test	N	Mean	SD	Descriptive Rating
Pretest	30	2.43	0.60	Low
Posttest	30	3.72	0.48	High

Note. Ratings based on scale interpretation: 1.00–1.49 (Very Low), 1.50–2.49 (Low), 2.50–3.49 (Moderate), 3.50–4.49 (High), 4.50–5.00 (Very High).

As indicated, the self-efficacy of the students was improved from a low level of mean equals 2.43 and standard deviation equals 0.60 prior to the intervention to a high level of mean equals 3.72 and standard deviation equals 0.48 after the intervention, showing improvement after being exposed to the RREEDE-based module.

The result is shown in Table 2 below, determining whether the difference between the posttest

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and the pretest mean scores was statistically significant.

Table 2: Paired Sample t-Test Results for Self-Efficacy Scores

Comparison	Mean Difference	*t*	*df*	*p*-value	Effect Size (Cohen's *d*)
Pretest–Posttest	1.29	14.82	29	< .001	2.38

Note. A significant difference was observed between pretest and posttest self-efficacy scores, indicating a large positive effect of the RREEDE-based module.

Notably, the t-test on the paired samples also displayed a substantial increase in math self-efficacy when exposed to the RREEDE-based module ($p < .001$). The effect size was calculated to be very large (Cohen's $d = 2.38$), which means that the intervention using the context-based modules was effective in improving students' beliefs in their math capabilities.

Qualitative feedback supported these quantitative results. A closer examination of twenty (20) randomly sampled modules showed that the parts on "Finding a Secret Message" and "Sharing of Thoughts/Experiences" were most fully completed by the students, at accomplishment rates of 100% and 91%, respectively. The activities in these sections necessitate students to contemplate and articulate their emotions, allowing them to link their understanding of mathematics to their personal experiences. Collectively, students' written comments showed perseverance, hope, and growing confidence. It is emphasized that such reflection activities tend to lessen academic anxiety and build positive self-concepts, therefore promoting self-efficacy (Ulusoy & Önen, 2014; Lunenburg, 2011).

Many studies confirm that context-centered learning environments greatly promote learners' mathematics confidence and self-efficacy. To mention, the study of Hasanah et al. (2022) established that contextualized instruction enhances students' problem-solving confidence and persistence. Likewise, Tran and Vu (2020) identified that meaningful and reflective involvement in modular activities enhances mathematical self-efficacy through higher metacognitive awareness. In addition, Zulnaidi and Zakaria (2019) stressed that contextual tasks used in real life not only enhance cognitive achievement but also foster learners' emotional resilience and motivation for mathematics. As a whole, these findings support the current study's results that incorporating context-based and reflective activities, like those incorporated in the RREEDE model, can significantly enhance students' mathematics self-efficacy by enhancing both cognitive mastery and positive affective experiences.

Conclusions

This research is establishing the impact of the developed module, which incorporates a context-based model of instruction, on the mathematics self-efficacy of OHSP grade eight students. This study revealed that the developed modules based on the Review–Real-life Context Activity–Examine–Engage–Derive–Evaluation (RREEDE) model had the potential to enhance

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the self-efficacy of OHSP grade eight students. Thus, the RREEDE-based modules are good instructional tools for improving students' confidence in mathematics, especially in the subject of triangle congruence.

Recommendations

Grade eight OHSP teachers are encouraged to employ the constructed RREEDE-based modules in teaching the subject of Triangle Congruence. Using modular instruction, teachers must closely observe the progress of students and offer appropriate and timely feedback as soon as possible. Students must be informed of their performance in the previous module before receiving a new one, as mathematics lessons build on each other. To ensure mastery of each topic, teachers must issue modules one by one and test students upon completion of each module. Students who have not attained the required competency should be given a chance to take the module again and go through the activities offered.

In addition, future researchers are invited to replicate this study using the modules developed with another group of grade eight OHSP students or regular students to validate further and solidify the findings of this investigation. Further research can also be conducted to examine students' attitudes and behaviors in modular learning situations. Lastly, mathematics teachers can opt to utilize the RREEDE model as a teaching method not just in modular learning but also in classroom instruction to promote students' participation, mental grasp of ideas, and overall learning experience.

Limitations and Future Research

Only a small sample of grade eight OHSP students from one institution participated in this research. Therefore, the results may not be applicable to all groups of learners. Future research should aim to use broad and diverse samples to study the RREEDE model's effect on different educational settings. Researchers should also look into long-term effects on self-efficacy and study its association with other affective constructs, such as motivation and resilience in mathematics.

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