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Digital Game-Based Learning Tool in Improving the Least Mastered Competencies of TLE 8 Students

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A B S T R A C T

The study Digital Game-Based Learning Tool In Improving The Least Mastered Competencies Of (TLE 8) Students was based on the integration of Technology and Livelihood Education in the Philippines' K-12 curriculum which aimed to equip students with the necessary skills and knowledge in TLE which included Grade students taking up Bread and Pastry Production Exploratory Subjects enrolled at Marinduque National High School S.Y. 2024 -2025. The researcher aimed to determine the profile of the respondents according to age, gender and socio-economic status. It also aimed to show the competence level of the students in the least mastered competencies before and after exposure to the three digital game-based activities in terms of use of tools and baking equipment and performance in mensuration and calculation. Furthermore, it wanted to distinguish if there is any significant difference in the pretest and posttest scores of the students in the least mastered competencies after exposure to the game-based activities. The researcher used a Quantitative Quasi-Experimental approach.

The results of the study state that majority of the respondents were between 14 to 15 years of age; 58.7% were female; thirteen or 28.3% of the respondents earned P10,001 – P15,000; 32.6% of the mothers of the respondents are high school graduates while 34.8% of the fathers graduated from college. On the occupation of parents, twenty-seven or 58.7% of mothers while twenty-six or 56.5% of fathers are self-employed.

The competence level of the students in the least mastered competencies after exposure improved with 95.6% against 58.7%. On the other hand, after use of digital game-based learning tools, the respondents with thirty-two or 69.6% had low mastery; eleven or 23.9% were moving toward mastery and lastly three or 6.5% mastered the competence. The significant difference in the Pre-test and Post-test scores of the respondents on the least mastered competencies showed a highly significant difference between the scores on the Pre Test and Post Test after exposure to digital game-based learning tools.

Based on Perform mensuration and calculation, there is a highly significant difference between scores of students before and after using game-based learning.

Keywords: least mastered competencies, digital game-based activities, mensuration and calculation

1. Introduction

The COVID-19 pandemic formed the need to enhance education forever. The impact of the pandemic moved the school to be responsive to the changing times. Teachers are obliged to improve their knowledge and skills in learning the new normal set-up of education. (Santos & Bantog, 2023)

According to the study of Valleccera & Basal (2024), students lack perseverance and attention in undertaking their tasks in Bread and Pastry Production. Students are assigned tasks to show their talent and gain the necessary skill, however, to delay in performing it which results to a poor performance and skill acquisition.

According to Abbott (2015), the 21st century skills are a wide array of information, skills, work ethics and character traits that are useful in today's accomplishment. They include learning and innovation skills which refer to originality, novelty, critical thinking, problem solving, communication and collaboration; and life and career skills which refers to flexibility and adaptability, and leadership and responsibility (P21 Framework Definitions, 2015). With these skills, individuals are prepared through the application of skills in daily use in analyzing information, making decisions and creating collaborative ideas to live and work in real life. According to Garduque (2012), skills are used in business, occupation and vocations which usually aim at practical application of what was learned from school. Practical skills is the application of the gained knowledge in making actual jobs or occupation to make it easier. In addition, Garduque emphasized that learning theories on concepts of knowledge are not enough because there is a need to have skills to perform, thus the importance of; technical and livelihood programs may help the students and graduates to become skilled workers of the future. Based on TESDA (2004), Bread and Pastry Production has various skills that can be developed through proper training. Three of which are the training, making

of baked products and cleaning and maintenance. It was believed that through competency-based curriculum it is easier for the students to learn and acquire skills for it is in demonstration approach.

However, nowadays students have little familiarity with the food preparation experience at home that resulted in unequipped individuals in food preparation. Food preparation can be developed through a school curriculum that involves individuals in practical activity in preparing the ingredients. Studies show that there is a need to provide opportunities for the students to practice and apply practical food preparation and baking skills. Beets (2007) concluded that through the given chances there is a noteworthy improvement in perceiving baking skills and knowledge of techniques in preparation. However, Lichtenstein & Ludwig (2010), stated that instruction in basic food preparation skills needs to be part of a long-term solution to fully manifest the skill.

Recent research on motivation of K-12 students shown alarming trend; students' interest in school tends to decline over time, with low achievers showing lower interest overall than high achievers (Lepper, Corpus, & Iyengar, 2005). Moreover, Hofer and Bendixen (2012) hypothesize that age is a factor that is critical in the development of a students' interest. It may change over the years and may affect the goals he or she is aiming for. Hence, the loss of interest in school matters is essential when students go to secondary school. Given this reality then, the teacher's greatest task is to provide learners whose interest levels differ and may vary from mood to mood.

Thus, the application of game-based learning is necessary in order to keep up with the times and interest of the students. According to Boctor (2013), the process by which the game-based learning approach supports learning comprises two steps: First, games can inspire students and use it in decision-making procedures; and second, students can test the outcomes which change based on the choices and decisions they make. It also allows students to communicate with other participants and discuss game-related moves; this improves social association skills.

INDEPENDENT VARIABLES
Digital Game Based Activities
Quizizz
Wordwall
Quizlet

DEPENDENT VARIABLES
Improved Competencies in TLE-BPP:
Use of Tools and Baking Equipment
Mensuration and Calculation

Figure 1: Research Framework

1.1 Research Problem

The integration of Technology and Livelihood Education (TLE) in the Philippines' K-12 curriculum aims to equip students with the necessary skills and knowledge in Technology and Livelihood Education. However, some competencies in TLE subjects remain the least mastered among students, indicating a need for more effective teaching strategies. As such, this study aims to investigate the effectiveness of Digital game-based learning tools in improving the least mastered competencies in Technology and Livelihood Education (TLE) 8. Specifically, the study sought to answer the following questions:

1. What is the profile of the respondents in terms of:

1.1 age; and

1.2. gender,

1.3.socio economics status, according to:

1.3.1 family income;

1.3.2 educational attainment;

1.3.3 educational attainment of parents and

1.3.4 parents' occupation?

2. What is the competence level of the students in the least mastered competencies before and after exposing them to the three digital game-based activities in terms of:

2.1 use of tools and baking equipment and

2.2 perform mensuration and calculation?

3. Is there any significant difference in the pretest and posttest scores of the students in the least mastered competencies after exposure to the game-based activities?

1.2. Materials and Methods

In gathering pertinent data and information on the questions posited in the study, the researcher employed a Quantitative Quasi-Experimental approach. The study was conducted using one group which took a pre-test then the respondents were exposed to digital game-based activities based on baking and pastry production. The respondents were given a post-test to determine if the performance of TLE students in BPP improved

The Grade 8 students taking up Bread and Pastry Production Exploratory Subject enrolled at Marinduque National High School S.Y. 2024 – 2025 served as respondents of the study.

The population for this study consisted of all students enrolled in Grade 8 Bread and Pastry Production at Marinduque National High School. A quasi-experimental design was employed, selecting one intact section comprising 45 students as the sample. This section was chosen based on the result of their Periodical Examination resulting in a Low mastery level.

The research instrument used the digital game-based learning activities which was designed by the researcher. This digital based-learning activity was used for teaching Bread and Pastry as an exploratory subject for Grade 8 in learning TLE. The activities were aligned to the Most Essential Learning Competencies of TLE 8. The instruments were subjected for the content validity and to the test of reliability to ensure that data are sound and replicable, and the results are accurate. The evidence of validity and reliability are prerequisite to assure the integrity and quality of a measurement instrument (Kimberlin & Wintersteing, 2008)

After the periodical test, the test result was analyzed, the percentage of correct response was computed to determine the mastery of the topics. The section that got the low mastery level was considered the subjects of the study. They were given a pre-test. Then they were exposed to the game-based activity made by the researcher. After exposure, the respondents were given a post-test to identify if there is an improvement in the learning ability of the respondents.

Inferential statistical tools were employed to analyze the collected data. For the profile of the respondents and the competence level of the students in the least mastered competencies before and after the implementation of the three-digital game-based activities, which involved descriptive questions, frequency and percentage. To determine the significant difference between the pretest and posttest scores of students in the least mastered competencies after exposure to game-based activities, a one-sample t-test was applied.

2. Results and Discussion

Table 1 - Distribution of Respondents by Age

Age	Frequency	Percent
12-13	17	37.0
14-15	28	60.9
16 and above	1	2.2
Total	46	100

Table 1 shows that the majority of the respondents were between 14 to 15 years of age with a frequency of 28 and a percentage of 60.9, followed by aged 12-13 with a frequency of 17 and a percentage of 37.0. The last age group is 16 and above with a frequency of 1 and a percentage of 2.2.

Table 2. Distribution of Respondents by Gender

Gender	Frequency	Percent
Male	19	41.3
Female	27	58.7
Total	46	100

As seen above, there are twenty-seven female respondents (58.7%) and nineteen male respondents (41.3%) which total to forty-six respondents.

Gender differences in students' self-efficacy are important to consider, as prior research has shown a positive correlation between self-efficacy and digital skills in secondary school students (Rohatgi et al., 2016). Understanding how self-efficacy varies between genders can provide valuable insights into how students engage with digital tools and technologies, potentially influencing the design of more inclusive and effective learning strategies. Meta-analyses on gender Differences in students' self-efficacy suggest that boys tend to have higher self-efficacy beliefs compared to girls ($g = 0.18$; Cai et al., 2017). However, the magnitude of these differences varies across different geographical regions ($g = -0.01$ to 0.34). The factors that could explain these regional variations in gender gaps in self-efficacy have not been thoroughly explored, leaving unanswered questions about whether cultural, economic, and social factors contribute to these differences and how they relate to students' digital skills.

Additionally, in a study by Aguilar-Cruz et al. (2023), gender was found to be a significant predictor of the outcomes of a Game-Based Learning (GBL) intervention. Male participants outperformed female participants in post-test results, suggesting that they had greater learning gains. Interviews revealed that male participants were highly motivated and felt encouraged by their participation in the GBL intervention, whereas female participants expressed more disinterest. Many female participants reported that they disliked the time limit in the game and found the increasing difficulty stressful. As a result, some of them gave up or felt frustrated with the game.

Table 3. Distribution of Respondents by Family Income

Family Income	Frequency	Percent
Below P 10,000	12	26.1
P 10,001-P15,000	13	28.3
P15,001 - P 20,000	9	19.6
P 20,001 - P 25,000	7	15.2
above P 25,000	5	10.9
Total	46	100

Table 3 shows that thirteen or 28.3% of the respondents earn P10,001 – P15,000; twelve or 26.1% earned below P10,000; while nine or 19.6% of respondents earned P15,001 – P20,000; followed by seven or 15.2% with an earning of P20,001-P25,000; and lastly, five or 10.9% earned above P25,000.

According to the study by Aguilar-Cruz et al. (2023), it is often assumed that students from better family conditions (such as living with both parents and having strong economic resources) have more opportunities and better access to quality learning. However, the findings of this study suggest that participants from better family conditions actually performed worse in Game-Based Learning (GBL) compared to their peers.

However, according to Ampofo, et.al. (2024), achieving great academic performance as a student can be greatly complicated for many who don't have a low-income background (Hassan et. Al, 2020) cited from Adzido (2016) added that family income level features a positive relationship on students' academic performance.

According to LI & Qiu (2018), the family income often impacted children's standing in school, peer's perceptions, stability in the community, and the safety of their families, and the impact on educational goals, which are all three key factors that were involved in determining a child's later success in life.

Thus, it shows that family income is a factor in the performance of the student because if they cannot afford to buy an electronic device for the student to use, then the student will not be able to follow through with the lesson that needs to be done.

Table 4. Distribution of Respondents by Educational Attainment of Parents

Educational Attainment	Mother		Father	
	Frequency	Percent	Frequency	Percent
Elementary Undergraduate	7	15.2	-	-
Elementary Graduate	1	2.2	2	4.3
High School Undergraduate	4	8.7	5	10.9
High School Graduate	15	32.6	16	34.8
College Undergraduate	6	13.0	7	15.2
College Graduate	13	28.3	16	34.8
Total	46	100	46	100

Table 4 shows that fifteen or 32.6% of the mothers of the respondents are high school graduate, thirteen or 28.3% are college graduate, seven or 15.2% are elementary undergraduate, six or 13% are college undergraduate, four or 8.7% are high school undergraduate and the remaining one or 2.2% is an elementary graduate. On the other hand, sixteen or 34.8% graduated from college, same as with the high school graduate. Seven or 15.2% are college undergraduate, five or 10.9% are high school undergraduate, and two or 4.3% are elementary graduates.

Despite (Ampofo, 2024) the fact that the different range of educational abilities among parents, all developed countries have the same conclusion: There is evidence of a great impact of the level of parents' education on their children's academic success in all developed countries. Additionally, (Li & Qiu, 2018) cited from Dekar (2012) concluding in his study that the academic level of parents influences their children's success in class. This also emphasized that parents' educational background and therefore the effects on students' academic performance indicated a positive significant relationship. This adds

to the evidence that students whose parents have at least a college degree do, on average, perform well in assessments of literacy, arithmetic, and science knowledge. Thus, students from developed countries averaged seven percentage points more in their age-adjusted scores on creativity, whereas those from low- or middle-income countries averaged 45 points more on their standardized scores. Parents' education has traditionally been described as a source of direct and obvious benefits to children's achievements. Students seem to be helped the best by those of better educational backgrounds. This suggests that students are inspired by their benefactors, and have greater expectations about themselves because their capabilities and outcomes are based on their parent's level of education. Nonetheless, most writers and researchers on the subject educational level of parents in relation with academic performance of their wards stressed more on the facts that, parents with higher educational level help their children in educational pursuit like, helping them to do their homework, encouraging and assisting them to review well, giving them more guidance on the way to study and buying materials which will aid in their learning. On the opposite hand, parents from low educational levels were seen to neither encourage their wards to find out, however, they themselves couldn't assist them nor guide them in their studies, which in totality affect their academic outcome. The contribution of families to students' inspiration and school success has been covered since the year 1953. According to the studies above, most researchers found a favorable association between Digital Game-Based learning and academic achievement, however few studies found a negative relationship between Digital Game-Based learning and academic performance. Students in a few selected schools in Kumasi's metropolitan area were chosen to participate in a study examining the link between digital game-based learning and their academic performance.

Based on the results above, it shows that the majority of the parents have graduated from high school or college, thus it suggests that these parents have a higher value in education. Educated parents are constantly concerned about their children's education, therefore, they are more encouraging and supportive in homework tasks and studies.

Table 5. Distribution of Respondents by Occupation of the Parents

Occupation	Mother		Father	
	Frequency	Percent	Frequency	Percent
Government Employee	17	37.0	8	17.4
Self – employed	27	58.7	26	56.5
Unemployed	2	4.3	12	26.1
Total	46	100	46	100

The table above shows that twenty-seven or 58.7% of mothers are self-employed while seventeen or 37.0% are government employees and the remaining two or 4.3% are unemployed. On the other hand, twenty-six or 56.5% of fathers are self-employed while twelve or 26.1% are unemployed and the remaining eight or 17.4% are government employees.

As supported by Table 3, it shows that the occupation of the parents is most likely on the minimum wage. As stated, most of the parents earn between P10,000 to P15,000 even though the majority are self-employed and government employees.

A parent's occupation plays a significant role in shaping the type of education and support children receive. The occupation of a parent can greatly influence their children's academic performance, as it determines not only their income but also their social status. Differences in parents' occupations often lead to variations in parenting styles, discipline approaches, and overall reactions to their children's needs. Parents in higher occupational classes or prestigious jobs are more likely to provide their children with a sense of security, as they have the financial means to handle emergencies, absorb economic shocks, and offer a comfortable living environment (Shah, 2021).

Table 6. Use of Tools and Baking Equipment Before Use of Digital Game Based Learning Tool

Score	Frequency	Percent	Verbal Interpretation
12-15	3	6.5	Mastered
10-11	16	34.8	Moving Toward Mastery
0-9	27	58.7	Low Mastery
Total	46	100	

The table above shows the score of respondents before use of digital game-

based learning tool. Twenty-seven or 58.7% of the respondents have a low mastery, followed by sixteen or 34.8% are moving toward mastery and finally three or 6.5% are Mastered.

With no intervention of educational tools, the result of the test shows that the majority of the respondents have a low mastery of the use of tools and baking equipment. Tools and equipment are crucial in home economics because they make activities easier to complete and more productively. They also aid in getting the right outcomes when baking and cooking. Woods (2018) concluded that with the proper equipment, a work can be completed

successfully while the lack of proper tools might cause students to work slowly and inefficiently, which could also lead to improper completion of tasks. Students frequently bemoan their inability to complete tasks with necessary resources.

According to Saucier, Vincent and Anderson's (2011) research, lack of tools and equipment may have a negative impact on learning, which is a significant issue for students studying home economics. Added to that Olayinka (2016), concluded that those students who were taught with complete tools and equipment perform better than those taught without proper tools and equipment.

The inaccessibility to tools and equipment in the school is a factor to the low scores obtained by the students. Respondents are not able to practice on actual equipment that are necessary to harness their talent in the said strand. Students who are not able to familiarize the tools and equipment in Bread and Pastry production will not be able to perform well. It is necessary that Marinduque National High School be able to provide the necessary equipment for the students to perform better.

Table 7. Use of Tools and Baking Equipment After Use of Digital Game Based Learning Tool

Score	Frequency	Percent	Verbal Interpretation
12-15	44	95.6	Mastered
10-11	2	4.3	Moving Toward Mastery
0-9	0	0	
Total	46	100	

Table 7 shows that after the use of digital game-based learning tool, majority of the respondents were able to master the use of tools and baking equipment with forty-four or 95.6%. While the remaining two or 4.3% were moving toward mastery.

The intervention of digital game-based learning tools shows significant improvement in the use of tools and baking equipment. It can enhance their attitude, motivation, interest and learning outcomes (Kalygua, 2013). Many online games activities and games provide opportunities for students to take control, which is why they often return to these games to practice. Additionally, these activities require minimal teacher intervention, as the game itself usually provides answers or results. Meta-analyses employ statistical methods to synthesize and compare the findings from multiple scientific studies, making them increasingly valuable as the body of empirical research on Digital Game-Based Learning (DGBL) grows. An example of such research is the meta-analysis conducted by Clark et al. (2016), which compiles and analyzes various studies on the effectiveness of DGBL. of 69 studies of DGBL providing information on 6,868 unique participants, which Clark et al. (2016) found that game-based approaches enhanced learning outcomes in comparison to traditional, non-game methods. Their meta-analysis revealed that the use of video games in education led to significant improvements in both cognitive and intrapersonal skills. Video games not only facilitated learning but also boosted motivation, intellectual openness, work ethic, conscientiousness, and positive self-evaluation. The benefits of game-based learning were similar to having a good teacher but did not surpass the effectiveness of strong pedagogical methods such as reciprocal teaching or problem-based learning.

Similarly, Aguilera et al. (2022) emphasized that games should not be viewed as replacements for teachers. Instead, they are most effective when combined with teacher-provided scaffolding and integrated into the classroom setting, without relying heavily on internal stories. The study also noted that games do not need to be overly complex, immersive, or feature advanced graphics. In fact, realistic graphics and relevant storylines may even hinder learning, suggesting that simpler games with less emphasis on graphics or narrative may yield better educational outcomes.

Table 8. Perform Mensuration and Calculation Before Use of Digital Game Based Learning Tool

Score	Frequency	Percent	Verbal Interpretation
20-25	1	2.2	Mastered
16-19	-	-	Moving Toward Mastery
0-15	45	97.8	Low Mastery
Total	46	100	

Table 8 indicates how the respondents perform mensuration and calculation before the use of digital game-based learning tools. Forty-five or 97.8% of the respondents had low mastery while the remaining one or 2.2% had Mastered it.

The scores clearly show the need for intervention since the majority of the respondents had low mastery of mensuration and calculation. Basic math facts are essential for quickly solving problems that individuals frequently encounter in daily life, as they are crucial for making calculations. Mastery of these fundamental facts enables individuals to perform mathematical operations efficiently and accurately (Burns, Codding, Boice, & Lukito, 2010; Cates & Ryhmer, 2003; Hudson & Miller, 2006; Shapiro, 2011). These basic facts also serve as a prerequisite for developing advanced mathematical skills in academic settings. Mathematics programs aim to teach students how to use these skills effectively (Gurganus, 2017; Hasselbring, Goin, & Bransford, 1987; Hinton, Strozier, & Flores, 2014; McCallum & Schmitt, 2011; Mercer & Miller, 1992; Stein, Kinder, Silbert, & Carnine, 2006; Woodward, 2006). To enhance students' mathematical proficiency, it is crucial to focus on developing the ability for quick, effortless, and accurate recall, which is essential for problem-solving (McVancel, Missall, & Bruhn, 2018). This can be achieved through systematically planned review-based repetition drills and

practice, which help students retain and recall key skills, such as multiplication tables, more effectively (Alptekin, 2019; Carnine, 1997; Kame'enui et al., 2002).

Table 9. Perform Mensuration and Calculation After Use of Digital Game Based Learning Tool

Score	Frequency	Percent	Verbal Interpretation
0-15	32	69.6	Low Mastery
16-19	11	23.9	Moving Toward Mastery
20-25	3	6.5	Mastered
Total	46	100	

Table 9 shows that after use of digital game-based learning tools, the respondents with thirty-two or 69.6% had low mastery; eleven or 23.9% were moving toward mastery and lastly three or 6.5% mastered the competence.

An additional two of the respondents were able to master the competence and eleven are moving forward. It is alarming to see that there are still thirty-two respondents who has a low mastery even after intervention. Mental abilities, health, psychological state, and social adjustment are key factors that influence educational attainment. A student with limited mental abilities is likely to experience lower academic success, and any deterioration in health or psychological well-being can negatively affect an individual's overall productivity and academic performance. Additionally, students who struggle with social adjustment may become more isolated, interact less, and have a reduced capacity for knowledge acquisition, leading to lower academic achievement (Ferla, Valcke, & Cai, 2009; Naji, 2002).

Mathematics, being a cumulative subject, requires understanding foundational knowledge or skills before progressing to more advanced concepts. The lack of comprehension and fear of mathematics can therefore become a widespread issue. Moreover, the abstract nature of mathematics, which is often disconnected from the physical world, makes it difficult to learn. Its reliance on abstract rules and concepts that require prior knowledge for practical application adds to its complexity.

According to the study by Aguilera et al. (2022), researchers aiming to assess the effectiveness of an intervention often consider experimental research as the "gold standard." A key feature of this approach is a pretest/posttest design, which measures performance on a particular variable before and after the intervention. Another important element is the use of a control group, which does not receive the intervention, allowing for comparisons with the experimental group. Randomized selection and assignment of participants to control and experimental groups help ensure the validity of these studies by controlling for "lurking" variables that could otherwise explain the changes. However, many studies on Digital Game-Based Learning (DGBL) either do not fully incorporate these methodological features or use them to a limited extent.

In the study by Udeozoro (2022), immersive technologies are becoming increasingly popular in teaching and learning due to their advantages in knowledge and skill acquisition. However, there is a lack of resources and guidance for educators looking to incorporate these tools into formal classroom teaching, particularly when it comes to assessment design and implementation. The most commonly used framework for assessment design, evidence-centred design (ECD), is complex and requires advanced machine learning skills to implement. As a result, its use has largely been restricted to large-scale computerized and game-based testing environments.

It is evident that there is a need to familiarize the table of weights and measures in baking, apply basic mathematical operations in calculating weights and measures and must value the importance of weights and measures in baking.

Significant Difference in the Pretest and Post-test Scores of the Students

Table 10. Significant Difference in the Pre-test and Post-test Scores in the Least Mastered Competencies in TLE 8

least mastered competencies	Pre-test		Post-test		t-value	df	p-value
	Mean	SD	Mean	SD			
use of tools and baking equipment	9.37	1.34	13.22	1.07	-22.2	45	< .001
perform mensuration and calculation	9.52	2.78	14.57	3.05	-12.5	45	< .001

Table 10 shows the significant difference in the Pre-test and Post-test score of the respondents on the least mastered competencies. The pre-test result on the use of tools and baking equipment indicates the mean with 9.37 and a standard deviation 1.34 while the post-test result with a mean of 13.22 and a standard deviation of 1.07. the t-value is -22.2 while the degree of freedom is 45. Thus, the use of tools and baking equipment has a highly significant difference with a p-value of <.001.

Based on Perform mensuration and calculation, the pre-test result mean is 9.52 and the standard deviation is 2.78; meanwhile the post-test result mean is 14.57 and the standard deviation is 3.05. The t-value is -12.5 and degree of freedom is 45. Therefore, the performance of mensuration and calculation has a highly significant difference with a p-value of <.001. Algani (2018) suggests that learning mathematics in school occurs in three stages: building a strong foundation, practicing mathematics, and ultimately reaching the self-stage. The first stage, the strong foundation, focuses on students' ability to

understand fundamental mathematical concepts such as calculations and counting. This phase is also referred to as "sensory learning," where teachers engage students using concrete objects like cubes, tools, and colors. This hands-on approach encourages learning through sensory experience and action.

The second stage, practicing mathematics, depends heavily on the first. As mathematics is a cumulative subject, each new concept builds upon previous knowledge. Therefore, if the foundational understanding is weak, subsequent learning will also be weak. However, if students have a strong base from the sensory-learning phase, they can more easily transition to practicing mathematical skills, mastering computational processes, and applying their knowledge effectively.

The final stage, the self-stage, occurs once students have successfully passed through the earlier stages. In this stage, students become more independent, reviewing lessons and solving homework on their own. They rely on the skills and abilities acquired during the previous stages, ultimately becoming self-reliant learners.

In the study by Aguilera (2022), educational theorist Seymore Papert was one of the pioneers in exploring the potential of computer games for enhancing learning. Papert's perspective was unique in that he argued digital gaming was not just a tool to deliver institutional knowledge, but rather, it was indicative of deep and complex learning. Papert distanced himself from the conventional "edutainment" discourse, which suggested that games could simply "trick" children into learning. He cautioned against the claims made by commercial edutainment companies and instead emphasized that games, when used properly, foster a richer learning experience.

The concept of Digital Game-Based Learning (DGBL) gained further traction through articles by Richard Van Eck (2006, 2015), which were widely disseminated through the education magazine EDUCAUSE. In these articles, Van Eck outlined four main approaches to DGBL:

Educational games designed specifically to teach certain concepts or skills.

Commercial off-the-shelf (COTS) games that are repurposed for educational purposes.

Student participation in game-making, allowing learners to engage with the creation process.

Gamification, where game-like elements (such as automated scoreboards and behavioral incentives) are integrated into non-game contexts, like workforce development.

Since the early 2000s, DGBL has gained popularity across various sectors, with academics, industry leaders, game designers, and educators adopting and applying the concept in different context.

Summary of Findings

The profile of the respondents were as follows - majority of the respondents were between 14 to 15 years of age with a frequency of 28 and a percentage of 60.9. Based on gender, twenty-seven female respondents (58.7%). According to family income, thirteen or 28.3% of the respondents earn P10,001 – P15,000 while based on the educational background of parents - fifteen or 32.6% of the mothers of the respondents are high school graduate. On the occupation of parents, twenty-seven or 58.7% of mothers are self-employed while seventeen or 37.0% are government employees and the remaining two or 4.3% are unemployed. On the other hand, twenty-six or 56.5% of fathers are self-employed.

The competence level of the students in the least mastered competencies before exposure to the three digital game-based activities in terms of use of tools and baking equipment showed that there are twenty-seven or 58.7% of the respondents have a low mastery followed by sixteen or 34.8% who are moving toward mastery and finally three or 6.5% are Mastered. Meanwhile, after the use of digital game-based learning tools, the majority of the respondents were able to master the use of tools and baking equipment with forty-four or 95.6%. While the remaining two or 4.3% were moving toward mastery.

On the other hand, the respondents perform mensuration and calculation before the use of digital game-based learning tools. Forty-five or 97.8% of the respondents had low mastery while the remaining one or 2.2% had Mastered it. While after use of digital game-based learning tools, the respondents with thirty-two or 69.6% had low mastery; eleven or 23.9% were moving toward mastery and lastly three or 6.5% mastered the competence.

There is a significant difference in the Pre-test and Post-test scores of the respondents on the least mastered competencies. The pre-test result on the use of tools and baking equipment indicates the mean with 9.37 and a standard deviation 1.34 while the post-test result indicates a mean of 13.22 and a standard deviation of 1.07, the t-value is -22.2 while the degree of freedom is 45. Student scores in the pre-test and post-test signify that there is an increase in the mastery of the competencies.

Based on Perform mensuration and calculation, the pre-test result mean is 9.52 and the standard deviation is 2.78; meanwhile the post-test result mean is 14.57 and the standard deviation is 3.05. The t-value is -12.5 and degree of freedom is 45. Therefore, the perform of mensuration and calculation has a highly significant difference with a p-value of <.001.

Conclusion

Based on the gathered data, it shows that there is a highly significant difference in the pretest and posttest scores of the students in the least mastered competencies after exposure to the game-based activities.

Thus , the null hypothesis of the study is not sustained.

Recommendation

Based on the gathered data, the researcher would like to recommend the following:

1. To further improve the competence level of the students in the least mastered competencies, perform mensuration and calculation, the researcher recommends more exercises on table of weights and measures in baking, apply basic mathematical operations in calculating weights and measures to make students value the importance of weights and measures in baking. To improve familiarization of the students on the competence.

2. Further studies on factors that affect the learning abilities of students to perform measurement and calculation may be made because the application of learning this is essential in the future, if the student is to pursue Bread and Pastry Production.

3. Further study on self-efficacy of students on the strand Bread and Pastry Production may be made to be able to identify factors that affect their mastery on their level of competence.

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REFERENCES

*Akkaya, S. (2018). The efect of game based activities in improving the concept of geometry sub-learning areas of primary school fourth class mathematics

A. K. Sahu and P. Dwivedi, "Knowledge transfer by domainindependent user latent factor for cross-domain recommender systems," Future Generation Computer Systems, vol. 108, pp. 320– 333, 2020.

Aguilar-Cruz, P. J., Wang, P., Xiang, Z., & Luo, H. (2023). Factors Influencing Game-Based Learning in the Colombian Context: A Mixed methods study. Sustainability, 15(10), 7817. https://doi.org/10.3390/su15107817

Aguilera, E., & De Roock, R. (2022). Digital Game-Based Learning: Foundations, applications, and critical issues. Oxford Research Encyclopedia of Education. https://doi.org/10.1093/acrefore/9780190264093.013.1438

Almusharraf, N., Aljasser, M., Dalbani, H., & Alsheikh, D. (2023). Gender differences in utilizing a game-based approach within the EFL online classrooms. Heliyon, 9(2), e13136. https://doi.org/10.1016/j.heliyon.2023.e13136

Ampofo, J., Xusheng, Q., & Xinyu, Z. (2024). Digital Game-Based learning as a determinant of students performance from low school divisions to high school division in some selected schools in Kumasi metropolis, Ghana. Journal in Research of Humanities and Social Science, 12(3), ISSN(Online):2321-

9467. https://www.researchgate.net/publication/381636599_Digital_Game-Based_Learning_as_A_Determinant_of_Students_Performance_f rom_Low_School_Divisions_to_High_School_Division_in_Some_Selected_Schools_in_Kumasi_Metropolis_Ghana

Arida, G. (2023). Visualization Techniques in Enhancing the Learner's Skills Performance in Bread and Pastry Production. Psychology and Education: A Multidisciplinary Journal, 10(5), 1-11. http://doi.org/10.5281/zenodo.8126228

Arida, G. C. (2023). Visualization Technique in Enhancing the Learning Skills Performance in Bread and Pastry Production. Psychology and Education: A Multidisciplinary Journal, 10, 511–520. https://doi.org/10.5281/zenodo.8126228

Ariwibowo, Eric Kunto. (2020). Wordwall: Media Pembelajaran Interaktif Mulai dari Quiz, Wordsearch, hingga Anagram. https://www.erickunto.com/2020/11/wordwall-media-pembel ajaran-interaktif.html

Bergin, S. & Reilly, R. (2005). The infuence of motivation and comfort-level on learning to program. In Proceedings of the 17th workshop on psychology of programming-PPIG'05 (pp. 293–304).

Borbon, J. (2021). Game-Based Learning in Online Instruction for TLE-7 Learners: A Strategic Modal. International Journal of Novel Research and Development , 8(4).

Bueno, M., Perez, F., Valerio, R., & Areola, E. M. Q. (2022). A Usability Study on Google Site and Wordwall . Net : Online Instructional Tools for Learning Basic Integration Amid Pandemic. Journal of Global Business and Social Entrepreneurship (GBSE), 7(23), 61–71.

Campos, D. G., & Scherer, R. (2023). Digital gender gaps in Students' knowledge, attitudes and skills: an integrative data analysis across 32 Countries. Education and Information Technologies, 29(1), 655–693. https://doi.org/10.1007/s10639-023-12272-9

Capistrano, C. (2019, January 18). Level of Application Skills in Bread and Pastry Production of TVL Grade 11 of Kapayapaan Integrated School. https://ojs.aaresearchindex.com/index.php/AAJMRA/article/view/8733

Chang, K. E., Wu, L. J., Weng, S. E., & Sung, Y. T. (2012). Embedding game-based problem-solving phase into problem-posing system for mathematics learning. Computers & Education, 58(2), 775–786.

Clark, D. B., Tanner-Smith, E. E., & Killingsworth, S. S. (2016). Digital games, design, and learning: A systematic review and meta-analysis. Review of Educational Research, 86(1), 79–122.

Cop, M. R., & Kablan, Z. (2018). The analysis of studies on educational games in Turkey. Kocaeli University, Journal of Education, 1(1), 52–71.

De Freitas, S. (2006). Learning in Immersive worlds: A review of game-based learning. https://researchre pository.murdoch.edu.au/id/eprint/35774/1/ gamingreport_v3.pdf. Accessed 26 September 2019.

Delima, D., & Mamaril, R. (2022). Awareness of Senior High school Students on Digital Literacy Skills: A Qualitative study. https://animorepository.dlsu.edu.ph/cgi/viewcontent.cgi?article=1048&context=sinaya. Retrieved February 22, 2025, from https://animorepository.dlsu.edu.ph/cgi/viewcontent.cgi?article=1048&context=sinaya

Effectiveness of online teaching learning activities in the attainment of course learning outcomes. (2021). In Asia Pacific Journal of Education Perspective: Vol. Vol. 4 (Issue No. 1, pp. 86–95) [Journal-article]. https://research.lpubatangas.edu.ph/wp-content/uploads/2022/06/11-APJAHS-2021-19.pdf

Escueta, J. (2024). Game-Based Learning towards students' performance in technology and livelihood education. PSYCHOLOGY AND EDUCATION: A MULTIDISCIPLINARY JOURNAL, 22(9), 1. https://doi.org/10.5281/zenodo.13166885

Farzan, R., DiMicco, J. M., Millen, D. R., Dugan, C., Geyer, W., and Brownholtz, E. A. (2008). Results from deploying a participation incentive mechanism within the enterprise. In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, ACM, 563–572.

Federation of American Scientists. (2006). Summit on educational games: Harnessing the power of video games for learning. Washington, DC: Author.

Gamification and Game-Based Learning | Centre for Teaching Excellence. (n.d.). University of Waterloo. https://uwaterloo.ca/centre-for-teaching-excellence/catalogs/tip-sheets/gamification-and-game-based-learning

Hairiyah, Nina, Raden Rizki Amalia, dan Eva Luliyanti. 2019. "Analisis Statistical QualityControl (SQC) pada Produksi Roti di Aremania Bakery Statistical Quality Control (SQC) Analysis of Bread Production at Aremania Bakery" 8: 41–48.

Hasram, S., Nasir, M. K. M., Mohamad, M., Daud, M. Y., Rahman, M. J. A., & Mohammad, W. M. R. W. (2021). The effects of wordwall online games (Wow) on english language vocabulary learning among year 5 pupils. Theory and Practice in Language Studies, 11(9), 1059–1066. https://doi.org/10.17507/tpls.1109.11

https://siterotle.weebly.com/descriptions.html

https://www.asiaeducationreview.com/engineering/news/elearning-trends-transforming-the-landscape-of-philippine-education-nwid-740.html

Ibrahim, R., & Jaafar, A. (2009). Educational games (EG) design framework: Combination of game design, pedagogy and content modeling. Proceedings of the 2009 International Conference on Electrical Engineering and Informatics, ICEEI 2009, 1, S. 293-298.

J. Handhika et al. (Eds.): ICETECH 2022, ASSEHR 745, pp. 446–457, 2023. https://doi.org/10.2991/978-2-38476-056-5_46

Karakoç, B., Eryılmaz, K., Özpolat, E. T., & Yıldırım, B. (2020). The Effect of Game-Based Learning on Student Achievement: A Meta-Analysis Study. Technology Knowledge and Learning, 27(1), 207–222. https://doi.org/10.1007/s10758-020-09471-5

Khamis, S., Ahmad, A. H., & Muraina, I. D. (2018). Knowledge visualization of students' performances: antecedent of knowledge generation model and decision making model. International Journal of Engineering & Technology, 7(3.20), 817-821.

Landers, R. N., & Landers, A. K. (2015). An empirical test of the theory of gamified learning the effect of leaderboards on time-on-task and academic performance. Simulation & Gaming, 45(6), 769-785.

Lin, C.-L., & Chang, W.-T. (2021, January). The Use of Baking Simulation Game to Enhance Students' Inquiry-based Learning . International Conference for Future Education. https://www.researchgate.net/publication/228456647

Mahyudi, A. (2022). Penggunaan Media Wordwall dalam Meningkatkan Penguasaan Bahasa Baku Siswa di Sekolah Menengah Pertama. Ulil Albab: Jurnal Ilmiah Multidisplin, 1(6), 1687–1694.

Malaguit, C., Briones, E., (2024). Games as Motivating Factor and Students' Performance in Bread and Pastry Production. Psychology and Education: A Multidisciplinary Journal, 19(9), 380-380. https://doi.org/10.5281/zenodo.11190422

Malliarakis, C., Satratzemi, M., & Xinogalos, S. (2014). Designing educational games for computer programming: A holistic framework. Electronic Journal of e-Learning, 12(3), 281-298.

Morin, D., Fard, H. S., & Saadé, R. G. (2019). Understanding online learning based on different age categories. Issues in Informing Science and Information Technology, 16, 307–317. https://doi.org/10.28945/4313

Musselman, Marija-Lisa, "The effect of game-based learning on middle school students' academic achievement" (2014). Graduate Research Papers. 211. https://scholarworks.uni.edu/grp/211

Nisbet, J. (2023). Game-Based Learning: Pros, Cons & Implementation Tips for Educators. prodigygame.com. https://www.prodigygame.com/main-en/blog/game-based-learning/

Rahmawati, A. P., & Wijayanti, P. R. (2022). Implementing Joyful Learning Strategy Using Wordwall in Order to Improve Reading Comprehension Skills. Proceedings Series on Physical & Formal Sciences, 3(2001), 32–35. https://doi.org/10.30595/pspfs.v3i.261

Rahmi, L., & Angraina, D. (2021). Training on utilization of Wordwall media as online-based learning assessment for elementary school teachers 08 Supayang. Sumatra Journal of Disaster, Geography and Geography Education, 5(2), 144–149.

Ryan, R.M., Deci, E.L. (2017) Self-determination theory: Basic Psychological needs in motivation, development, and wellness. Guilford Publications. https://doi.org/10.1521/978.14625/28806

Santos, J. M., & Bantog, D. D. (2023). Development of Game-Based Assessment Tools (GBAT) Using Quizizz Application for Technology and Livelihood Education (TLE) Subject. Kasetsart Journal of Social Sciences, 44(3). https://doi.org/10.34044

Sari, M. H., Susetyo, Noermanzah, Wardhana, D. E. C., & Kusumaningsih, D. (2020). Understanding the level of students' reading comprehension ability. Universal Journal of Educational Research, 8(5), 1848–1855. https://doi.org/10.13189/ujer.2020.080521

Sari, P. M., & Yarza, H. N. (2021). Pelatihan Penggunaan Aplikasi Quizizz Dan Wordwall Pada Pembelajaran Ipa Bagi Guru-Guru Sdit Al-Kahfi. SELAPARANG Jurnal Pengabdian Masyarakat Berkemajuan, 4(2), 195. https://doi.org/10.31764/jpmb.v4i2.4112

Shah, S., & Hussain, Dr. (2021). Parental occupation and its effect on the academic performance of children. JETIR, 8(8), ISSN-2349-5162.

Sundayana. 2015. Statistika Penelitian Pendidikan. Bandung : Alfabeta

Supardi, and Agus Dharmanto. (2020). "Analisis Statistical Quality Control Pada Pengendalian Kualitas Produk Kuliner Ayam Geprek Di Bfc Kota Bekasi." JIMFE (Jurnal Ilmiah Manajemen Fakultas Ekonomi) 6(2):Inpress. doi: 10.34203/jimfe.v6i2.2622

Tamosevicius, R. (2022, November 21). Why Is Game-Based Learning Important? eLearning Industry. https://elearningindustry.com/why-is-game-based-learning-important

TESDA (2004). Competency-based curriculum bread and pastry production NC II of Technical Education and Skills Development (TESDA) Authority.

Udeozor, C., Abegão, F. R., & Glassey, J. (2023). Measuring learning in digital games: Applying a game‐based assessment framework. British Journal of Educational Technology, 55(3), 957–991. https://doi.org/10.1111/bjet.13407

Vandercruysse, S., Vandewaetere, M., & Clarebout, G. (2012). Game-based learning: A review on the effectiveness of educational games. In M. M. Cruz-Cunha (Ed.), Handbook of research on serious games as educational, business, and research tools (pp. 628–647). Hershey, PA: IGI Global.

Vargianniti, I., & Karpouzis, K. (2019). Effects of Game-Based Learning on Academic Performance and Student Interest. In Lecture notes in computer science (pp. 332–341). https://doi.org/10.1007/978-3-030-34350-7_32

Kalygua, M.; Mantai, L.; Maronne, M. Efficient Vocabulary Learning Through Online Activities. Procedia Soc. Behav. Sci.2013,83,35–38. [CrossRef]