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Simulation-based learning and skills mastery among TVL-Home Economics students in bread and pastry production

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ABSTRACT

This study investigated the relationship between simulation-based learning and skills mastery among Technical-Vocational-Livelihood (TVL)–Home Economics students at Lahug National High School–Night, Cebu City Division. Specifically, it examined the respondents' profiles, their experiences with simulation-based learning, their level of skills mastery, and the relationship between the two main variables as a basis for a proposed Simulation-Based Learning Intervention Plan. A quantitative descriptive-correlational research design was employed, involving 135 respondents selected through proportionate stratified random sampling from a population of 204 Grade 11 and Grade 12 students. Data were gathered using an adapted and validated survey questionnaire and analyzed through frequency counts, percentages, means, standard deviations, and Pearson's Product-Moment Correlation Coefficient. The results suggested that the respondents had overall positive experiences with simulation-based learning, especially in the areas of student-faculty contact, collaboration, and active engagement. The overall skills mastery obtained a mean of 3.91 interpreted as Agree with safety practices as the strongest dimension. There were still potential to increase the differentiation of learning experiences, the performance of independent tasks, the correctness in following specified criteria and the timely completion of practical exercises. The Pearson correlation analysis (r) demonstrated a substantial positive and statistically significant association between simulation-based learning and skills mastery ($(r = 0.730)$, $(p < .001)$). The p-value was below the significance level of .05 and hence the null hypothesis was rejected. The finding suggests that greater positive simulation-based learning experiences were associated with higher skills mastery, but the correlational design does not support causation. Based on the findings, a Simulation-Based Learning Intervention Plan was presented to enhance differentiated activities, repetitive practice, timely feedback, teacher direction, independent performance and realistic practical tasks.

Keywords: Simulation-based learning; skills mastery; Technical-Vocational-Livelihood; Home Economics; bread and pastry production; practical skills; TVL students; intervention plan; Cebu City, Philippines.

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INTRODUCTION

Technical-Vocational-Livelihood (TVL) curriculum was one of the main components of the Philippine K-12 Basic Education Program that sought to equip the learners with the required competencies for employment and entrepreneurial activities. Unlike purely academic strands, which were focused on theoretical learning, the competency-based approach used in the TVL curriculum required learners to demonstrate their knowledge and skills in technical fields. The competencies in the Home Economics strand included competencies in Bread and Pastry, Food and Beverage, and Cookery, which enabled the students to prepare for work immersion, earned a national certificate, and got a job in the future. In particular, Bread and Pastry Production required students to develop practical skills in measuring ingredients, preparing dough and batter, applying baking techniques, handling equipment, and observing food safety and sanitation standards. As the industries became more complex and demanding in terms of the skills of the students, educational institutions faced an uphill task of implementing methods that will improve their students' skills and made them ready for employment. Technical and Vocational Education and Training (TVET) was vital in developing the knowledge and skills needed for successful employment, entrepreneurship and lifelong learning as UNESCO (2022) pointed out. Similarly, Arroz (2024) emphasized that Home Economics education should continuously enhance the students' competencies through creative teaching approaches that encouraged practical learning experiences.

Simulation-based learning was among the instructional strategies that can be used to support competency-based learning since through this approach, learners get exposed to real-life situations within the learning environment. Learners got the chance to improve their technical skills, self-confidence, and decision-making skills through guided practice, collaboration, immediate feedback, and performance repetition. This kind of learning experience was relevant to the field of Home Economics, since in Home Economics, students were required to display psychomotor skills rather than theoretical skills. It has been observed through research that learning experiences improve the competencies and employability of the TVL learners (Urgelles & Urgelles, 2024; Herosano & Cuenca, 2025). For students specializing in Bread and Pastry Production, simulation-based activities may provide opportunities to practice baking procedures, correct mistakes, improve product quality, and develop greater confidence in performing practical tasks.

The TVL education was competency-based oriented however mastery of skills of the learners remained to be a major priority of education. Many TVET institutions were still struggling to ensure that learners gained abilities that satisfy constantly changing industry norms (UNESCO, 2022). In the same vein, schools in the Philippine context also faced constraints in terms of instructional resources, exposure to real work in the field, and possibilities for continual practical application that may affect students' technical competence and confidence. Roble (2023) highlighted that the development of competency among TVL learners was still affected by the diversity in teaching approaches and learning experiences. At the local level, Lahug National High School - Night under Cebu City Division was continuously implementing competency-based instruction under the Home Economics strand but teachers still observed variability in the practical performance, confidence and readiness of students in laboratory activities and work immersion preparation. These realities pointed up the need of finding instructional strategies that may lead to enhanced skills mastering.

Simulation-based learning has been adopted in many professional courses such as nursing, medicine, and engineering but there were few research done on Senior High School learners under the Technical-Vocational-Livelihood route. Cias (2024) stated that many local studies involving TVL students focused more on project-based learning and competency development than simulation-based learning. Likewise, Urgelles and Urgelles (2024)

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suggested to conduct further investigations about contextualized teaching strategies that can improve the practical skills of the students in technical-vocational education. Moreover, empirical evidence on the relationship between simulation-based learning and skills mastery among TVL–Home Economics students, particularly those specializing in Bread and Pastry Production in public secondary schools in Cebu, remains limited. The literature gap highlighted the importance of studying the association between these variables in the context of TVL learners in Lahug National High School – Night to generate evidence which can be used for improving teaching instruction.

The implementation of this research was likewise supported by the national educational policies endorsing competency-based and learner-centered system of education. K-12 was put into place by virtue of the Enhanced Basic Education Act of 2013 (Republic Act No. 10533) that highlighted the value of the K-12 learner-centered, competency-based education that will provide every student who completed it with opportunities in higher education, employment, entrepreneurship, and even as an individual who continuously learning. The Technical Education and Skills Development Act of 1994 (Republic Act No. 7796) also put forth a competency-based technical education that supported business and industry. Then the Philippine Qualifications Framework Act (Republic Act No. 10968) gave further guarantees that students' competencies were in line with internationally and nationally recognized qualification standards. Following these policies, the objective of this study was to identify the relationship that existed between simulation-based learning and skills mastery of the students in TVL–Home Economics Program at Lahug National High School - Night located at Lahug, Cebu City. The findings may benefit students by identifying areas of strength and aspects of practical learning that require further improvement. The results of this study provided the information that will contribute to the development of the Simulation-Based Learning Intervention Plan that will enhance the effectiveness of the teaching methods used in this field as well as the skills of the students in their area of study.

Statement of the problem

This study aimed to determine the relationship between simulation-based learning and the skills mastery of Technical-Vocational-Livelihood (TVL)–Home Economics students at Lahug National High School - Night, Cebu City Division, during the School Year 2026–2027, as a basis for developing a proposed Simulation-Based Learning Intervention Plan to enhance students' skills mastery.

Specifically, this study sought to answer the following questions:

1. What is the demographic profile of the respondents in terms of age and gender?
2. What is the level of simulation-based learning among TVL–Home Economics students in terms of student–faculty interaction, collaborative learning, active learning, feedback, time on task, high expectations, and diverse learning?
3. What is the level of skills mastery of TVL–Home Economics students in terms of technical competence, accuracy of performance, safety practices, and work efficiency?
4. Is there a significant relationship between simulation-based learning and the skills mastery of TVL–Home Economics students?
5. Based on the findings of the study, what Simulation-Based Learning Intervention Plan may be proposed to enhance the skills mastery of TVL–Home Economics students?

METHODOLOGY

The study employed a descriptive correlational research approach that was quantitative in nature. Quantitative research used numbers as data to describe variables and to analyze their interaction with one other (Creswell & Creswell, 2023). Similarly, Miksza et al. (2023) described descriptive research as describing the features of an individual or a phenomena, and correlational research as determining the degree and direction of the link between two or more variables without changing them. This approach was used because the study wanted to find out the association of simulation-based learning and the skills mastery of the TVL–Home Economics students of Lahug National High School-Night. The descriptive part of the study was used to describe the profile of the respondents, determine the level of simulation-based learning, and determine the level of skills mastery of the TVL–Home Economics students. Data collected were summarized and described through descriptive statistics such as frequency, percentage, weighted mean, and standard deviation. The correlational aspect was used to find out if there exists a substantial connection between simulation-based learning and students' abilities mastery. The study did not involve the manipulation of variables; thus, Pearson's Product-Moment Correlation Coefficient (Pearson's r) was used to establish the strength and direction of the association between the independent variable, simulation-based learning, and the dependent variable, skills mastery. The data were utilized to design a Simulation-Based Learning Intervention Plan for the improvement of skills mastery of TVL–Home Economics students.

The flow of the study, as illustrated in Figure 2, encompassed all research activities and followed the Input-Process-Output (IPO) Model, which explained the systematic flow of the research process. The model presented the information required as the input, the procedures undertaken as the process, and the expected result as the output, and it served as the framework in achieving the objectives of the study. The input of the study consisted of the respondents' profile in terms of age, sex, and Home Economics specialization. It also included the respondents' level of simulation-based learning and level of skills mastery, which served as the primary variables of the study. The preparatory process included obtaining necessary research docs, receiving necessary approvals from concerned departments, and obtaining informed consent of the concerned participants. Since the study utilized an adapted questionnaire, the instrument underwent expert validation and pilot testing before its administration. The validated questionnaire was then distributed to the respondents, after which the accomplished questionnaires were retrieved, tabulated, and subjected to the appropriate statistical analyses. Finally, the results were analyzed, interpreted, and presented in the research report. The output of the study was a Simulation-Based Learning Intervention Plan designed to strengthen the implementation of simulation-based learning in the Home Economics program. The intervention plan was designed to address the identified weaknesses and to assist teachers in improving the skills mastery of students through effective and competency-based instructional techniques.

The study was conducted at Lahug National High School–Night in Lahug, Cebu City, specifically under the Schools Division of Cebu City, as shown in the location map of the research environment presented in Figure 3. This institution was offering the Track of Technical-Vocational-Livelihood (TVL) with the specialization in Home Economics wherein the teaching-learning process was conducted through competency-based instruction aiming to impart skills essential for the preparation of the learners in terms of employment, entrepreneurship, and certification. Lahug National High School–Night was selected as the research environment since this institution can provide an appropriate setting for investigating the relationship between the simulation-based learning and the skills mastery of TVL–Home Economics students. In addition, the school used simulation-based and performance-based

learning exercises that are consistent with the Home Economics curriculum; hence, it would be appropriate to use this school to evaluate students' learning experiences through simulation-based learning and skills mastery. This study would be beneficial to Lahug National High School–Night because the results could generate school-specific information on the relationship between simulation-based learning and skills mastery of TVL–Home Economics students in Bread and Pastry Production. The results will help teachers identify students' strengths and areas that need further improvement in technical competence, accuracy of performance, safety practices, and work efficiency. These findings also guide teachers and school administrators in improving practical learning activities, providing more opportunities for guided and independent practice, and strengthening students' preparation for performance assessments, work immersion, and future employment or entrepreneurship. Furthermore, the findings will serve as the basis for a proposed Simulation-Based Learning Intervention Plan tailored to the students' identified learning needs. This makes the study relevant to the school because it offers practical information that may support instructional improvement and enhance the delivery of the TVL–Home Economics program.

The respondents for this study were 135 TVL–Home Economics students of Lahug National High School–Night in School Year 2026–2027. The entire population of the study involved 204 students, which include 119 Grade 11 and 85 Grade 12 students. The size of 135 respondents was arrived at using the Slovin's Formula with 5% margin of error. The respondents were chosen through proportionate stratified random sampling. First, the population was stratified according to their grade levels (Grade 11 and Grade 12). Then, the number of respondents in each stratum was computed proportionately based on their respective share in the total population size, with 79 students of Grade 11 and 56 students of Grade 12 included. After computing for the number of respondents in each stratum, the respondents were then randomly selected using a computer-generated random number generator. The use of proportionate stratified random sampling was considered the most appropriate sampling technique because the respondents belonged to two naturally occurring groups with different population sizes. Through the proportional representation of Grade 11 and Grade 12 students, the sampling process helped reduce any possible biases in sampling and created an accurate representation of all students of the population of TVL–Home Economics. The distribution of the respondents is as follows: the Grade 11 stratum had a population (N) of 119 and a sample (n) of 79, representing 58.3% of the respondents; the Grade 12 stratum had a population (N) of 85 and a sample (n) of 56, representing 41.7 % of the respondents; and the total population (N) of 204 yielded a total sample (n) of 135, representing 100%.

The research instrument that was used in the study was a modified version of the NSSE (National Survey of Student Engagement) which was designed by Kuh (2001). More specifically, the indicators of effective education practices about student engagement in learning and the indicators of skills assessment of Technical-Vocational Education and Training (TVET), which was used to measure the skills mastery of students through competency-based learning, were adopted and modified for use in the study. There were two major parts in the questionnaire. In the first part, the level of simulation learning was measured according to seven dimensions which include Student and Faculty Interaction, Collaborative Learning, Active Learning, Feedback, Time on Task, High Expectations, and Diverse Learning. These seven dimensions consisted of questions about how much the students learned from the use of simulations. In the second part, the level of skills mastery of TVL-Home Economics students was determined based on four dimensions, namely Technical Competence, Accuracy of Performance, Safety Practices, and Practical Tasks. Each statement was rated by the respondents on a five-point Likert scale. For both parts of the survey, the options were 5 –

Strongly Agree, 4 – Agree, 3 – Neutral, 2 – Disagree, and 1 – Strongly Disagree. With the help of this rating scale, the researcher was able to evaluate the level of experience of the simulation-based training and skills mastery among students. The survey underwent expert validation and modifications to ensure its content validity and appropriateness for the target population. Moreover, provisions of the Data Privacy Act of 2012 (Republic Act No. 10173) were followed in the whole process of conducting the study. It was purely voluntary to participate in the research, and all data provided by the respondents were highly confidential.

The data gathering process involved three stages, namely the initial stage, the data gathering stage, and the stage after data gathering. During the whole process, the researcher made sure that the confidentiality of all the information offered by the participants was guaranteed. In the preliminary stage, a letter seeking permission to carry out the study was sent to the Schools Division Superintendent of the Cebu City Schools Division. Upon granting of permission, the researcher was able to consult with the school principal and the TVL-Home Economics teacher concerning the schedule of survey administration. Permission to conduct the study was also obtained from the school. In the data gathering stage, the survey questionnaires were distributed to the selected TVL–Home Economics students with the assistance of their subject teacher. Before conducting the survey questionnaire, the respondents were enlightened on the objective of the study. This was done to assure them that all answers will be kept confidential. The respondents were given ample time to fill up the survey questionnaire truthfully and exhaustively. The survey questionnaire collected information regarding the experience of the students on simulation learning and their mastery of skills in Home Economics. The use of the survey questionnaire proved to be practical and convenient for collecting the needed data for the study. In the post-data gathering stage, after collecting all the completed questionnaire forms, the researcher examined them to ensure that there were no unanswered items. The answers provided were coded, classified, and tallied for further analysis with the help of proper statistical tools. The results were analyzed in light of the objectives of the research study. In the whole process of research, all the data collected were treated with utmost confidentiality following the requirements of the Data Privacy Act.

Ethical considerations were very significant in ensuring that the research was carried out in an appropriate manner. Other than following the requirements of carrying out research, the ethics considerations ensured that the research process was conducted in an appropriate way, built trust among the respondents, and maintained the rights of the respondents. Informed consent has been one of the key ethics considerations in this case. Prior to conducting the research, all the respondents have been informed of what the research entails. They have also been told that participating in the research was purely optional and that they can either accept to be part of it or reject it without any kind of penalty. Informed consent has been sought from all respondents before carrying out the research. Confidentiality and privacy were equally observed through the entire process of carrying out this research. Any information shared by the participants was treated with confidentiality and securely kept. The personal details like names or other identifiers were stripped off the information collected from the participants to preserve their identity. The results were presented based on aggregate or summarized information so that no individual's answers would be traceable to him or her. The participants were also informed that their answers will be kept confidential and used only for the purpose of the study. The study was also carried out considering the busy schedule of the participants. The data were collected at an appropriate time in order to avoid any disruptions in their studies. In addition, the questionnaire was constructed using appropriate and relevant questions to the participants' learning environment.

For the analysis of the data gathered in the research study, statistics was used. With the aid of proper statistical analysis, the findings of the research were able to provide accurate information. The following statistical tools were used in analyzing the data. Frequency count

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was a statistical tool in which the number of responses for each category or option was determined, and it was one of the effective ways to provide a summary of the distribution of responses on the experience and skill acquisition of the TVL-Home Economics students through simulations. The Likert scale was a statistical tool in which the participants' level of agreement and perception towards the statement given in the survey was measured using the five-point Likert scale. The weighted mean was computed to identify the average rating of each indicator and variable in the study, and it gave an idea of the respondents' perception about simulation-based learning and the skills mastery of the students based on the corresponding descriptive rating. Standard deviation was employed in determining the dispersion of the respondents' answers from the mean, which would show the respondents' answers were near to each other or scattered. The Pearson Product-Moment Correlation Coefficient (Pearson r) was used to determine the relationship between the independent and dependent variables, namely the simulation-based learning and skills mastery of the TVL-Home Economics students.

For the analysis of the perceptions of the participants about the simulation training and their skills mastery, the researchers used a five-point Likert scale. These response choices were assigned corresponding values for proper quantitative analysis of the data collected from the participants. In the computation of the weighted mean, the researchers were able to get the overall value of the variables using the responses of the TVL Home Economics students. For the level of simulation-based learning of TVL–Home Economics students, a scale of 5 (SA) corresponded to the numerical rating of 4.21 - 5. 00 and the descriptive rating of Strongly Agree, which meant that the respondents strongly perceived that simulation-based learning was consistently practiced and effectively enhanced their learning experiences. A scale of 4 (A) corresponded to the numerical rating of 3.41 - 4.20 and the descriptive rating of Agree, which meant that the respondents perceived that simulation-based learning was frequently practiced and positively supported their learning experiences. A scale of 3 (N) corresponded to the numerical rating of 2.61- 3.40 and the descriptive rating of Neutral, which meant that the respondents perceived that simulation-based learning was sometimes practiced and moderately supported their learning experiences. A scale of 2 (D) corresponded to the numerical rating of 1.81 - 2.60 and the descriptive rating of Disagree, which meant that the respondents perceived that simulation-based learning was seldom practiced and provided limited support to their learning experiences. A scale of 1(SD) corresponded to the numerical rating of 1.00 - 1.80 and the descriptive rating of Strongly Disagree, which meant that the respondents perceived that simulation-based learning was rarely or never practiced and did not adequately support their learning experiences.

For the level of skills mastery of TVL–Home Economics students, a scale of 5 (SA) corresponded to the numerical rating of 4.21 - 5. 00 and the descriptive rating of Strongly Agree, which meant that the respondents demonstrated a very high level of skills mastery, reflecting excellent competence, accuracy, confidence, safety practices, and performance in practical tasks. A scale of 4 (A) corresponded to the numerical rating of 3.41 - 4.20 and the descriptive rating of Agree, which meant that the respondents demonstrated a high level of skills mastery, showing proficiency in performing the required competencies in Home Economics. A scale of 3 (N) corresponded to the numerical rating of 2.61- 3.40 and the descriptive rating of Neutral, which meant that the respondents demonstrated a moderate level of skills mastery, indicating satisfactory but inconsistent performance of the required competencies. A scale of 2 (D) corresponded to the numerical rating of 1.81 - 2.60 and the descriptive rating of Disagree, which meant that the respondents demonstrated a low level of skills mastery, indicating limited competence and requiring further improvement in practical

performance. A scale of 1(SD) corresponded to the numerical rating of 1.00 - 1.80 and the descriptive rating of Strongly Disagree, which meant that the respondents demonstrated a very low level of skills mastery, indicating minimal competence and the need for substantial improvement in performing Home Economics skills.

RESULTS AND DISCUSSION

Profile of the respondents and overview of the study

This section presents, analyzes, and interprets the data gathered from 135 Technical-Vocational-Livelihood (TVL) Home Economics students of Lahug National High School-Night, Cebu City, in School Year 2026-2027. The study used a descriptive correlational research design that was quantitative in nature. The 135 respondents were drawn from a population of 204 students (119 in Grade 11 and 85 in Grade 12) using Slovin's formula with a 5% margin of error and proportionate stratified random sampling by grade level. Computer-generated random numbers were then used to select 79 Grade 11 students (58.3%) and 56 Grade 12 students (41.7%), a total of 135 respondents (100%). Data were collected with a questionnaire adapted from the National Survey of Student Engagement and from indicators of skills assessment in Technical-Vocational Education and Training. It measured simulation-based learning in seven dimensions and skills mastery in a second part, using a five-point Likert scale from 5 (Strongly Agree) to 1 (Strongly Disagree). The data were analyzed with frequency, percentage, weighted mean, and standard deviation, and with the Pearson Product-Moment Correlation Coefficient (Pearson r) to test the relationship between the two variables. Means were interpreted as Strongly Agree (4.21-5.00), Agree (3.41-4.20), Neutral (2.61-3.40), Disagree (1.81-2.60), and Strongly Disagree (1.00-1.80). The discussion is grounded in the data gathered, and the results are interpreted in direct relation to the objectives of the study: to describe the respondents' profile, determine the level of simulation-based learning and the level of skills mastery, establish the relationship between the two variables, and provide a basis for a Simulation-Based Learning Intervention Plan.

In terms of age and gender, 68 respondents (50.37%) were aged 17-18 years, of whom 36 were male and 32 were female. The remaining 67 respondents (49.63%) were aged 15-16 years, of whom 33 were male and 34 were female. In total there were 69 male and 66 female respondents out of 135 (100%). This near-equal distribution shows that both age groups and both genders were almost evenly represented. Nyström and Ahn (2025) addressed the vocational learning of upper-secondary students and the need for learning arrangements that develop both theoretical and practical knowledge. This underscores the importance of understanding the learner population, although the present study did not test differences in simulation-based learning or skills mastery by age or gender. These variables were included for profiling only, so no conclusions about group differences should be drawn from them.

With respect to specialization, all 135 respondents (100%) were enrolled in Bread and Pastry Production. The respondents therefore shared one vocational specialization and learned in the same environment. This specialization involves the measurement of ingredients, preparation of mixtures, production techniques, equipment handling, and sanitation. Wibawanto et al. (2022) found that simulation-based interactive multimedia improved learning outcomes among vocational students, which supports examining simulation-based learning within a specific technical-vocational context. Because every respondent came from the same specialization, the findings should not be generalized to other Home Economics specializations without further research, and the proposed intervention plan should be grounded in the needs of Bread and Pastry Production.

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Level of simulation-based learning

Simulation-based learning was the first major variable of the study. Simulation allows learners to practice procedures, apply concepts, interact with instructors and peers, receive feedback, and develop skills in a controlled setting. Chernikova et al. (2020), in a meta-analysis of 145 empirical investigations, reported an overall large positive effect of simulation-based learning on complex skills and emphasized the importance of scaffolding in simulation environments. The seven dimensions examined here are discussed in turn below.

On student-faculty interaction, the grand mean was 3.92 (SD = 0.50), interpreted as Agree. The highest-rated indicator was the instructor's responsiveness to students' needs (M = 4.07, SD = 0.70), followed by gaining deeper understanding through the instructor's insights and examples that could be adapted to one's own practice (M = 4.01, SD = 0.77). Learning from the instructor's comments before, during, or after the learning experience obtained a mean of 3.90 (SD = 0.82). The lowest-rated indicator was the chance to discuss the learning experience objectives with the teacher (M = 3.70, SD = 0.80), although it was still interpreted as Agree. Teacher support was thus a positive feature of the simulation experience, while the slightly lower rating on discussing objectives suggests that some learners may need clearer explanations before an activity begins. This is consistent with Ahn and Nyström (2023), who pointed to the role of teachers in vocational simulations, particularly in setting learning objectives and planning learning activities. Teachers in Bread and Pastry Production should therefore explain objectives, expected outputs, and performance standards before each simulation.

For collaborative learning, the grand mean was 3.88 (SD = 0.61), interpreted as Agree. Having the chance to collaborate with peers obtained the highest mean (M = 3.90, SD = 0.86). Discussing thoughts with peers followed (M = 3.88, SD = 0.77), and discussing ideas and concepts with other students was lowest (M = 3.85, SD = 0.80). The differences were slight, which suggests that opportunities for cooperation were generally positive, with room to strengthen structured discussion and the exchange of ideas. Collaboration is relevant to real occupational tasks, but group work does not guarantee that every student contributes equally. Scholtz and Hughes (2021) recommended strategies such as team structuring, coaching, mentoring, feedback, and student engagement to strengthen simulation-based learning. Navarro-Parra and Chiappe (2024) emphasized the potential of virtual learning environments to connect educational experiences with real-life practice. Teachers may assign rotating roles such as performer, observer, safety officer, and feedback provider so that each student takes part in practical activities and in evaluating peers.

For active learning, the grand mean was 3.87 (SD = 0.58), interpreted as Agree. Reflecting on one's thinking during the learning experience received the highest mean (M = 3.91, SD = 0.74). Learning how to apply course concepts to future real-life experiences followed (M = 3.90, SD = 0.86), and the statement that the learning activities made learning time more productive obtained a mean of 3.89 (SD = 0.89). Reflecting on emotions experienced during the learning experience was lowest (M = 3.78, SD = 0.78). Students generally saw simulation as more than passive acquisition of information, since they reported reflecting on their thinking and applying concepts. The lower rating for emotional reflection suggests that learners may need more opportunities to discuss difficulties, doubts, and feelings when facing complex tasks. This is consistent with Chernikova et al. (2020) on instructional scaffolding and with Ahn and Nyström (2023) on teachers' design of and reflection on learning activities. Post-simulation reflection on ingredient measurement, mixing technique, equipment operation, and product quality could therefore be built into the intervention plan.

For feedback, the grand mean was 3.82 (SD = 0.67), interpreted as Agree. Giving and receiving feedback from peers obtained the higher mean (M = 3.86, SD = 0.78), while receiving feedback from the instructor about one's thinking obtained a mean of 3.78 (SD = 0.76). Both indicators were rated favorably, but the lower rating for instructor feedback suggests that teacher-provided feedback may be an area for improvement. Feedback is most valuable when it identifies specific strengths, points out what needs correction, and indicates what to do in the next attempt. Cai et al. (2023) revealed positive effects of feedback in technology-based learning, particularly when explanations accompany it, and Brands et al. (2025) highlighted the importance of learners' ability to give feedback to others in vocational learning. Performance checklists on procedure, accuracy, safety, and product quality, together with criteria for peer feedback, could strengthen this dimension in Bread and Pastry Production.

For time on task, the grand mean was 3.85 (SD = 0.57), interpreted as Agree. The statement that the learning experience activities made learning more productive received the highest mean (M = 4.01, SD = 0.72). Having enough moments within the given timeframe to apply the material was rated 3.83 (SD = 0.75). Completing the coursework in a reasonable amount of time was lowest (M = 3.72, SD = 0.78). The simulation exercises were largely seen as productive, but the lower score for timely completion suggests that some activities need more careful planning and pacing. Chernikova et al. (2020) identified ongoing practice and scaffolded instruction as important components of simulation learning, and Ahn and Nyström (2023) provided evidence of the importance of practical aspects in vocational training. The intervention plan might divide practice into preparation, production, quality check, and cleanup stages with defined time allocations, while maintaining hygiene and quality standards.

For high expectations, the grand mean was 3.81 (SD = 0.69), interpreted as Agree. The instructor providing an environment that encouraged students to challenge their own thinking and abilities obtained a mean of 3.84 (SD = 0.78). Clarity and ease of understanding of the learning experience objectives obtained 3.78 (SD = 0.88), the lowest in this dimension. Students felt motivated to improve, but expectations for each activity could be communicated more clearly. Gentrup et al. (2020) found an association between teachers' expectations and students' later learning and achievement, and Navarro-Parra and Chiappe (2024) stressed the importance of linking simulated learning to the curriculum and practical learning. Together these point to the need for appropriate expectations combined with clear instruction. Explicit learning goals, evaluation measures, required measurements, production methods, sanitary practices, and final product characteristics should be communicated before every simulation.

For diverse learning, the grand mean was 3.78 (SD = 0.60), interpreted as Agree, the lowest-rated of the seven dimensions. The learning experience offering a variety of ways to learn the material obtained the highest mean (M = 3.84, SD = 0.79), followed by the instructor being inclusive of different perspectives in thinking and learning (M = 3.83, SD = 0.80). A variety of ways of assessing learning obtained 3.77 (SD = 0.90), and the instructor individualizing the learning experience to meet particular needs was lowest (M = 3.67, SD = 0.83). The learning environment was thus perceived as inclusive, but individualized support may be inconsistent. Compren et al. (2024) highlighted the importance of considering individual learning needs in vocational education, and Rufaidah et al. (2024) revealed variation in the learning needs, characteristics, and readiness of vocational students. Some learners may need more help with measuring ingredients and following procedures, while others can handle production tasks independently, so alternative routes to the same competencies could be offered without lowering performance standards.

Taken together, the overall simulation-based learning mean was 3.85 (SD = 0.45), interpreted as Agree. Student-faculty interaction was highest (M = 3.92, SD = 0.50), followed by collaborative learning (M = 3.88, SD = 0.61) and active learning (M = 3.87, SD = 0.58). Time on task obtained 3.85 (SD = 0.57), feedback 3.82 (SD = 0.67), high expectations 3.81

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(SD = 0.69), and diverse learning 3.78 (SD = 0.60), the lowest. All seven dimensions were rated Agree, which indicates a positive perception of simulation-based learning. Teacher support, collaborative interaction, and active participation were relatively strong, while diverse learning, high expectations, and feedback merit further attention. This is consistent with Nyström and Ahn (2023) on the use of simulations in vocational teaching and with Wibawanto et al. (2022). The planned intervention responds to these descriptive findings, and its effectiveness should be judged through implementation rather than through the present results.

Level of skills mastery

Skills mastery was the second major variable and reflects how well respondents had acquired and applied the skills required in TVL-Home Economics. The results are presented below for technical competence, accuracy of performance, safety practices, and work efficiency.

For technical competence, the grand mean was 3.81 (SD = 0.61), interpreted as Agree. Following standard operating procedures during practical tasks obtained the highest mean (M = 3.94, SD = 0.86), closely followed by properly using tools, equipment, and materials (M = 3.93, SD = 0.83). Demonstrating the competencies expected in the specialization obtained 3.79 (SD = 0.85), and correctly performing the required Home Economics procedures obtained 3.75 (SD = 0.85). Completing practical activities with minimal supervision was lowest (M = 3.64, SD = 0.81). Students considered themselves competent in performing procedures and using practical materials correctly, which matters in bread and pastry production where measurement, equipment use, and procedure determine product quality and consistency. The lower rating for working with minimal supervision suggests that learners still need some guidance. Isana and Dinglasan (2026) found that simulation training supported the competencies and confidence of Grade 11 TVL-Home Economics students, and Urgelles and Urgelles (2024) stressed the importance of practical training in skill acquisition and transfer. Repeated exposure to practical tasks with gradually reduced teacher supervision, supported by performance checklists, could strengthen this dimension.

For accuracy of performance, the grand mean was 3.92 (SD = 0.55), interpreted as Agree. Paying attention to details while performing laboratory tasks obtained the highest mean (M = 4.06, SD = 0.86), followed by carefully following instructions during practical activities (M = 4.04, SD = 0.80). Minimizing errors obtained 3.90 (SD = 0.87), and producing outputs that meet quality requirements obtained 3.87 (SD = 0.76). Completing practical tasks according to established standards was lowest (M = 3.73, SD = 0.78), though it remained within the Agree range and above the neutral point. Respondents therefore showed a relatively high degree of accuracy, and some students may need more practice in consistently adhering to standards. This agrees with Isana and Dinglasan (2026), whose study showed that simulation-based activities increased the competencies and confidence of Grade 11 TVL-Home Economics students in practical tasks. The high ratings for attention to detail and instruction-following suggest that simulation-based activities may have helped students become careful and accurate.

For safety practices, the grand mean was 4.08 (SD = 0.68), interpreted as Agree, the highest among the skills mastery dimensions. Safely handling tools, equipment, and materials obtained the highest mean (M = 4.13, SD = 0.97), followed by maintaining cleanliness and sanitation in the work area (M = 4.12, SD = 0.88). Properly using personal protective equipment obtained 4.08 (SD = 0.89), and proper waste disposal after laboratory activities obtained 4.07 (SD = 0.81). Observing Occupational Health and Safety (OHS) procedures during practical work was lowest (M = 3.99, SD = 0.94). Students appeared to recognize the importance of safe

handling and of keeping work areas clean and sanitized, which is especially relevant in Bread and Pastry Production given the equipment, preparation surfaces, and baking facilities involved. The comparatively lower score for observing OHS procedures indicates that knowledge of safety procedures deserves continued attention. Isana and Dinglasan (2026) reported that simulation-based learning supported practical competencies and confidence among TVL-Home Economics students, which provides context for using practical learning to reinforce safe procedures. Safety demonstrations and checklists for equipment handling, cleaning, and inspection should therefore remain part of every simulation.

For work efficiency, the grand mean was 3.83 (SD = 0.67), interpreted as Agree. Using materials efficiently and avoiding unnecessary waste obtained the highest mean (M = 3.98, SD = 0.85), followed by organizing work before performing practical tasks (M = 3.93, SD = 0.87). Solving simple problems encountered during practical work obtained 3.80 (SD = 0.93), and working independently while maintaining quality output obtained 3.79 (SD = 0.97). Completing practical activities within the allotted time was lowest (M = 3.65, SD = 0.89). Students appeared aware of the importance of organizing their work and using materials efficiently. These results relate to Chernikova et al. (2020), who found that simulation-based learning contributes to complex skills through practice and instructional scaffolding. Alharbi et al. (2024) likewise claimed that simulation-based learning promotes skills acquisition but noted limitations regarding knowledge retention, which makes repeated practical simulations important. The lower rating for completing tasks on time suggests a need to strengthen pacing and task sequencing, for example through timed activities that do not sacrifice accuracy, sanitation, or safety.

In summary, the overall skills mastery mean was 3.91 (SD = 0.53), interpreted as Agree. Safety practices were highest (M = 4.08, SD = 0.68), followed by accuracy of performance (M = 3.92, SD = 0.55) and work efficiency (M = 3.83, SD = 0.67). Technical competence was lowest (M = 3.81, SD = 0.61). This is consistent with Chernikova et al. (2020), who found that simulation-based learning can develop complex skills when appropriate guidance and training opportunities are provided. Alharbi et al. (2024) suggested a major correlation between simulation-based learning and students' knowledge and skills development, but their evidence came from higher education and healthcare professions rather than TVL-Home Economics, so it should be treated cautiously. The high ratings indicate that students believe they have the skills needed for essential practical tasks in Bread and Pastry Production. However, these ratings reflect self-reported perceptions on the criteria used in this study and are not objective proof that every student has mastered all required competencies. Safe handling of tools and equipment and cleanliness and sanitation are strengths of the respondents. The lower means for technical competence and work efficiency suggest that further practice is needed in adhering to standard operating procedures, working without close supervision, arranging materials, and working within the allotted time. Demonstration, practice, simulations, and performance assessment with clear standards for technical skills, product accuracy, sanitation, and time management can address these needs.

Relationship between simulation-based learning and skills mastery

To determine whether students' experience of simulation-based learning was related to their skills mastery, the Pearson Product-Moment Correlation Coefficient was computed at the 0.05 level of significance. The result was r = 0.730 with a p-value of less than .001, which indicates a strong positive relationship, described in the analysis as a very high positive correlation. Because the p-value was lower than 0.05, the relationship was statistically significant, and the decision was to reject the null hypothesis (H0) of no significant relationship between simulation-based learning and skills mastery. Respondents who perceived more

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positive simulation-based learning experiences also reported higher skills mastery. Through simulated tasks, learners practice procedures, use tools and materials, receive guidance, and improve through repetition, which supports technical competence, accuracy of performance, safety practices, and work efficiency. The correlation does not establish cause and effect. It shows only a strong positive association, which is consistent with the favorable results for simulation-based learning and skills mastery reported above.

This finding is supported by earlier studies. Chernikova et al. (2020), in a meta-analysis of 145 empirical studies, demonstrated the positive influence of simulation learning on skill acquisition, particularly the positive effects of guided learning and scaffolding. Qi et al. (2026) described the contribution of simulation and experiential learning to the practical skills of vocational learners through practice and instructional resources. Ismiyati et al. (2022) indicated that a simulated learning approach improved students' learning competencies, and Wibawanto et al. (2022) found that simulation-based interactive multimedia enhanced the learning outcomes of vocational students. These studies strengthen the relevance of the present finding that simulation-oriented and experiential learning helps develop practical competencies and improve performance.

Synthesis of findings

The 135 TVL-Home Economics students, all in Bread and Pastry Production, were nearly evenly distributed by age (68 or 50.37% aged 17-18 and 67 or 49.63% aged 15-16) and gender (69 male and 66 female). They rated simulation-based learning at an overall mean of 3.85 (SD = 0.45) and skills mastery at an overall mean of 3.91 (SD = 0.53), both interpreted as Agree. The strongest aspects were student-faculty interaction (M = 3.92) for simulation-based learning and safety practices (M = 4.08) for skills mastery. The areas needing attention were diverse learning (M = 3.78), high expectations (M = 3.81), and feedback (M = 3.82) in simulation-based learning, and technical competence (M = 3.81) and work efficiency (M = 3.83) in skills mastery. The Pearson r of 0.730 ($p < .001$) at the 0.05 level of significance led to rejection of the null hypothesis, showing a strong and significant positive association between the two variables. The results therefore address each objective of the study and add school-specific evidence on how simulation-based learning relates to skills mastery in a technical-vocational setting, with the caveat that the evidence is correlational and perception-based. These findings provide the empirical basis for the Simulation-Based Learning Intervention Plan, which the next chapter presents and which targets clearer objectives, stronger feedback, individualized support, supervised practice that gradually becomes independent, and consistent safety and time management practices.

CONCLUSION

This study examined the relationship between simulation-based learning and skills mastery among TVL-Home Economics students majoring in Bread and Pastry Production at Lahug National High School-Night. Using a quantitative approach, with a questionnaire and statistical analysis, the study determined the respondents' profile, their experiences in simulation-based learning, their level of skills mastery, and the correlation between the two variables. The respondents came from various age groups and genders, but all belonged to the Bread and Pastry Production specialization under the TVL-Home Economics strand. Overall, the findings show that the students' learning experience and skills mastery were generally

favorable and satisfactory, and that a significant positive relationship exists between simulation-based learning and skills mastery.

With regard to simulation-based learning, the students reported favorable experiences, particularly in student-faculty interaction, collaborative learning, and active learning. These results make clear that teachers play a critical role in guiding students to participate actively in the learning process. Diverse learning, however, emerged as the area most in need of improvement. This indicates a need for differentiated activities that attend to the varying learning abilities and needs of the students, so that simulation-based experiences can benefit all learners equally.

In terms of skills mastery, the students demonstrated a good level of competence, with safety practices as their principal strength. Nevertheless, their technical competence still requires further development, especially in completing tasks independently, following prescribed standards, and managing time effectively. Taken together, these results suggest that while students observe proper safety procedures in practical work, they need more opportunities for repeated practice, guided performance, and independent task completion to strengthen their technical proficiency.

The analysis further revealed a very strong positive and statistically significant relationship between simulation-based learning and skills mastery. It follows that students who experience more effective simulation-based learning tend to show higher levels of skills mastery. This relationship, however, does not imply causality between the two variables, and the result should be understood strictly as an association. This finding served as the basis for the proposed Simulation-Based Learning Intervention Plan, which aims to address the identified areas for improvement.

In light of these conclusions, several recommendations are offered to enhance students' practical skills and mastery. TVL-Home Economics teachers are encouraged to incorporate varied and differentiated simulation-based activities that provide repeated practice, guided performance, constructive feedback, and independent task completion, while assessing technical competence, accuracy, safety practices, and efficiency. School administrators should provide adequate tools, equipment, materials, facilities, and appropriate scheduling to support the implementation of the intervention plan. Students, for their part, should participate actively, practice consistently, remain receptive to feedback, observe safety and sanitation procedures, manage their time well, and perform tasks with greater independence. Schools are likewise encouraged to strengthen partnerships with industry stakeholders to offer demonstrations, practical training, and industry-informed feedback, which may help students connect classroom simulations with workplace expectations and industry standards. Curriculum implementers and education officials may consider integrating differentiated simulation-based learning activities and competency-based performance assessments into relevant TVL-Home Economics learning experiences. Finally, future researchers may conduct similar studies involving other TVL specializations, schools, and learning environments, explore other assessment tools, examine additional factors related to skills mastery, and employ appropriate research designs to investigate the effectiveness of specific simulation-based learning interventions.

In conclusion, the study affirms that simulation-based learning is meaningfully associated with students' skills mastery in Bread and Pastry Production. By strengthening diversity in learning and technical competence while sustaining the existing strengths in teacher interaction and safety practices, stakeholders can better equip students with the practical skills expected of them in the workplace.

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