Improving Tertiary Students' Academic Performance and Appreciation of the Life and Works of Jose Rizal Course through Digital-based Biographical Museum Simulation

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Abstract

The study examined the effectiveness of the digital-based biographical museum simulation on the student's academic performance in the Life and Works of Jose Rizal Course using the quasi-experimental research design. A qualitative research design was also employed to determine the effects of the proposed innovative learning tool on the students' appreciation of the said course. The participants were fifty (50) college students who underwent a match-pairing process dividing them into experimental and comparison groups. Eight simulated stories revealing the life journey of Jose Rizal were created. Content presentation was guided by the GAT RISAL appreciative-based instructional planning framework. The data were collected using paper-pencil assessment tools and focus-group discussions. Quantitative data were analyzed using both descriptive and inferential statistics while the qualitative part was examined using content and thematic analyses.

Results indicated that the test mean scores of the experimental group, from pre-test to post-test, significantly increased by 6.96 points, which is higher than the comparison group that exhibited an increase of 4.08 points. On the other hand, the formative test mean scores of the two groups revealed an average level indicating the same level of academic performance. Regarding the research hypotheses, there was a significant difference between the formative test mean scores of the experimental and comparison groups. There were also significant differences between the pre-test and post-test mean scores of both groups. Moreover, the qualitative results highlighted that there was an improvement in the students' appreciation of the Rizal course as an effect of the proposed innovation tool.

***Keywords**: digital learning, Jose Rizal course, biographical museum, simulation*

Introduction

The life and works of national heroes have already been integrated into history learning (Pirzada et al., 2022; Pramono et al., 2019) and used in teaching students with moral principles and values in the classroom (Ahmad, 2014; Warnick, 2023). National heroes were included in textbooks and other reading materials (Jat et al., 2018; Lanjwani et al., 2023), putting a premium on their heroic deeds and values.

José Protacio Rizal Mercado y Alonso Realonda, popularly known as Jose Rizal, is one of the national heroes of the Philippines whose writings empowered many Filipinos to achieve freedom during the Spanish colonial period. His famous literary creations, particularly Noli Me Tangere and El Filibusterismo, are good materials for inculcating a sense of nationalism among students. Hence, Rizal's life and works offer source of inspirations which may help students in building their moral character and patriotism.

In pursuit of planting Filipino values such as love of the country, the course The Life and Works of Jose Rizal was offered in the tertiary education in adherence to Republic Act No. 1425, which mandates the inclusion of the life, works, and writings of Jose Rizal in the curricula of public and private schools, colleges, and universities. However, this course is getting less appreciated among college students nowadays, which has been a pressing dilemma for teachers. In fact, in an extensive study, teachers found that students exhibit a lack of interest in the course, dubbing it as one of the most boring subjects (Deligero-Badilles, 2018).

Deponio and Viray (2022) stressed that it is crucial to consider the approach to be used in the teaching process. In their study, they accentuated that teachers must employ contextual teaching and learning approach (CTL) to induce students to be responsive, interactive, and critical in understanding the life and works of Rizal. As the course encompasses historical information, what students often do is that they tend to memorize dates and other details about Rizal's life and works. Learning the subject this way would be less interesting as it fails to underscore the relevance of Rizal's deeds and ideas to inculcate values among young people such as nationalism, which can be promoted through civic engagement (Camposano, 2019).

Failure to instill into the minds of the students the socio-political relevance of the course would only add up to students' negative attitudes toward learning (Deligero-Badilles, 2018). As such, there is a need for innovative strategies in teaching the life and works of Rizal to Filipino college students. Teachers play a crucial role in making the subject more interesting and relevant to students' personal lives and future endeavors (Salcedo, 2016). Otherwise, students' lack of interest and lack of engagement would remain barriers to teaching and learning the course.

In support, Llamazares de Prado and Arias Gago (2023) mentioned in their study that accessing information using digital tools is continuously gaining importance worldwide; likewise, they indicated that educational institutions should embrace this kind of transformation to promote awareness and accessibility of

information. Evidently, the digitization of teaching and learning is increasingly practiced nowadays with the advent of technological advancements and changing societal demands (Arısoy, 2022). Since almost all people across the globe have already attuned to using digital technologies for various purposes (Andersen et al., 2021; Burbules et al., 2020), it is not surprising at all that educational institutions have presently leveraged digital-based platforms for improving instruction. In fact, studies showed that it is more effective to use digital technologies than traditional instructional methods in terms of improving students' academic performance (Keane et al., 2023; Lewin et al., 2019).

In the context of documenting and preserving the information of a prominent figure through the support of digital technologies, Shakour (2018) stated that putting premium on contemporary biographical museums is a pedagogical innovation as it appeals to the younger generations and can influence them to imitate the good deeds and values of a particular personality during his or her lifetime. This digital-based biographical museum can be used to present the different aspects of life of a famous personality or figure in an innovative and creative way. Unlike the traditional museum, this strategy employs digital tools that make the presentation of information more realistic, interactive, and appealing to the students. Even so, there is still a dearth of studies on whether it improves students' academic performance.

Furthermore, while the use of digital technologies in historical and archaeological museums is widely known (Dunn et al., 2019; Luther et al., 2023), there needs to be more corpus of published articles about the use of digital-based biographical museum simulation in educational contexts. To fill the identified gaps, this study aimed to explore the effectiveness of digital-based biographical museum simulation in improving students' academic performance and appreciation in the Life and Works of Jose Rizal course.

Objectives

The general objective of the study was to examine how the digital-based biographical museum simulation improved the academic performance and appreciation of tertiary students in the Rizal course. The specific objectives were:

1. To compare the pre-test, formative and post-test means scores of the tertiary students in comparison and experimental groups in various assessments;
2. To examine the significant differences between the formative test and post-test scores of the tertiary students in both groups;
3. To analyze the significant difference between the pre-test and post-test of each group; and
4. To examine the effects of the digital-based biographical museum simulation on students' appreciation of the Rizal course.

Review of Related Literature

Innovative Approaches in Teaching Social Science

In the 21st century, education has advanced to a point where people and technology are adapted to open new opportunities. Social science teachers today must create innovative approaches to engage and interact with their students (Plaza, 2021).

The development of information and technology has sped up changes in teaching strategies and the environment in which students learn (Dunwill, 2016). Gen Z students appreciate group conversations and a more engaged learning environment (Kozinskyi, 2017). They can easily access information, and they are not constrained by any particular location or time when it comes to studying. Furthermore, the use of different instructional media helps the students enhance their multiple intelligences which are beneficial to understanding social science courses. The application of unique teaching methods and techniques to social science teaching builds an encouraging learning environment where students can explore their abilities and intelligences (Madhumita, 2016).

Teaching the Life of National Heroes and the Value of Heroism

Planting the value of heroism among students can be best practiced by using national heroes as role models. More than knowing and being aware of the lives of national heroes, students should realize the importance of heroism. As stated in the study by Sun et al. (2023), heroism is a predictor of civic engagement.

Based on the premise that individuals learn emotional and affective behaviors by emulating models (Bandura, 1997), it was claimed that using heroes as role models is effective in values education (Yazici & Aslan, 2011) and moral education (Respess, 2017). Moreover, teaching values displayed by the heroes in the past helps students recognize their importance in present-day situations. It can lead to students' realization of the need to contribute to addressing the present social, economic, political, and environmental struggles.

Furthermore, teaching the life of national heroes allows students to cultivate heroic values that are essential for their character development (Ahmad, 2014). It serves as a strong foundation for them to practice the value of heroism through their active participation in a democratic society (Perrotta, 2017).

Computer-Assisted Simulation and Students' Academic Performance

Improving students' academic performance has been a focal interest of many researchers in the academic world. In fact, plenty of studies have been conducted exploring innovative teaching strategies to address students' learning difficulties and poor academic performance (Khurshid & Ansari, 2012; Setiawan et al., 2021; Yawman & Appiah-Kubi, 2018).

Various research show that computer-based learning and students' academic performance are significantly associated. In the study by Bakaç et al. (2011),

it was found that computer-assisted instruction with simulation is effective in increasing students' achievement in Physics activities. Additionally, Mihindo et al. (2017) revealed that computer-based simulations positively helped students to effectively understand Chemistry concepts which led them to get higher performance in the said subject. The use of computer simulation in teaching and learning Physics was also recommended by Kabigting (2021) since it contributed to students' increased participation and performance.

Technology adoption in the field of education is increasingly practiced among schools as they continue to innovate teaching methods and strategies (Afridi & Chaudhry, 2019; Oyetade et al., 2020). Such a trend has become relevant nowadays since 21st-century students are considered to be tech-savvy (Liao et al., 2016; Sanabria & Arámburo-Lizárraga, 2017). Using traditional methods may no longer be effective in piquing their attention; thus, teachers must integrate technology into the process of teaching and learning.

In terms of digital museums, development originally aimed to copy the traditional museum into web form (Tong & Ma, 2021), but as the process of digitalization has advanced, the exhibition styles have also improved. Digital museums are continuously becoming more modern, incorporating technologies in the design, construction, and production to provide high-quality viewing experiences.

In classroom teaching and learning, digital museums allow teachers to promote cultural heritage even without requiring their students to do an actual museum visit. As stated in the study by Eguz (2020), a digital museum is computer-assisted, which can be used in the classroom as an instructional tool for teachers in helping students internalize cultural content and stimulate their creative thinking. Although it would not provide rich experiences unlike what the actual museum visits could offer, digital museum still has its affordances: immersive experience and no barrier of distance (Mamur et al., 2020).

While there have been studies conducted on the development of digital museums and their applications in the classroom setting, there is still a need to explore how effective a digital-based museum simulation is in improving the students' academic performance and their appreciation towards the life and works of a famous personality or figure such as a national hero.

Theoretical Framework

The first theory that supports this study was the Cone of Experience by Edgar Dale. It is based on the idea that learning experiences progress from concrete to abstract. Digital simulations provide students with a more immersive environment which allows them to better capture real-life contexts. This is a type of experiential learning that enables students to use more of their senses, which can lead to a better appreciation of the life and works of Jose Rizal. In the simulated tool, students perform several challenges that make use of their metacognitive, problem-solving, creative, collaborative, and critical thinking skills. Talan (2021) stated that simulations are effective in developing students' 21st-century skills such as problem-solving and critical thinking.

Furthermore, the Hierarchy of Learning by Robert Gagne was also used as a theoretical foundation for this study. In Gagne's Hierarchy of Learning, problem-solving is the highest level of cognitive process. Rizal's life and works can be used as a medium to develop students' problem-solving skills by relating various socio-political issues nowadays; however, this would not be achieved without prior knowledge and the acquisition of other cognitive skills. In improving problem-solving skills, Sutadji (2020) underlined the importance of prior knowledge as it involves the acquisition of attitude and skills necessary to go through the next learning process.

In the development of a digital-based biographical museum, the study was essentially grounded in the Technology, Pedagogy, and Content Knowledge (TPACK) framework which entails the integration of the technology-based learning into the presentation of content knowledge and the pedagogical execution (Koehler et al., 2014). The theory also explains the cohesive interaction among these three elements namely, technology, pedagogy, and content, encourages interactive learning experiences of the students through deep engagements with technology-based tools. As such, the development of a simulated museum for narrating the life stories of Jose Rizal establishes a context-specific response that transforms the content-based learning course into an interactive content delivery designed to increase students' interest, appreciation, and learning opportunities in the Rizal course.

Furthermore, the GAT RISAL appreciative learning instructional planning framework was anchored on Frederickson's broaden-and-build theory of positive emotion. This theory states that appreciation is reinforced through positive emotions, transforming students to be creative, knowledgeable, and socially aware (Fagley, 2018).

Methodology

The researchers used a quasi-experiment research design to examine the effectiveness of the digital-based biographical museum simulation on the academic performance and appreciation of the Rizal course. The respondents of the study were tertiary students from Kolehiyo ng Lungsod ng Dasmarinas, a locally funded educational institution in Dasmarinas City, Cavite, Philippines.

A total of sixty-eight (68) tertiary students were included in the administration of the pre-test as the first stage of the study. The results of the pre-test were used as a basis for the matching-pairing process, reducing the number of participants from 68 to 50 students. These fifty (50) students were divided into two groups: comparison and experimental groups. Each group had a twenty-five (25) sample size. The comparison group was exposed to the learning tool and activities recommended by the Commission on Higher Education (CHED) syllabus. On the other hand, the experimental group consisted of students who used the biographical museum simulation learning tool created by the researchers using Adobe Flash CS 5.5 and Action Script 2.0, which is a prototype-based object-oriented programming language that builds interactive and gamified learning materials. Some images displayed on the simulated tool were lifted from and credited to various online sources. Eight simulated stories revealing

the life journey of Rizal from his childhood up to the printing of his novel "Noli Me Tangere" were created. Both learning tools were delivered through online modality as part of the distance learning system of the institution.

Before the conduct of the study, the researchers secured permission from the Research Ethics Committee of the institution. The study was granted an "exemption for review" as it would not involve vulnerable populations; however, informed consent and data privacy form were asked to accomplish by the participants indicating their approval of utilization and reporting of the results.

The effectiveness of the learning tool on academic performance was determined through the scores obtained by the tertiary students to the pre-test, formative, and post-test assessment tools. Data were analyzed using both descriptive and inferential statistics. Weighted mean and standard deviation were the descriptive statistics being used while the Independent T-test and Paired t-test were employed to treat the inferential statistics part. Further clarifications and verification of results were done using focus-group discussions (FGD) with the participants of both groups. There were sixteen (16) participants included in the FGD to discuss the learning opportunities, potential biases and disadvantages, course appreciation, and possible improvements in the proposed pedagogical innovation for teaching the Rizal course. They were selected based on the performance from pre-test and post-test as shown below.

Table 1
Distribution of FGD Participants based on their Performance from Pre-test and Post-test Results

Number of Students selected for FGD	Pretest Score	Posttest Score
4	Very Low	Very High
4	Low	Very High
4	Low	Very High
4	Average	Very High

The said criteria for participant selection were employed to ensure equal representation of the students who have shown varied academic performances before and after the proposed intervention. The qualitative data were analyzed using content analysis (Bengtsson, 2016) and thematic analysis (Braun & Clarke, 2006).

On the other hand, the development of the digital-simulated tool was anchored in the ADDIE model, which was originally developed at Florida State University's Center for Educational Technology. ADDIE stands for Analyze, Design, Develop, Implement, and Evaluate; these are all stages that serve as a guide for educators and instructional designers when designing and developing an instructional material or training program. As described by Handrianto et al. (2021), the ADDIE model is a systematic guide for planning, designing, and developing an instructional strategy.

To apply the said model, the researchers first identified the social science courses that gained less student engagement and low cumulative performance in the semester. After comparing the academic grades obtained by the students from different social sciences courses, it was found that The Life, Works and Writings of Rizal course gained low performance. The results of the comparison were further validated by the semi-structured interviews with the instructors. They shared that some students think that they have already had enough knowledge of the life of Rizal since he has been mentioned in history classes since elementary classes which resulted in low appreciation. Moreover, instructors noted that some students were no longer interested in history-related subjects because of the traditional method of learning delivery experienced by them even during the transition to online classes. Although instructors made use of computer applications to connect with students, they still presented the topics in lecture or discussion methods only.

In relation, since strengthening appreciation is the starting point to more engagement and improved performance, the researchers specifically designed an instructional planning framework to enhance the presentation of topics in the Rizal course called “GAT RISAL” which is derived from the name of the Philippine National Hero. This framework consists of the following:

Goal Orientation	This part lays down the lesson objectives that shall be achieved by the students after the learning session.
Abstraction	This part initially introduces the lessons to the students. This also provides an overview of the lessons/topics to be discussed. This can be in the form of a “riddle”, “word hunt”, etc.
Transformation	This part provides thought-provoking questions that students must ponder. Questions must require students to relate the present situation to the past and future and situate the transformations that took place.
Reflection	Grounded in the transformations, this part allows students to have an in-depth analysis of the changes in society from Rizal’s time to the contemporary world. This part must allow students to have critical and reflective insights that can be applied to life.
Innovative Discussion	This part pertains to the discussion proper. This thoroughly explains the concepts using computer technology.
Scrutinization	This part serves as an assessment to examine if the lesson objectives have been attained or not. This part imitates and reintegrates the lessons in the form of a short quiz/formative assessment.

Amplification	This part further determines how far the students have learned the lessons. This can be in the form of extended learning activity, computer-assisted games, or cooperative learning.
Life Integration	This part strengthens the appreciation of the life story of Rizal. This part emphasizes Rizal's experiences can be a learning experience that can be applied to daily endeavors.

The ADDIE model, coupled with the GAT RISAL appreciative learning instructional planning framework, is expected to provide positive effects on the academic performance and appreciation of the students of the Rizal course which will possibly lead to the inculcation of nationalistic values within themselves.

Results and Discussions

Results revealed that the mean score for both groups is 12.40 out of thirty (30) items pre-test with a standard deviation of 4.26 as shown in Table 2. This mean score was interpreted as "low" which means that students have low knowledge or less interest in the Rizal course affecting their performance before the intervention. Since the mean scores for both groups are identical, the selection process used to assign participants to each group was successful. Moreover, the low scores obtained by the students were used as a baseline for improvement after exposure to two learning tools: the CHED-recommended activities and the simulated stories enshrined in the biographical museum. Such a selection technique was employed to ensure that each score of the participant from the comparison group was paired with a corresponding or similar score from the experimental group (Nunez et al., 2023).

Table 2

Performance level of the tertiary students in the comparison and experimental group according to the pre-test mean scores

Group	Mean	Std. Dev.	Descriptive Interpretation
Experimental Group	12.40	4.26	Low
Comparison Group	12.40	4.26	Low

Legend: 27– 30 = Very High; 23 – 26 = High; 15 – 22 = Average; 8 – 14 = Low; 1 – 7 = Very Low

There were three formative tests provided to students to determine their learning progress while exposed to two learning tools as manifested in Table 3. Each test had a total of fifteen (15) items and was constructed in a multiple choices-type of test following the Revised Bloom's Taxonomy. Results indicated that tertiary students from both groups had the same average performance in the first formative test. The experimental group got a mean of 10.00 while

the comparison group obtained a 9.20 mean with a standard deviation of 1.83 and 2.16, respectively. During the FGD with the two groups, they collectively shared that their average scores in the first formative test were the results of adjustments with the new course and the online platform used in school. Similarly, Lamb et al. (2020) underlined that as they adopt new technology into the process of learning, students need time for adjustments, which affects their learning experience and outcomes.

A commendable improvement was documented in the performance of the experimental group in the second formative test with the mean score of 10.84 which is interpreted as "high" with the standard deviation value of 2.41. This is higher than the average performance of the comparison group which got a mean score of 9.04 with the standard deviation value of 2.89. Students from the comparison group mentioned that some of them do not prefer too many paper-pencil activities such as graphic organizers, reflection papers, and essays. They also noted that online learning became even less interactive because of too much and repeatedly used written activities to be done after lectures. The outcome in which the experimental group outperformed the comparison group was also corroborated by Männistö et al. (2019), favoring the use of digital learning in improving students' learning outcomes.

Likewise, the same level of performance was observed in the last formative assessment in which the experimental group performed better than the comparison group. The former got a mean score of 11.20 with a standard deviation value of 1.94 while the latter obtained a mean score of 9.96 with a standard deviation value of 1.46. Results revealed that the experimental group which used the biographical museum simulation maintained their good performance in two formative tests. This was further validated by the comments of the students on the utilized tool stating that the interactive presentation of the topics sustained their interest and excitement in accomplishing the activities. This is in line with what Beckem and Watkins (2012) stated that using digital simulation can increase students' engagement due to its interactive learning environment.

Generally, both groups revealed an average performance after consolidating the scores they obtained from the three formative tests. Despite the high performance exhibited by the experimental group as compared to the comparison group, the mean difference was relatively low.

Table 3
Performance level of the tertiary students in the comparison and experimental group according to the formative test mean scores

Covered Simulations	No. of Items	Group	Mean	Std. Dev.	Descriptive Interpretation
Childhood Years to Early Education of Jose Rizal	15	Experimental	10.00	1.83	Average
		Comparison	9.20	2.16	Average
Education in Ateneo De Manila and Unibersidad De Sto. Tomas	15	Experimental	10.84	2.41	High
		Comparison	9.04	2.89	Average
Life in Spain, Paris, and Noli Me Tangere was published in Berlin	15	Experimental	11.20	1.94	High
		Comparison	9.96	1.46	Average
Overall	45	Experimental	32.04	4.45	**Average**
		Comparison	28.20	4.53	**Average**

Legend: 14 – 15 = Very High; 11 – 13 = High; 8 – 10 = Average; 5 – 7 = Low; 1 – 4 = Very Low
Legend: 41– 45 = Very High; 34 – 40 = High; 23 – 33 = Average; 12 – 21 = Low; 1 – 11 = Very Low

Like the formative test results, both groups had the same average performance in their post-test as shown in Table 4. The experimental group got a mean score of 19.36 while the comparison group obtained a mean score of 16.48 with the standard deviation values of 6.26 and 4.73, respectively. However, it is noticeable from the results that, despite having the same average performance, the experimental group performed better than the comparison as shown in the mean scores. The mean difference of 2.88 indicates that the utilization of the simulated learning tool forwarded certain advantages to the students resulting in improved academic performance. Bello et al. (2016), likewise, found that simulations are effective in improving students' academic performance.

Table 4
Performance level of the tertiary students in the comparison and experimental group according to the post-test mean scores

Group	Mean	Std. Dev.	Descriptive Interpretation
Experimental Group	19.36	6.26	Average
Comparison Group	16.48	4.73	Average

Legend: 27– 30 = Very High; 23 – 26 = High; 15 – 22 = Average; 8 – 14 = Low; 1 – 7 = Very Low

Using the inferential statistics analysis tools, the significant difference between the formative test mean scores of the tertiary students in both groups was examined as shown in Table 5. Results indicated that there was no significant difference between the performance of both groups in the first formative test with a mean difference of 0.80 and t-value of 1.414 indicating that they exhibited a partly identical average performance.

However, in the second formative test, there was a significant difference between the two groups obtaining a mean difference of 1.80 and a t-value of 2.390 at 0.05 level of significance. The same results were generated from the third formative test indicating a mean difference of 1.24 and a t-value of 2.558 at the same level of significance.

Collectively, there was a significant difference between the formative test scores of both groups with a mean difference of 3.84 and a t-value of 3.025 at a 0.01 level of significance. The experimental group got an overall formative mean score of 32.04 which is higher than the 28.20 of the comparison group. This means that there was an accelerated learning progress recorded in the performance of the experimental group in the Rizal course. Such an increase may be derived from sustained interaction, enjoyment, and appreciation. Through the simulation approach with the aid of technology, Luo et al. (2016) revealed in their study that students understood and appreciated concepts, leading to their improved performance.

Table 5
Test of significant difference between the formative test mean scores of the tertiary students in the comparison and experimental groups

Covered Simulations	Group	Mean	Mean Difference	t-value	Remarks
Childhood Years to Early Education of Jose Rizal	Experimental	10.00	0.80	1.414	Not Significant
	Comparison	9.20			

Covered Simulations	Group	Mean	Mean Difference	t-value	Remarks
Education in Ateneo De Manila and Unibersidad De Sto. Tomas	Experimental	10.84	1.80	2.390*	Significant
	Comparison	9.04			
Life in Spain, Paris, and Noli Me Tangere was published in Berlin	Experimental	11.20	1.24	2.558*	Significant
	Comparison	9.96			
Overall	Experimental	32.04	3.84	3.025**	Significant
	Comparison	28.20			

*df = 48; **Significant at .01 level; *Significant at .05 level*

With regard to the post-test mean scores of the students, results revealed that the mean difference between the two groups was 2.88 which is quite small indicating that there was no significant difference between the post-test mean scores of the tertiary students in the comparison and experimental groups. Since both groups obtained the same average performance, there were no documented significant effects that would make them different.

Table 6

Test of significant difference between the post-test mean scores of the tertiary students in the comparison and experimental groups

Test	Group	Mean	Mean Difference	t-value	Remarks
Post-test	Experimental	19.36	2.88	1.836	Not Significant
	Comparison	16.48			

df = 48

Unlike the previous results, there was a recorded significant difference between the pre-test and post-test of each group. The post-test consists of questions similar to the pre-test. A significant difference between the pre-test and post-test mean scores of the experimental group was recorded with a mean difference of -6.96 and a t-value of -7.413. Similarly, there was a significant difference between the pre-test and post-test mean scores of the comparison group with a mean difference of -4.08 and a t-value of -4.309.

Results indicated that the two learning tools provide positive effects on the students' academic performance. While both had identical results, it seems noticeable that the experimental group performed better than the comparison group considering the mean difference. Supporting the number, tertiary students from the experimental group claimed that they were able to sustain their participation in online classes due to the simulated learning stories being used. The biographical museum simulation further supplements the knowledge

gap and boredom in learning history. On the contrary, while they displayed an improvement in their test scores, students from the comparison group argued that there is a tendency to lose their interest and appreciation in learning the Rizal course due to the static lesson presentation and repeated written activities. The same findings were found by Srisawasdi and Panjaburee (2015), revealing that students in the experimental group that used a simulation technique in learning Science concepts performed better than those in the control group.

Table 7

Test of significant difference between the pre-test and post-test mean scores of the tertiary students in each group

Group	Test	Mean	Mean Difference	t-value	Remarks
Experimental	Pre-test	12.40	-6.96	-7.413**	Significant
	Post-test	19.36			
Comparison	Pre-test	12.40	-4.08	-4.309**	Significant
	Post-test	16.48			

*df = 24; **Significant at .01 level*

The results may vary depending on the number of topics that have been simulated, the levels and types of assessment tools, and the number of students involved in the data collection.

Effects of the digital-based biographical museum simulation on students' appreciation of the Rizal course.

Fifteen (15) students from the experimental group were purposely selected for the FGD. Five students were from the group who got very high scores. The same number of students were from the group who got high scores and another five students from the group who obtained average scores in the assessment procedures conducted. During the FGD, participants shared their positive experiences with the digital-based biographical museum simulation and its interactive tools. It was highlighted how the lessons were structured according to the GAT RISAL instructional planning framework, and improvements were noted in the students' academic performance in the Rizal course, which was delivered via distance learning.

Presents multisensory learning. Ten (10) students collectively shared that the biographical museum simulation made them feel that they were in the actual museum as they walked through the corridor of the Rizaliana museum. Each door of the museum presents a challenging activity that must be accomplished by the users before they can proceed to the next door or floor. One of the examples is shown in Figure 1 revealing a scrutinization activity in which users are required to use the direction keys to execute that task in a limited time. They also mentioned that learning activities presented at each door and the interactive storytelling of the tour guide essentially appeal to their auditory, visual, and kinesthetic senses as shown in Figure 2. Participants further emphasized that the application of background music to the animation made

the learning journey more alive and engaging. The results are relative to the study by Taljaard (2016), stating that the use of digital tools in learning appeals to students' multiple senses, which makes the learning process more engaging and interactive.

Figure 1
Scrutinization Activity

Figure 2
Innovative Discussion Activity

Enhances independent acquisition of knowledge. Five (5) students emphasized that biographical museum simulation enables them to work and learn independently as they are required to read the directions and work on the task alone. They also mentioned that the simulated tour guide helps them accomplish each task given as exhibited in Figure 3. Because of the guided learning, it becomes easier for them to navigate the biographical museum properly, meaningfully, and independently. The careful adherence to the directions scaffolds them in task completion which also helps them acquire and produce knowledge independently. Limniou et al. (2021) explained that digital

learning should promote independent acquisition of knowledge to improve students' critical thinking skills.

Figure 3
Goal Orientation Activity

Makes use of authentic assessment. Six (6) students argued that while biographical museum simulation is a computer-assisted learning tool, it can still be relevant to the real-life setting. The reflective questions and life-integration activities allow them to connect the learned knowledge to the actual practice in real life. The performance tasks presented in the simulated tools still allow them to work either independently or collaboratively which strengthens their understanding of the Rizal course and its essence to character building and personal growth. Moreover, they explained that simple reflective journals and essays as activities help them enhance their logical reasoning and locate their learning progress. In connection, Nicola-Richmond and Watchorn (2018) also argued that simulations, as these tend to mimic real-world situations, provide authentic learning experiences for students.

Increases learning engagement. All students mentioned that the interaction between them and the simulated tools allowed them to remember important details of the life story of Jose Rizal. It also helped them create a mental picture that reinforces the understanding and the analysis of the significance of Rizal's experiences and life stories to their learning growth and nationalistic behavior creating a long-lasting impact on their personal life. For instance, the reflection activity through the story of the moth shown in Figure 4 allows them to reflect on and clarify their personal values making them more engaged in the construction of learning. These results can be associated with the study by Wegenera et al. (2017), emphasizing the importance of interactive simulation in increasing students' engagement in the learning process.

Figure 4
Reflection Activity

Discusses Rizal's life in a clear, enjoyable, and interactive manner. All of them stated that the biographical museum simulation presented the life of Jose Rizal in a clear, enjoyable, and interactive manner. Each floor level of the museum presents the life of Jose Rizal in order, from birth up to the time he published his first novel, making the students properly follow the progression of his life. Such resulted in a clear understanding of Rizal's experiences, struggles, and memories. Aside from clarity, the interaction was sustained due to mind games that allow users to think flexibly, enhance mental agility and memory, and improve critical thinking and problem-solving skills. As presented in Figure 5, the implication activity in the form of drag and drop game enhances the user's skills in remembering, organizing, and deliberating factual information which reinforces the use of prior and new knowledge learned. Providing activities that enable students to activate their prior knowledge is important as it reduces students' cognitive load and contributes to their learning performance (Dong et al., 2020).

Figure 5
Amplification Activity

Aside from what were mentioned above, some activities in the intervention also included (1) posing metacognitive and provocative questions that oblige students to know intellectual prowess in analyzing situations related to the life journey of Rizal; (2) relating the ideas with the value and aim of citizenship through short-response essays; and (3) posting situational questions and online commitment energizer games that foster convergent and creative thinking skills, and other activities that enhance higher-order thinking skills of the students.

Conclusion

The study examined how the digital-based biographical museum simulation improved the academic performance and appreciation of tertiary students in the Rizal course. Digital museums as interactive materials are used for teaching art-related courses, historical timelines, and archeology. The teaching of the heroes' biographies in an interactive presentation and the retelling of the life stories, achievements, and struggles in the society contributed to the compendium of innovative strategies in teaching social sciences. Unlike other interactive tools, the proposed innovation builds on the importance of appreciation to sustain their interest in learning the hero's biography.

As an instructional intervention, the digital-based biographical museum simulation effectively helped students appreciate the Life and Works of Jose Rizal course as it provides them with an interactive learning environment and authentic learning experiences. Another key characteristic of digital-based biographical museum simulation is that it promotes multi-sensory learning which makes the students more engaged in the learning process. Consequently, this simulation tool positively affected tertiary students' academic performance and appreciation of the course.

Recommendations

The researchers highly recommend that social sciences instructors utilize a biographical museum simulation in teaching the life stories of national heroes. They may also pursue creating simulated learning tools that enhance students' metacognitive, reflective, creative, critical, and problem-solving thinking skills. The utilization of biographical museum simulation may also be extended to other learning areas and topics that need an interactive walking through the museum of learning.

To solidify the claims regarding its positive effects on student's academic performance and appreciation, conducting research with the use of mixed methods research designs may be pursued by future researchers to produce wide sets of quantitative and qualitative data for examining the effects of biographical museum simulation or similar simulated tools. Additionally, the inculcation of social issues, problems, and challenges into the biographical museum simulation may be done to further increase students' understanding of the contemporary world and how past events influenced the present and the future.

Aside from the tool itself, it is also suggested that the "GAT RISAL", the researcher-developed appreciation learning instructional planning approach, be employed to the contextualization of learning materials to enhance the student's appreciation of topics being discussed. As digitalization is continuously developing, future researchers may also consider looking at strategies for utilizing new tools for innovating digital-based biographical simulation.

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