i-WARM: Development of a Board Examination Reviewer Web Application for Filipino Pre-Service Physical Educators Utilizing the Unified Spaced Repetition and Hypercorrection Techniques

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Abstract

One of the major parameters by which college graduates' productivity is gauged is their board examination performance. Relevantly, the development and utilization of sophisticated tools and technology to facilitate reviews are encouraged and worthy of such exploration. This study aimed to develop an integrated web application reviewer for MAPEH (music, arts, physical education, and health) (*i-WARM*) with the use of unified spaced repetition and hypercorrection techniques. The descriptive research and development (R & D) design was used and employed in a nine-step process in which functions were built for effective learning and retention of concepts. The evaluation was conducted by 106 graduating Bachelor of Physical Education students from a teacher education institution in Central Luzon, Philippines. Results revealed that the *i-WARM* is easy to use and easy to learn as it was viewed as clear and understandable, accessible, and has a flexible feature and interface. Pre-service physical educators perceived that the services provided by the web application were useful for their review as it was rated functional and informative. Frequent problems such as crashes and downtimes were not observed by the user during their exposure to the web application. The *i-WARM* could be explored as a potential aid in assisting learners to acquire concepts easily through an interactive interface. This may likewise assist teachers and students in establishing retention of significant concepts for future licensure examinations.

1. Introduction

Education needs to adapt to the new and advanced mode of teaching and learning due to the continuous hypercompetitive industries brought about by the Industrial Revolution (IR) 4.0. Thus, the term Education 4.0, where professionals and technology work hand in hand, was invented to grant the need for IR 4.0 in the education sector (Hussin, 2018). As development technologies are increasingly made available and rapidly utilized by most businesses, it is viewed as a demand in the education area to attend to the needs of information and communications technology and completely establish a well-supported learning environment for students (Indarta et al., 2022). Further, according to Bond et al. (2020), the brisk adaptation of education's digital transformation is not influenced; other sectors are developing as well. Similarly, Education 4.0 has a major role to play in strengthening the structure of the industry's manpower skills. On this note, the educational system has made an extensive contribution to the success of the industrial revolution (Jung, 2020). The study by Pangandaman et al. (2019) claimed that Education 4.0 will provide a learning environment that is globalized, virtualized, automatized, flexible, and networked. In this case, higher education institutions, particularly the teacher education program, must keep acquainted with the latest developments and trends to transpire the responsive method of teaching and learning. To meet the demand for Education 4.0, all educational institutions shall continuously pursue innovative teaching and learning processes to address and complement the changing educational landscape (Halili, 2019). Furthermore, the use of technology in education creates an impact in honing the interest of the learners to participate in classroom activities. Facilitating teaching and learning can be enhanced through the involvement of technological advancements. In this matter, several studies have noted that the incorporation of technology in teaching improved students' learning (Halili et al., 2018; Halili & Sulaiman, 2016; Maryam & Halili, 2015; Potter et al., 2016).

The conversion of the conventional classroom settings and teaching approaches has been significantly embraced by educators and policymakers to allow distance learning, blended learning, and practical learning (Wu et al., 2018). As reported by Hussin (2018), the application of technology in teaching will support the instructors in making their lessons more creative and effective, thus, student engagement will increase. In addition, information and communications technology offers a variety of educational tools and instruments, particularly applications that can be accessed using smartphones or mobile devices, which could elevate students' motivation in their studies (Aguiar-

Castillo et al., 2022). Cognizant of this, it is relevant for teachers to apply the current technology in their teaching pedagogy. Education 4.0 is notably essential for everyone living in society, however, Qureshi et al. (2021) claimed that there are individuals and academic institutions experiencing difficulties in adapting the new and innovative teaching. Therefore, it is vital to upgrade the digital teaching competence of teachers in a rapid digital transformation in education (Esteve-Mon et al., 2022). This idea was highlighted in the study of Talysheva et al., (2021) who reported that teachers in the new generation are exposed to and engaged in technological advancements which made them digitally literate and competent to teach necessary knowledge and skills to the students. According to Aljraiwi (2017), a web application-based learning environment assists the teacher in facilitating the teaching and learning processes of the students. Hence, learners' performance and motivation are seen to be improved through web application-based learning. In this aspect, the web application helps motivate students to study and learn more. The web has had a great influence on our society and the dependability of web applications has become essential. As specified by Li and Xue (2014), web applications, particularly in the delivery of information and services, are one of the most widely used online platforms in today's generation.

In the Philippines, administrators and faculty in higher education institutions perceived that their level of readiness and skills in implementing and integrating digital resources for teaching and learning was sufficient since most of them attended several capacity-building workshops in technology literacy (Alda et al., 2020). Additionally, it is reported in the study of Lucero et al. (2021) that both students and faculty members of public and private universities manifested a high level of e-learning readiness. To successfully continue the integration of education 4.0 in the classroom setting, the incorporations of ICT programs such as webinar workshops, coaching and mentoring sessions, and faculty development activities may serve as an avenue to level up the status of usage of technology applications in teaching and learning (Hero, 2020). However, teacher education institutions have inaccessible and unavailable digital infrastructure and virtual laboratories, leading to poor attainment of education 4.0 (Alda et al., 2020). In similar literature, it is purported that there is a need to re-design research programs and initiatives and reinforce teacher training expertise for education 4.0's fulfillment in the country.

1.1. Literature Review

1.1.1. Use of Web Applications as a Tool for Education

The development of technological tools provides feasible materials for learning at any pace using portable devices like smartphones, tablets, and laptops among others. In this case, the web application became popular and has been of interest in conducting research toward designing online lessons (Kwangmunag & Pitakaso, 2018). Bringula and Basa (2011) professed that the web application became an educational instrument for delivering teaching and instruction. The utilization of a web application in class has various advantages that could help both teachers and students in their teaching and learning process. Moreover, it was revealed that the web application in class engages students to participate in learning activities and helps teachers to facilitate presentations (Lin & Jou, 2012). However, Urh et al. (2015) revealed that not all developed applications are used by the target participants. Web-based applications and mobile application development may face failure due to unrealistic or unarticulated project goals.

Web applications have enormously contributed to online education as they help educators develop, provide, and exchange learning content for students. Relative to this, web-based education is expected to extend numerous things like learning management systems where educators can upload learning materials and facilitate virtual sessions and activities, monitor the learning status of the students, and the finest services that the web could offer to the users (Podder et al., 2020). Schools and universities are consistently incorporating technological and digital tools like the usage of web applications as a platform to improve the teaching and learning conditions in the current educational modalities. Subsequently, teachers diligently transform educational processes by selecting appropriate technological learning tools, organizing learning management systems, and constructing virtual spaces for synchronous and asynchronous learning (Salas-Rueda, 2020).

1.1.2. Spaced Repetition and Hypercorrection for Students' Learning

Research in the discipline of learning and memory constantly shows that people have a higher level of long-term retention if they read the information once and try to recall it, rather than re-reading it persistently (Seibert Hanson & Brown, 2020). In this case, long-term retention improves even more especially when the delay period between each occurrence of recall is continuously lengthened,

which is a practice procedure called spaced repetition (Roediger III & Butler, 2011). Tabibian et al. (2019) stated that spaced repetition is a technique used to memorize lessons effectively and efficiently through a repetitive review of content following a determined schedule for long-term retention. Seibert Hanson and Brown, (2020), declared that when using spaced repetition, a learner who correctly recalls knowledge from the previous day will not be evaluated again for two days. The following test would be four days later if the learner remembers it correctly at that time. If the learner answers properly, the time between tests expands (e.g., the next three intervals would be 10 days, two weeks, and three weeks). If the learner replies erroneously, the knowledge is retested the next day until the student answers properly. After which, the testing interval gradually increases.

Spaced practice benefits memory which could help students retain their knowledge over time. The spacing effect has the advantage of improving memory in recalling studied materials and potentially has a long-term effect on learning (Kang, 2016). The human brain can easily retain knowledge from previous reviews or studies through spaced repetition (Amiri et al., 2017). This study was supported by Tabibian et al. (2019) who stated that a learner could remember what he has learned based on how many times he reviewed it which also has something to do with the time elapsed of the last appraisal. Reddy et al. (2016) claimed that spaced repetition is a widely used practice in retaining information for teaching new mediums of learning, especially in reviewing what has already been taught. It was presented in the study of van Loon et al. (2015) that students appeared to be quite confident in their misconceptions, implying that they are well-established. The relationship between confidence in misunderstandings and their rectification appears to be complicated. On the other hand, learners who have high confidence in existing knowledge may have trouble acquiring contrasting information. In this situation, they are likely more difficult to correct because high-confidence misconceptions are more strongly represented in memory than low-confidence misconceptions (Ecker et al., 2011).

Misconceptions cannot be corrected unless learners receive feedback (Metcalfe et al., 2012) and when learners are strongly confident in a misperception, feedback may be most helpful (Cordova et al., 2014). Specifically, when learners are given clear feedback that they have a misperception, misconceptions held with high confidence are more likely to be corrected than misconceptions maintained with low confidence, a phenomenon known as the hypercorrection effect (van Loon et al., 2015). Presumably, when students confidently make an inaccurate response, the correction input

is likely to surprise them and call their attention to it (Metcalfe et al., 2012). Subsequently, students are more attentive when the given feedback refutes their high-confidence misconceptions and this may result in paying more attention to accurate information, leading to the hypercorrection effect (Metcalfe & Finn, 2012). The hypercorrection effect was found significant in correcting the errors of the answers that were based on the level of confidence in previous and existing knowledge. The study presented that a strong error in answers can be corrected when feedback is given immediately. As a result, students can easily recall a correct answer when the test is administered again (Carpenter et al., 2018).

1.1.3. The Role of Task-Technology Fit in Web Application Development

The Task-Technology Fit (TTF) theory (Goodhue & Thompson, 1995) provides a means to measure the effectiveness of technology in a system by evaluating the relationship between the technology and the tasks that the technology aims to support. It has been suggested that this theory is considered one of the most important developments in information systems (IS) (Melchor-Ferrer & Buendia-Carillo, 2014). Task pertains to the general process done by individuals' physical or cognitive actions (Goodhue & Thompson, 1995) which turn inputs into outputs (Xiaoyun, 2020) in the given environment. Meanwhile, technology is defined as a tool used by a person that is served to execute or assist individuals in executing tasks. Performance means the accomplishment of an individual in a portfolio of tasks. Correlatively, "TTF is defined as the extent to which technology assists an individual in performing the tasks and is consequently affected by the interaction between the characteristics of the tasks and functionalities of the technology" (Spies et al., 2020, p. 399).

The model was first developed in 1995 when researchers evaluated the use of information technology in leading the performance, assessing usage impacts, and judging the relationship between the task and technology characteristics to measure how a system technology gives features and supports the 'fitness' required by the task (Goodhue & Thompson, 1995). The same study also indicated the purpose of showing the positive impact of technology through a good integration of TTF. Following this, improved performance will be the result if the technology fits the characteristics it aims to support (Spies et al., 2020). The use of TTF became prominent in various studies of IS and was widely used in the different contexts of education and information technology (Al-Rahmi et al., 2020; Aljukhadar et al., 2014; Howard & Rose, 2019; Isaac et al., 2017; Park, 2019; Xiaoyun, 2020).

However, the premise of the theory states that the performance of the individual can be enhanced when the technology's provided functionalities meet the needs of the users and fit the tasks on hand (Xiaoyun, 2020).

The basic TTF model shows a lens of the relationship between technology usage and the function it creates. This model demonstrates that when the technology and task are well-fitted with each other, performance will be higher (Raven et al., 2010). In a setting where the user uses technology to perform a certain set of tasks, the model's premise is that the technology's performance is generated by the alignment or fitness of the task requirements and the characteristics of the technology that make the individual perform the tasks. TTF covers five constructs that constitute the model, namely: task characteristics, technology characteristics, task-technology fit, technology utilization, and performance impact (El-Gayar et al., 2010). This traditional model carries eight (8) dimensions of fitness, but not all are much used in IS research because these dimensions did not seem to be reflective and pertinent to the concept of fitness as indicated by Park and Raven (2006) as cited in Raven et al. (2010). For this reason, Park and Raven (2006) as cited in Raven et al. (2010) re-designed the model with three (3) dimensions, namely: ease of use (EOU), ease of learning (EOL), and task match (TM) to simplify the fit measurements. The authors modified the model in conjunction with the well-tested measure for performance labeled as 'measured for usefulness'. In their work, the revised model was tested in the context of the knowledge management system and was found effective. They additionally noted that there is a need to replicate the study in other contexts.

Therefore, the present study replicated Park and Raven's (2006) re-configured TTF model in a new context and type of technology. Dimensions were found suitable, applicable, and compatible in the development and evaluation of the web application. Moreover, the said dimensions are defined, in their utilization, by Raven et al. (2010). For instance, ease of use (EOU) refers to the usability of the system and how it works through the structures of the method. More so, it is the usefulness of the system that is aligned to the procedures along with serving its purpose to the users. Ease of learning (EOL), on the other hand, pertains to the appropriateness of the method and the competency of the product to provide adequate and easy-to-learn features for the users. Task match (TM) pertains to the ability of the system to perform its function that could meet the needs of the users. It also asserts how

well the system works and its effectiveness with a good product. Perceived usefulness works as an indicator that could influence the performance of users and it is expected to bring out the best result.

1.1.4. Teacher Education Program in the Philippines

The development and improvement of the Philippine education system have been on the list of the government's top priorities to achieve high-quality education in both basic education and higher education institutions (Amanonce & Maramag, 2020). Teacher education programs became a prominent element of an education system that desires to reinforce altruistic and right training to nourish teacher education students with adequate skills and succeed in the 21st-century workplace (Mugot & Sumbalan, 2019). Likewise, education reform in the Philippines brought by IR 4.0 aims to strengthen 21st-century skills among its learners. Similarly, teacher education, as the bridge to attain these goals, has a crucial responsibility in equipping the pre-service teachers with sufficient 21st-century teaching skills, i.e., creative, and critical thinking, collaboration, communication, and technology literacy (Mugot & Sumbalan, 2019). Meanwhile, Dela Rosa and Vargas (2021) said that Teacher Education Institutions (TEIs) must provide quality instruction and ensure appropriate training to the pre-service teachers as this will be their preparation for the world of teaching. This idea was supported by Visco (2015) as it was reported that there is a need to take special care and attention to teacher education students, such as providing interventions in which adequate provisions are given to ensure how pre-service educators are trained and fostered.

The study by Apare et al. (2018) stated that to ensure the quality of teaching performance, one should pass the Board Licensure Examination for Teachers (BLEPT) before engaging in the teaching field. In this sense, the Board Licensure Examination for Teachers (BLEPT), recognized as one of the influential factors that determine the quality of education in the country (Antiojo, 2017), serves as the standard in assessing qualifications for licensing candidates (Apare et al., 2018). In this manner, graduates of the teacher education program shall take the BLEPT to practice their profession (Botengan et al., 2018) as this was mandated in the Republic Act 7836 or the "Philippine Teachers Professionalization Act of 1994". This act is supervised by the Professional Regulation Commission (PRC) following the set of performance indicators by the National Competency-Based Teacher Standards (NCBTS) (Botengan et al., 2018) with the purpose to distinguish competencies among teacher education graduates (Antiojo, 2017). To pass the BLEPT, the aspirant must attain at least

75% of the average score. For instance, Bachelor of Elementary Education (BEED) test-takers must acquire 40% in general education and 60% in professional education. On the other hand, Bachelor of Secondary Education (BSEd) graduate examinees shall earn 40% from professional education, 40% from specialization courses, and 20% in general education (Orlanda-Ventayen et al., 2020).

With all the gaps identified in previous works of literature and studies, the researchers set the aim to develop a board examination reviewer web application for Filipino pre-service physical educators with the applied utilization of unified spaced repetition and hypercorrection techniques grounded on the TTF dimensions subject to evaluation. The study will be found beneficial, upon its fulfillment and execution, to all physical education majors by elevating the status of MAPEH board passer in the Board Licensure Examination for Professional Teachers. Furthermore, the output will serve as a tool to facilitate a better review undertaking. Hence, the following specific objectives were addressed in the study:

1. To develop a web application board examination reviewer applying the unified spaced repetition and hypercorrection techniques;
2. To evaluate its task-technology fitness (i.e., ease of use, ease of learning, task match) including the users' perceived usefulness; and
3. To assess its task technology characteristics.

2. Methodology

2.1. Research Design

The study was anchored on the Research and Development (R & D) design to come up with an innovative educational product or output planned to materially benefit individuals, groups, and wider society (Bayarcelik & Taşel, 2012). As stated by Richey and Klein (2014), design and development research is "the systematic study of design, development and evaluation processes to establish an empirical basis for the creation of instructional and non-instructional products" (p. 1). A quantitative approach and descriptive research design were employed to determine the ease of use, ease of learning, task match, users' perceived usefulness, and task technology characteristics of the

developed web application. Subsequently, a quantitative research method was utilized to report the statistical interpretation and presentation of the data collected (Ahmad et al., 2019).

2.2. Population and Sampling

To evaluate the developed web application, a simple random sampling technique from the list of currently enrolled pre-service physical education teachers (PSPEs) at the time of the study in one public university in Central Luzon, Philippines was utilized to recruit respondents from the given sampling frame ($N = 106$). However, 120 PSPEs were invited to participate in the testing and evaluation of the *i-WARM* to reduce the possibility of survey attrition - a situation where participants are approached but decide not to take part in a survey or those who begin a survey but do not complete it (Hochheimer et al., 2016). These PSPEs were selected because they have already completed 100% of the required courses and they recently attended multiple in-house reviews in preparation for their board examination. They are best fit to constitute the sampling frame of the study because they will likewise be the primary beneficiaries of the application.

2.3. Instrument Validation and Reliability Testing

The adapted instrument used for evaluating the *i-WARM* was found in the study of Raven and Park (2010). It consists of five (5) TTF dimensions (i.e., ease of use, ease of learning, task match, users' perceived usefulness, and task-technology characteristics). To ensure the validity of the benchmark statements, six (6) experts (i.e., experts whose expertise includes computing studies, language, research, and educational technology) were invited to evaluate the relevancy of each item. According to Lynn's (1986) criteria, the item-level content validity index (I-CVI) of 0.78 for six to ten (10) experts is acceptable for a validated benchmark statement to be included in the tool. The result of the six (6) validators concluded three (3) items with 0.86 computed I-CVI and the rest attained a 1.00 (16 items) which meant that all benchmark statements in the questionnaire's items were valid and appropriate for their intended purpose. Furthermore, minor revisions of items in terms of grammar were applied in conformity with the consolidated comments and suggestions of the validators. Subsequently, one (1) benchmark statement from dimension 1 was removed due to its overlapping meaning with other constructs. In this manner, an overall 18 benchmark statements were formed. Additionally, the reliability test of the instrument was administered and pretested among 18 PSPE respondents who were excluded from the pool of final evaluators. Based on the result, the

internal consistency using Cronbach's alpha obtained a value of 0.796 which indicates a good reliability index (Fornell & Larcker, 1981).

2.4. Data Collection and Evaluation

A request letter to the public university in Central Luzon, Philippines was provided to seek permission for the conduct of data gathering. Detailed information, purposes, and objectives of the study were all included in the informed consent form. The respondents were asked to visit and access the web application. They were advised to use the application and observe its functions as if they were reviewing for their board examination for one day. After this, respondents were asked to evaluate it through the provided Google form link.

2.5. Ethical Considerations

The authors assured the respondents that no personal information was stored and that their feedback would remain confidential. They were likewise informed that their participation would be voluntary and that they could withdraw at any given time without repercussion.

2.6. Prototype Development

The initial prototype design and features of the web application were designed using Canva - a tool or platform for designing graphics that can create presentations, posters, documents, and other visual content using ready-made templates for the users. Elements like shapes, lines, texts, and images, were utilized to outline the arrangement of the content and interface of the web application. The development of the web application was geared with plenty of tools. Front-end Development (Client-Side) focuses on the visibility and visual aspect (physical appearance) in the development process of the web application. This includes the design, color, images, texts, and other user-interface features. The front end made the web application visually appealing to the users. Back-end Development (Server Side) was used in developing the web application to maintain its function on the users' side like clicking the buttons, submitting the item/question, generating numerical data, and setting the level of access (like signing up as a User or Admin). The back end made sure that the web application worked adequately and without error. The back-end was first developed to install the questions/items, and correct and incorrect responses in the item bank. This process was first considered to store the number of items needed in the item bank. On the other hand, the front end

was developed after the admin side to examine the user interface and workflow of the web application, specifically the performance of the unified spaced repetition and hypercorrection techniques.

As the unified spaced repetition and hypercorrection techniques are integrated into the web application, the reviewee or user will swiftly receive feedback if their answer is correct or not. If users do not get the correct answer, they will encounter the same items/questions after a specific set of intervals. In this case, the two techniques work together for a better review. Consequently, users are expected to get a correct answer when they encounter the same items/questions again. Reviewers will not finish the review unless they get all items correct.
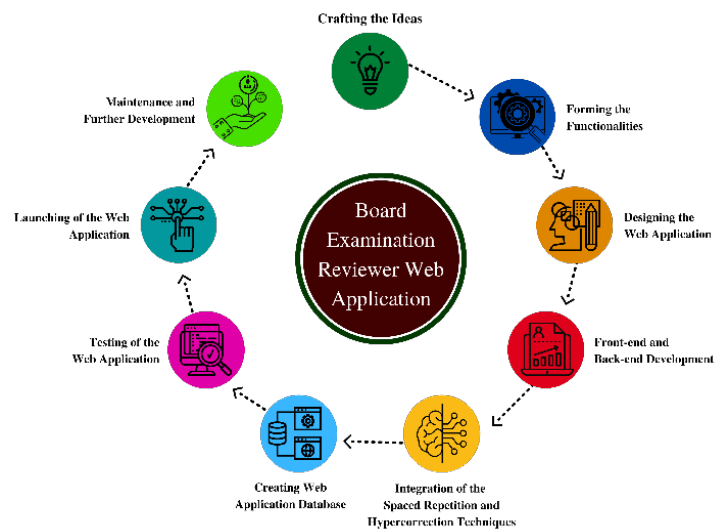
Figure 1. The Stages of the Development Process of *i-WARM*

3. Results and Discussion

3.1. Development of the Board Examination Reviewer Web Application

3.1.1. *i-WARM*: User Interface

The first feature of the developed web application is its landing page (Figure 2) where a short description and aim of the web application can be seen. There is also an about section in the *i-WARM* where the overview of the study and the techniques are provided for better comprehension of the

workflow of the web application. The website also includes a Contact Us section that includes the information of the proponents/researchers such as their pictures, names, and respective email addresses which can help reviewees easily communicate their concerns or queries. Presented also in Figure 2 is the user login interface where reviewee information like name and university will be asked by the system.
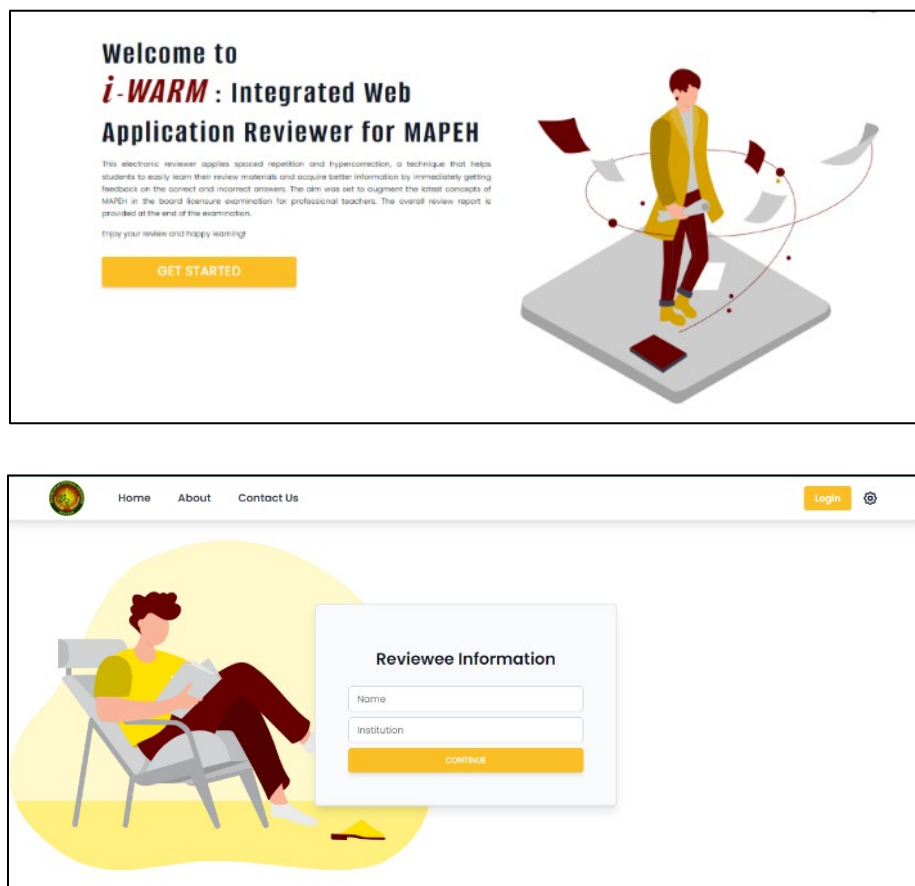

Figure 2. Landing and user login page of *i-WARM*

The *i-WARM* contains an instruction that appears as a guide to the pre-service physical educators for their review. This contains the type of test and the task of the unified spaced repetition and hypercorrection techniques. As was shown in Figure 3, reviewees have the choice to select the number of items they would want to take. Since there are plenty of questions/items stored in the item bank, a randomized type of review was materialized.
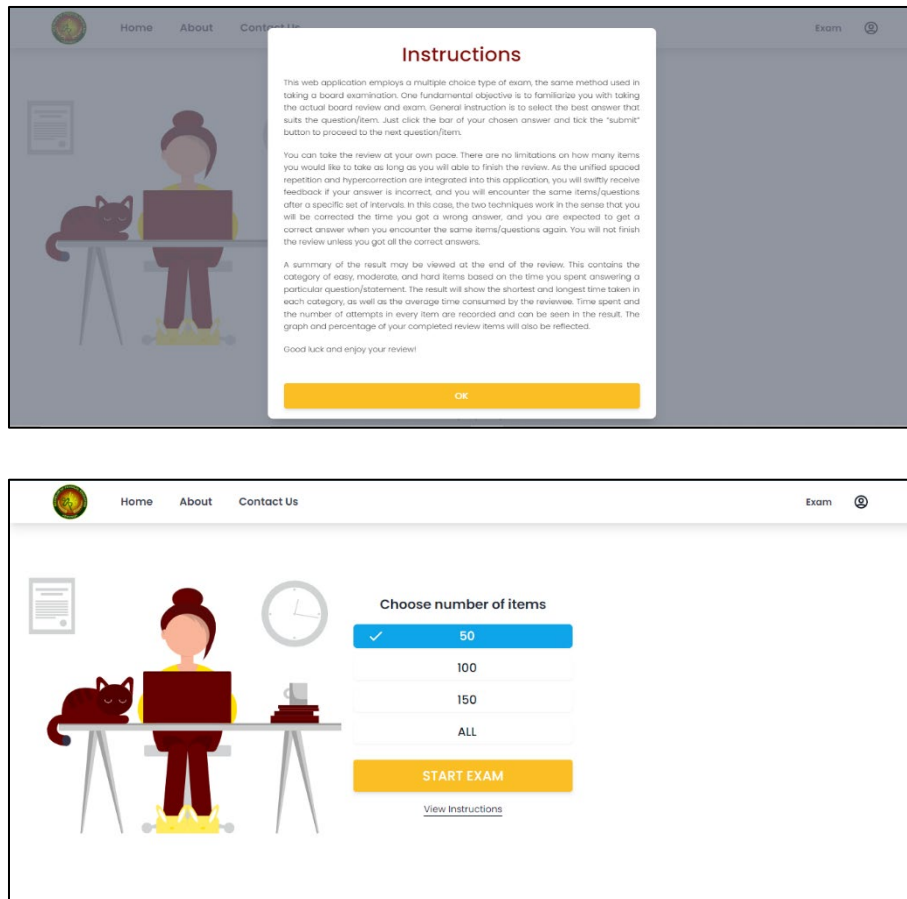
Figure 3. Usage instructions and selection of the number of items to review.

Review proper will start after deciding the number of items to take (Figure 4). The web application employs a multiple-choice type of exam, the same type of test used in taking the board examination. The general instruction is to select the best answer that suits the question/item. Reviewees will click the bar of their chosen answer and will tick the "submit" button to know if their answer is correct or incorrect. The web application will automatically show if the reviewees' answer is correct (as seen in Figure 4). In this manner, the work of the hypercorrection technique is being applied to the web application. In the case where the reviewee did not get the correct answer, an incorrect icon will show up along with its corresponding feedback.
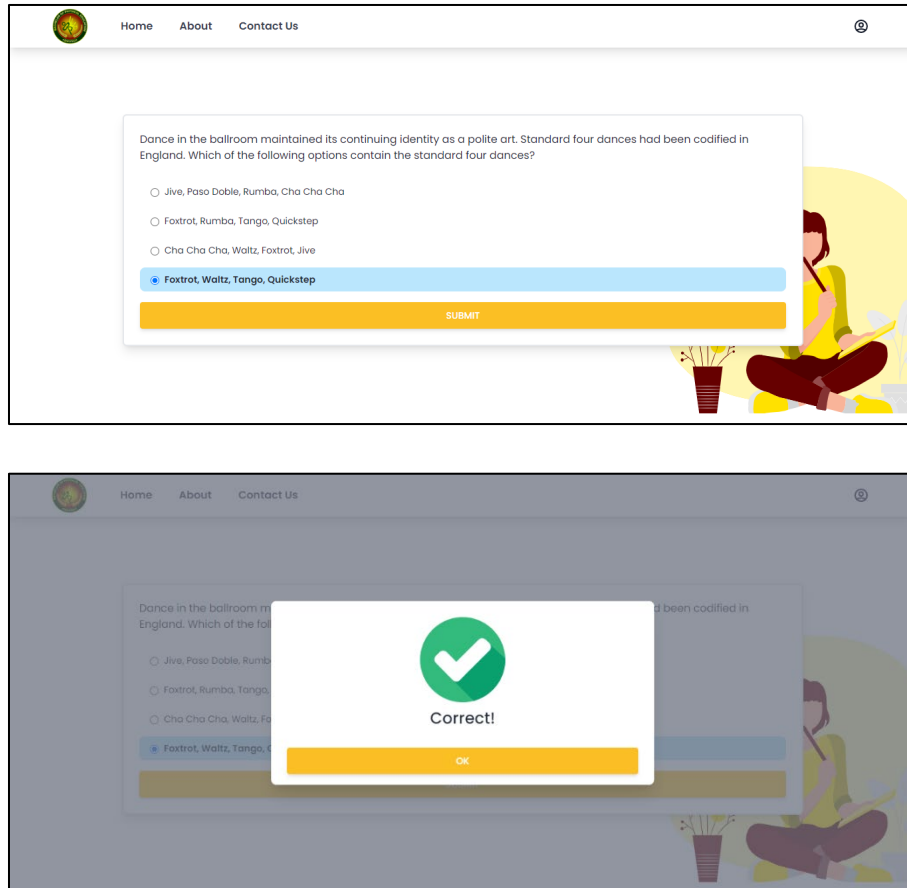
Figure 4. Screenshots of the review proper and its feedback.

As the two techniques are integrated into the web application, the reviewee will swiftly receive feedback if their answer is incorrect and will encounter the same items/questions after a specific set of intervals (Figure 5). Reviewees will not finish the review unless they answered all items/questions correctly. After completing the review/exam, users can view the summary of the results. As reflected in the conceptual framework, particularly in the output of the paradigm of the study shown in Figure 3, the content of the result may be viewed at the end of the review (Figure 6).
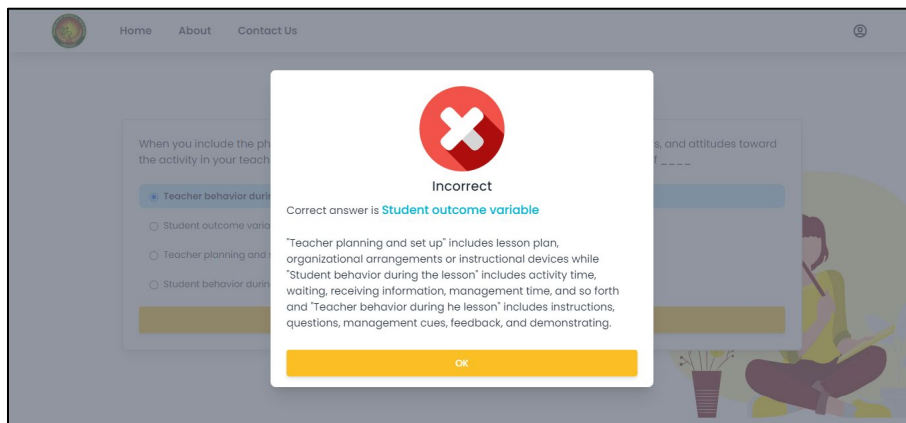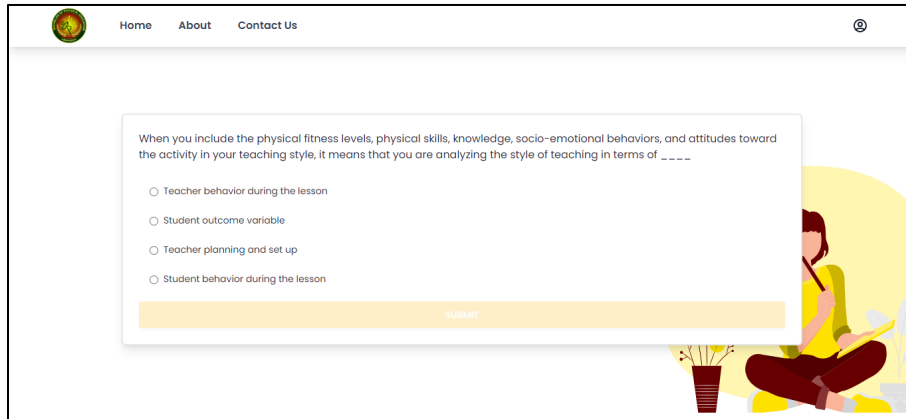
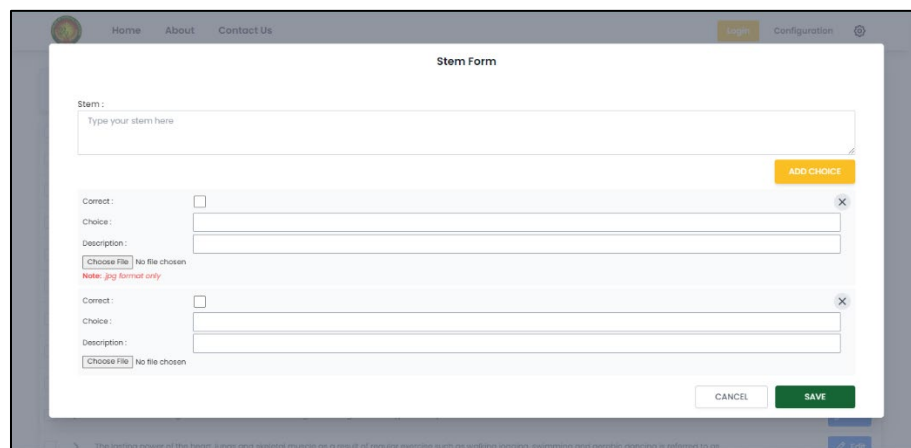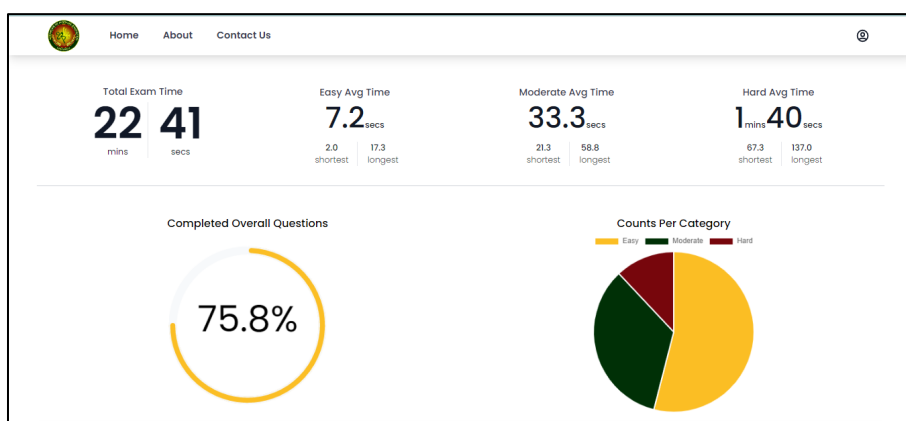**Figure 5**. Screenshots of review proper and its feedback.

Figure 6. Screenshot of a sample overall review report.

3.1.2. *i-WARM*: Admin Interface

The *Admin* side will be used as the professor or teacher's authorization to store, delete, and update items/questions in the item bank. Login credentials, using a strong password, are also required to access it. Depicted in Figure 7 is the item bank where the authorized person can put a stem, correct response, and foils/distractors in the system. Teachers/professors can customize the number of choices (as seen in Figure 7). Determining the correct answer should be identified to be reflected on the user side. Admin can also append feedback or rationalization for better learning. Attaching images in a jpeg format is also allowed. The authorized person shall click the save button for the item/question to be added to the item bank.

Figure 7. Screenshots of question/item bank editing (e.g., viewing, creation, updating, deletion).

Presented in Figure 8 is the system framework of *i-WARM* which illustrates the summary of the user and admin interface. For instance, the user's first interface is the landing page where the information of the web application is located. The "home page" of the system includes the profile of the reviewee such as their name and institution, the content of the review, and the reports. The review contains the instructions and the selection of the number of items to review. After which, the examination proper will take place. As was shown in the figure above, the profile and reports are connected to the database which provides support to the function of the developed web application. The work of an admin includes the storing of items, questions, and feedback in the item bank. The admin side is also associated with the database because the stored items will be reflected in the test of the users.
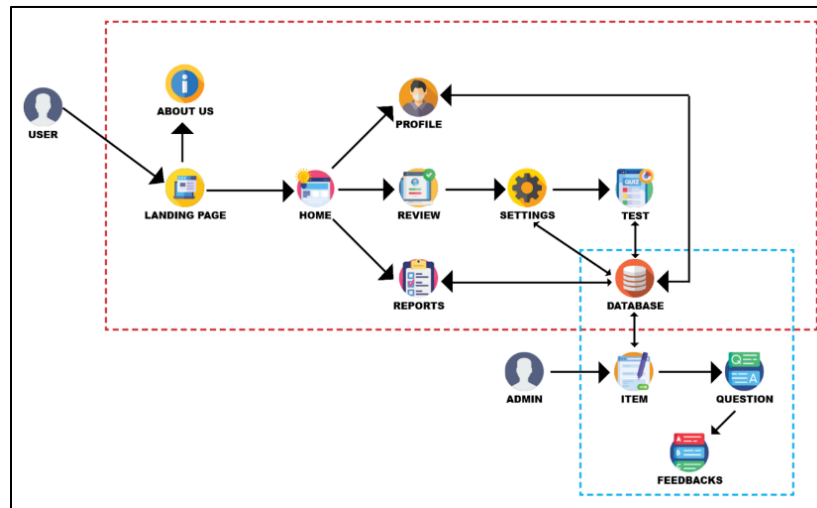
Figure 8. *i-WARM*'s System Framework

3.2. Evaluation of the Web Application's Task-Technology Fitness and Users' Perceived Usefulness

3.2.1. Ease of Use

Table 1 shows that the web application was notably clear and understandable to use ($\bar{x}$ = 5.00; SD = 0.00). A similar result was achieved in the statement "I find the web application easy to access." which obtained a "strongly agree" as a verbal description ($\bar{x}$ = 5.00; SD = 0.00). A mean of 4.89 (SD = 0.31) for the first statement was noted among the respondents, which indicates that the web application is user-friendly. It also provides flexible feature interaction as it garnered a mean of 4.72 (SD = 0.44). This indicates that the web application is easy to access. The result of this dimension has declared that the developed web application is comprehensively easy to use. This also means that the developed board examination reviewer web application has interactive programs that are simple to use, efficient, entertaining, and can maximize user participation. In support of the results, users would perform at their best capacity with a platform that is not difficult to utilize (Dehinbo, 2011). In addition, the usefulness and ease of use provide a factor that could influence the users in their utilization, especially with the newly developed and released technologies. It further suggests that

ease of use perceived the user's acceptance and behavior regarding the implementation of the information system (Ng'uni & Phiri, 2019).

Table 1. Result of the Dimension 1 (Ease of Use).

Ease of Use	*M*	*SD*	Verbal Description
The web application is user-friendly.	4.89	0.31	Strongly Agree
The web application provides flexible features interaction.	4.72	0.44	Strongly Agree
I find the web application clear and understandable to use.	5.00	0.00	Strongly Agree
I find the web application easy to access.	5.00	0.00	Strongly Agree

3.2.2. Ease of Learning

Presented in Table 2 indicates that the respondents strongly agreed that it is easy to become familiar with using the web application as this statement attained the highest mean of 4.89 (*SD* = 031). Also, respondents easily learned to use the web application based on the weighted mean of 4.83 (*SD* = 0.36). Regarding the negative benchmark statements of the second dimension, users answered "Strongly Disagree" in terms of the difficulty and the long duration of the web application to learn as these were evaluated with a mean of 1.11 (*SD* = 0.31) and 1.28 (*SD* = 0.63), respectively. The results manifest that the web application is not complicated for the users. This suggests that learning to use the web application provides a maximum level of usability which indicates an effective interaction with the users (Lew et al., 2010). More so, learnability demonstrates the user's cognitive processes in navigating the web application which indicates their understanding of the features. (Loraas & Diaz, 2011). In this case, the perceived possibility of failures in the developed web application decreases as learning to use it easily increases.

Table 2. Result of the Dimension 2 (Ease of Learning).

Ease of Learning	M	SD	Verbal Description
Learning to use the web application is easy for me.	4.83	0.36	Strongly Agree
It is easy for me to become familiar with using the web application.	4.89	0.31	Strongly Agree
I find it difficult to learn how to use the web application. *	1.11	0.31	Strongly Disagree
It took me a long time to learn to use the web application. *	1.28	0.63	Strongly Disagree

3.2.3. Task Match

Table 3 presents the result of the dimension task match. Respondents "strongly agreed" that the functionality of the web application serves what they need very well, and the services provided by the web application match their requirements as these statements achieved a common mean of 4.72 ($SD = 0.54$). Based on the results, the web applications provided the needs of the respondents. It was strongly shown that the task given by the board examination reviewer web application matched the requirement of the user doing their review. This intensely determined that the user's satisfaction with using the web application has been met. In this regard, task match supports the system in delivering the needs of the user (Park, 2019). Likewise, the task match process aims to efficiently assign tasks to users based on their preferences and utility functions, considering various factors and dynamics in the computing environment (Tran-Dang & Kim, 2022).

Table 3. Result of the Dimension 3 (Task Match).

Task Match	M	SD	Verbal Description
The functionality of the web application serves my needs very well.	4.72	0.54	Strongly Agree
The services provided by the web application match my requirements.	4.72	0.54	Strongly Agree

3.2.4. Perceived Usefulness

It was noted in Table 4 that respondents rated the application useful for their board examination as it was ranked with the highest mean of 4.78 ($SD = 0.52$). This indicates that the web application serves its purpose to help the pre-service physical educators in reviewing for the board examinations. Relatively, the web application provided a glimpse of the board examinations which made it easier for the respondents to take the exam ($\bar{x} = 4.72$; $SD = 0.54$). Moreover, the respondents also perceive the web application to be effective in reviewing board review subject matters or topics ($\bar{x} = 4.56$; $SD = 0.58$). Alongside these results, the web application enhanced the confidence ($\bar{x} = 4.56$; $SD = 0.58$) and productivity ($\bar{x} = 4.56$; $SD = 0.67$) of the respondents. The results revealed that the respondents perceived the web application as useful, especially in taking the board examinations. Moreover, it was clearly defined that the user perceived gaining confidence in taking the actual board exam review and board examination. This is the reason that the two unified techniques brought learning to them. Hence, discovering the usefulness of the web application would increase the performance and productivity of the users in terms of utilizing the purpose of the system (Hess et al., 2014). Correspondingly, Orehovački et al. (2019) also indicated that continuous utilization of web applications is brought by user satisfaction and expectations as they perceived it as useful along with their intentions to use it.

Table 4. Result of the Dimension 4 (Perceived Usefulness).

Perceived Usefulness	*M*	*SD*	Verbal Description
Using the web application, my confidence in taking the board licensure examination for professional teachers improved.	4.56	0.58	Strongly Agree
Using the web application, my productivity in reviewing for the board exam increased.	4.56	0.67	Strongly Agree
The use of the web application is so effective in reviewing relevant board review subject matters or topics.	4.56	0.58	Strongly Agree
The use of the web application made it easier to perform board examination reviews.	4.72	0.54	Strongly Agree
I find the web application useful for my board examination.	4.78	0.52	Strongly Agree

3.3. Assessment of Task and Technology Characteristics

The relationship between the functionalities of the technology and the features of the tasks has an impact on the task technology characteristics, which are related to how much technology helps a person do the activities (Raven et al., 2010). Table 5 displays the evaluation of the respondents in the web application based on the fifth dimension (Task Technology Characteristics). The statement "I would rate the overall quality of the web application to be functional and informative." earned the highest mean score of 4.67 ($SD = 0.65$). These results also justify the "Strongly Disagree" responses of the respondents on the statements "There were unexpected or inconvenient downtimes on the web application which made it harder to do my review." ($\bar{x} = 1.22$; $SD = 0.52$) and "There were frequent problems and crashes on the web application that affected my review." ($\bar{x} = 1.11$; $SD = 0.31$). The excellent characteristics of the web application such as functional and informative corroborate the results. Furthermore, it is stated that the technology provides the necessary functions for meeting the tasks needed by the user. Relative to this, Shi et al. (2021) mentioned that the deployed application must necessarily and consistently perform its purpose for the user experience to remain high-quality. Therefore, the assurance of a system's deployment secures the functionality and purpose of the web application (Barnard et al., 2013).

Table 5. Result of the Dimension 5 (Task Technology Characteristics).

System (Task Technology) Characteristics	*M*	*SD*	Verbal Description
There were unexpected or inconvenient downtimes on the web application which made it harder to do my review.	1.22	0.52	Strongly Disagree
There were frequent problems and crashes on the web application that affected my review.	1.11	0.31	Strongly Disagree
I would rate the overall quality of the web application to be functional and informative.	4.67	0.65	Strongly Agree

Based on the evaluation results of the web application, it was reported that most of the positive benchmark statements from the five (5) dimensions of TTF gained a high mean, resulting in a good and effective technology tool for review. On the other hand, negative benchmark statements where

difficulties and common problems in technology applications stated were not experienced by the user in their exposure to the web application. This immensely signifies that the developed web application with the name, "*i-WARM*" possessed a user-friendly, accessible, easy-to-learn, useful, functional, and informative new type of application system.

4. Conclusions, Limitations, and Recommendations

4.1. Conclusions

The study was conducted to develop and evaluate a board examination reviewer web application for Filipino pre-service physical educators. The following conclusions were derived relative to the results:

1. Nine (9) steps were recorded in the development process of the board examination reviewer web application, namely: (a) crafting the ideas; (b) forming the functionalities; (c) designing the web application; (d) front-end and back-end development; (e) integration of the spaced repetition and hypercorrection techniques; (f) creating web application database; (g) testing of the web application; (h) launching of the web application; and (i) maintenance and further development. In addition, a system framework was developed which illustrates the interface of the user and the admin.

2. The board examination reviewer web application was evaluated through its task-technology fitness dimensions, namely: ease of use, ease of learning, and task match. Moreover, the users' perceived usefulness and the task technology characteristics were also included in the evaluation phase.

   2.1. **Ease of Use**. The indicators in the dimension of ease of use recorded high mean scores with a verbal description of "strongly agree". In particular, two indicators obtained a mean score of 5.00 ($SD = 0.00$) which indicates that the board examination reviewer web application is easy to access.

   2.2. **Ease of Learning**. The respondents "strongly agreed" when asked if the web application is easy to learn ($\bar{x} = 4.83$; $SD = 0.36$). Moreover, a mean score of 4.89 ($SD = 0.31$) with a verbal description of "strongly agree" was obtained in terms of familiarization with the web application. On the other hand, when the respondents were

asked if they experienced any difficulties and long duration of learning to use the web application, a verbal description of "strongly disagree" with mean scores of 1.11 ($SD = 0.31$) and 1.28 ($SD = 0.63$), respectively were recorded.

2.3. **Task Match**. In evaluating the task match dimension, all indicators namely "The functionality of the web application serves my needs very well" and "The services provided by the web application match my requirements" recorded a similar mean score of 4.72 ($SD = 0.54$).

2.4. **Perceived Usefulness**. The board examination reviewer web application was regarded to be useful ($\bar{x} = 4.78$; $SD = 0.52$) and made it easier to perform a review ($\bar{x} = 4.72$; $SD = 0.54$). Moreover, the web application also increased the confidence ($\bar{x} = 4.56$; $SD = 0.58$) and productivity ($\bar{x} = 4.56$; $SD = 0.67$) of the reviewees. Also, the respondents "strongly agreed" with the effectiveness of the web application with a mean score of 4.56 ($SD = 0.58$).

3. In terms of the task technology characteristics of the web application, negative statements were included in the indicators which obtained "strongly disagree" remarks as a verbal description. Also, the respondents "strongly disagreed" with the indicators "There were unexpected or inconvenient downtimes on the web application which made it harder to do my review" ($\bar{x} = 1.22$; $SD = 0.52$) and "There were frequent problems and crashes on the web application that affected my review" ($\bar{x} = 1.11$; $SD = 0.31$). The justification of these results was seen in the rating of the overall quality of the web application with 4.67 as the mean score and "strongly agree" as the verbal description.

A board examination web application that integrates spaced repetition and hypercorrection techniques named *i-WARM* was successfully developed. Positive results were manifested in the evaluation phase of the web application using the task-technology fitness dimensions. The web application was observed to be easy to access as indicated in the evaluation of the respondents. The respondent's evaluation also indicates that they easily learned and became familiar with its interface. *i-WARM* achieved its intended goal which was to provide a tool for board examination. Based on the perception of the respondents, the web application is strongly useful since it effectively improves their confidence and productivity in reviewing materials in MAPEH. Furthermore, *i-WARM* system characteristics received a positive outcome in the evaluation phase which indicates that the overall quality of the application is functional and informative.

4.2. Limitations of the study

The following limitations were ascertained in the process of the completion of the study:

1. The evaluation of the developed web application focused only on the users. Experts' evaluation was not considered in this study.
2. Participants for the testing and evaluation of the web application were trimmed down due to time constraints.
3. The web application was not tested and evaluated by pre-service physical educators from other institutions.
4. Other target features in the web application were not developed because of the limited time allotted in the developmental stage.

4.2.3. Recommendations

To strengthen the study and implement the developed board examination reviewer web application, the following recommendations were identified.

1. It is recommended that the web application must be tested and evaluated by pre-service physical educators of other institutions.
2. Evaluation of the teachers/professors to the developed web application is suggested.
3. It is suggested that the board examination reviewer web application has a section for each category in MAPEH.
4. For future development, the web application may have a feature where users can take their assessment tests and scores may be viewed.
5. It is suggested that the web application may further be developed by making it more intelligent such as:
   a. Developing a permanent student account where the system can automatically send a "Question/s of the Day" to the users to encourage them to review.
   b. Allowing teachers/professors to send a set of items/questions of review for their students to enhance review practices and performance.
6. It is suggested to employ other proven effective learning techniques in the web application for better review and memory retention.

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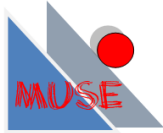
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