Development of an Online Challenge - Based Training Model to Enhance Digital Citizenship Knowledge, Creative Problem Solving, and Digital Media Creation in High School Students

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Abstract – **The objective of this study is to develop a training model based on online challenges that will improve digital citizenship knowledge, creative problem solving, and digital media creation among high school students. The procedure consists of the following three steps: 1) Engage 2) Investigate, and 3) Act. In addition, the model includes eight components: Trainer, Trainees, Contents, Online Training Tools, Learning Outcomes, Teaching Methods, Evaluation, and Community. The implementation of using the model to increase trainees' capacity in these dimensions was successful, and the trainees' level of satisfaction were "very satisfied."**

Keywords – **online training, challenge-based learning, digital citizenship, creative problem solving, digital media creation**

1. Introduction

The advancement of technology has contributed to the transformation of all facets of society, including education. The expansion of information and communication technologies has a significant impact on conventional training methods, resulting in the evolution of numerous educational systems and the emergence of new contexts that structure education courses. Challenge-based learning is one of the increasing educational belief systems.

Challenge-based learning (CBL) is a novel training method intended to motivate students to solve real-world problems in a creative manner [1]. It fosters an environment in which students can conduct independent research on real-world problems and apply their findings logically.

Traditionally, literacy has been defined as the ability to read and write in contemporary media. However, in the twenty-first century, the term literacy has become more challenging. It requires new skills, such as the ability to create digital media, to make the term "literacy skill" meaningful [2]. In conjunction with other literacies, digital media literacy has the potential to improve students' digital citizenship [3], which is commonly defined as the capacity to participate effectively in online communities. In online education, digital citizenship plays an important role as well the formalizations that guide digital citizenship learning and practice promote improvement- and engagement-related ideals and concepts [4].

To enhance the growth in students' capacity on such characteristics, this work was established to develop an online challenge-based training model to promote knowledge of digital citizenship, creative problem solving, and digital media creation in high school students.

2. Research Objectives

1) To develop an online challenge-based learning training model to enhance digital citizenship knowledge, creative problem solving and digital media creation in high school students
2) To evaluate the validity of the online training model developed
3) To implement the training model and evaluate the students' learning outcomes

3. Research Framework

As illustrated in Figure 1, a training framework consists of the following five components: online training, challenge-based learning, digital citizenship knowledge, creative problem solving, and digital media creation. Ultimately, students trained using such a model should acquire digital citizenship knowledge and skills, as well as creative problem-solving and digital media creation abilities.
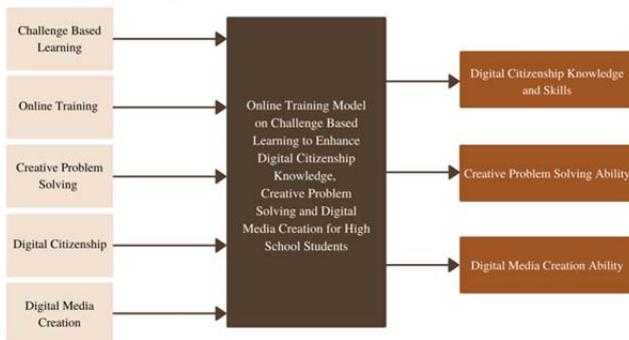

Figure 1. Research Framework

4. Literature Review

4.1. Online Training

Alongside traditional learning and teaching methods, online training has emerged as a new method of education. Despite its popularity as a learning method, distance education is troubled by high dropout rates. According to the study, the course, the student, and the learning environment contribute to the decision to drop out [5]. For an online training program to be effective, it is recommended that the program emphasize both motivational and skill-building aspects. The model developed by Hubbard and Romeo's has been recognized as a successful framework example [6]. The model consists of three training components, namely pedagogical, strategic, and technical training. Lai et al. [7] investigated the efficacy of an online training course designed to provide students with the pedagogical rationale for self-directed technology utilization for learning, the strategic basis for pairing technology choice, and the strategies for effectively utilizing technological tools. The results demonstrated that Hubbard's three-part training framework was effective for designing self-directed technology use in online learning training courses.

4.2. Challenge-Based Learning

The process of challenge-based learning begins with the definition of a big idea, which is a broad concept that can be explored in various ways. The core concept must be engaging and relevant to the students. The challenge is defined after the big idea has been identified and the essential question has been formulated. Then, the students must create guiding questions, activities, and resources to instruct them on how to improve a successful solution. The following step is evaluation, which will determine the solution. When an efficient solution is reached, the process of implementation begins. Lastly, an assessment is conducted to evaluate the entire process and determine whether the solution can be enhanced [8]. Challenge-based learning enables students to freely select what and when to study and to interact with digital learning materials. Ifenthaler [9] found that learning participation in challenge-based online learning environments was positively related to learning effectiveness.

Challenge-based learning makes use of the advantages of the e-learning mode. It utilizes the communication tools and allows learners to collaborate and interact at various times and locations. Moreover, challenge-based learning allows students to integrate a variety of flexible and low-cost technological tools into their studies, as well as the resources and content that guide them in solving the problems they have selected [10].

Castro and Zermeno [11] outlined the impact of an online entrepreneurship course that used challenge-based learning. The study was carried out at a university in Mexico with the participants of 20 students from various disciplines. The results demonstrated that the students developed long-term business ideas to address local, national, and global issues. The students began with a fundamental question. They emphasized the significance of entrepreneurship in economic and social development as well as employment. They expressed a strong interest in the subject of sustainable development and how to expand initiatives that promoted it in their responses to the discussion forums. Nevertheless, in some contexts, participants were uncertain how to construct proposals for initiatives aimed at addressing the obstacles to sustainable development. In the subsequent phase of the investigation, students were given a problem to analyze in order to generate solutions. Students were able to reflect on their ideas by brainstorming and

conducting research data for problem-solving in order to improve the proposal. The participants could then advance to the next phase of challenge-based learning, where each problem had multiple solutions demonstrating their ability to apply curriculum-based knowledge.

4.3. Creative Problem Solving

Creative problem solving (CPS) is an approach to resolving problems or identifying opportunities when conventional methods fail. CPS encourages individuals to evolve new perspectives and think creatively in order to devise a plan to overcome obstacles and achieve their goals [12]. There are five steps to creating innovative ideas and solutions using the CPS model. The first step is to clarify the objective, desire, or problem. The second step is to investigate the issue from multiple perspectives while recognizing and identifying it. The third step is to generate solutions to the problem questions identified in the first step. The fourth stage of CPS is the convergent stage, in which individuals starting to concentrate on analyzing all of their feasible alternatives and developing solutions. Individuals examine potential solutions to determine whether they meet their needs and criteria, and then determine whether such solutions can be successfully implemented. Then, they consider how the solutions can be improved and which ones are the best fit. The fifth and final step is to develop an action plan, beginning with the identification of resources and actions necessary to implement the optimal solution. Then, they communicate their strategy and ensure that all stakeholders comprehend and accept it [13].

4.4. Digital Citizenship

Multiple definitions of digital citizenship have been developed by researchers. However, its longest-standing definition is "the norms of behavior associated with technology use" [14]. Ribble et al. [15] have developed a nine-element framework to instruct digital users on how to responsibly use technology and become digital citizens. These nine elements can be classified into three categories (respect, educate, and defend). Respect consists of etiquette, access, and the law; these elements are used to demonstrate respect for other digital users. Education consists of the components of literacy, communication, and commerce; these components are used to teach the appropriate use of the digital world. Protect includes the elements of rights and responsibilities, security, and health and wellness; these elements are used to maintain safety in both digital and non-digital environments.

4.5. Digital Media Creation

Students should be able to create various types of digital media, including audio, graphics, digital stories, animation, video, and blended media [2]. Graduates from all disciplines are in high demand for the ability to create digital media that adheres to digital media principles [16]. Potential communication and audience interaction in online environments necessitate knowledge and application of these principles, in addition to crucial literacy, in order to comprehend societal issues and how one's media creations can affect others [17]. Reyna et al. [18] have introduced a framework for teaching students digital media literacy and digital media production. The framework considers three interdependent factors: conceptual, functional, and audio-visual. The conceptual domain is required to adapt content to a variety of digital media objects. However, content creation for audio podcasts, posters, and videos are fundamentally distinct. For video, the type, timeline, and information flow of the shots are essential, whereas there is no visual component in audio podcasts. The functional domain is associated with computer proficiency. Examples of such skills include digital photography, video recording, video editing, and 3D design. Application of knowledge of audio and digital media principles to the creation of potential digital artifacts is associated with the audio-visual domain. The artifacts could be audio-only, visual-only, or a combination of both, such as a video. The audio-visual domain includes audio quality, sound effects, layout design, color theory, typography, the use of images to express ideas, the visual design principle, the video shot, the rule of thirds, transition, and timing.

5. Research Design

This study was done to develop an online challenge-based training model to enhance digital citizenship knowledge, creative problem solving, and digital media creation in high school students. The model's reliability was then determined using an expert's perspective, and it was implemented in the actual class to determine whether an improvement is feasible.

Two hundred of high school students was employed as sample group in the study. For determining the validity and dependability of the training model, five specialists with at least 5 year-experience in relevant fields served as experts.

The study had been divided into three phases, as follows.

Phase 1) Development of online challenge-based training model
Phase 2) Expert Determination
Phase 3) Implementation

The learning outcome was assessed using rubric scoring tools on the pre-test/post-test and the exam. As assessment instruments, the effective index (E.I.), arithmetic mean, and standard deviation were used.

6. Results

The findings of the study will be presented in three parts: (1) an online challenge-based learning training model, (2) the validity of the developed model, and (3) the implementation results in terms of improving digital citizenship knowledge, creative problem solving, and digital media creation in high school students.

An online challenge-based learning training model aiming to enhance digital citizenship knowledge, creative problem solving and digital media creation in high school students has been proposed as shown in figure 1. The creating process was initiated by applying the concepts obtained from experts in the elements of the learning process and the synthesis of information, concepts, theories, research papers related to creating activities and learning, with the purpose to create learning activities, promote knowledge of digital citizenship, creative problem solving and digital media creative.

The model consists of eight elements that are necessary to consider initiating the learning: trainer, trainee, teaching method, community, learning outcome, content, online training tools, and evaluation, which are further explained as follows;

Element (1) trainers, trainers would facilitate the difficult learning process and encourage trainees to share their perspectives on the learning topics. The instructors must be knowledgeable about issues related to digital citizenship, original thinking, and content creation.

Element (2) trainees, the participants in the training would engage in games and learning activities. The main requirements for the trainees are that they should have 1) adequate communication and information technology skills for self-learning in an online learning environment; and 2) the capacity for self-regulation in learning.

Figure 2. The online challenge-based learning training model to enhance digital citizenship knowledge, creative problem solving and digital media creation

Element (3) contents, which is related to digital citizenship, digital media creation and other content that corresponds to the context of challenging problems. The content will be compiled into information in various online media formats such as 1) Video, whose primary function is to concurrently present images, audio, and text. 2) Reading Materials that present the subject matter in the most comprehensive and structured manner. 3) Infographics are the media with important characteristics for pleasantly summarizing content and easily digested, and 4) additional learning resources that would assist trainees' ability to comprehend of learning objectives.

Element (4) online training tools, which are tools used to organize online training based on a challenging learning management approach. To enhance knowledge of digital citizenship, creative problem solving, and digital media creation include 1) devices for accessing information such as smartphones, computers, tablets 2) the Internet. 3) information media and 4) learning record form

Element (5) learning outcome, which is part of behavior skills and knowledge that the trainees are expected to acquire and be able to practice after the duration of the training. Typically, the trainer would select grading as the indicator of trainees' knowledge level. This study divided the learning outcomes into three categories: 1) the ability to solve problems creatively, 2) the effectiveness of learning digital citizenship, and 3) the ability to create digital media.

Element (6) training method, which is the process that the trainer operates to enable the trainees to learn in accordance with the objectives. With different methods that differ regarding the essential elements in lessons, the trainers need to strategize the training techniques to help improve the quality and efficiency of training. The training method is applied in conjunction with the challenge-based learning process.

Element (7) learning assessment, the element refers to the evaluation of the trainees' learning process. The study's assessment was divided into 1) digital citizenship achievement, creative problem-solving ability, and digital media creation ability skill assessment, and 2) level satisfaction using the questionnaire.

Element (8) community in organizing online training, which is based on this challenge-based learning approach. Training participants are challenged by using actual problems or issues related to the community they lived in as challenges. The community engagement between the participants and the community would enable the participants to generate innovative concepts and ask vital questions in a pragmatic manner. It also led to the knowledge discovery process (Investigate), creative media development process (Act) and sustainable learning.

Apart from that, there are three primary steps to initiate learning. (1) Engage, the main idea of this step is to engage the trainees with the desired learning outcome. To achieve that result, trainers must encourage trainees to generate big ideas that align with the learning objective. The trainers are supposed to pose a question that is sufficiently difficult to arouse their curiosity and excitement to answer. (2) Investigate, this step requires the trainees to analyze the situation and think critically. The trainer must guide the trainees through the learning process by using guiding questions or activities. The trainees would also be encouraged to synthesize what they learned at the end of the discussion. And, (3) Act, the step should proceed with the expression of the learning outcome that trainees have synthesized by stating what they have learned. The solution should be generated and developed with practicality in mind. The solution from the issue should be implemented and evaluated by the experts. The group can discuss of the alternative outcome or generate additional ideas in addition to those presented.

Model validity result

The validity assessment of the training model had been conducted. The model was assessed for content validity index (CVI) by 5 specialists. The results of the assessment of the validation of the model showed the content validity index (CVI) = 1.00 (shown in table 1) which is valid and applicable.

Table 1. Content Validity Index (CVI) of online training model. In summary, according to the aspects assessed

Item	Validity		
	N	CVI	Meaning
1. The purpose of the online training model;	5	1.00	Appropriate
2. Elements of the online training model;	5	1.00	Appropriate
3. Steps of the online training model;	5	1.00	Appropriate
4. Methods of measurement and evaluation of the online training model;	5	1.00	Appropriate
summary			Appropriate

Implementation results

The researcher assessed the learning outcome from the target group after using the training model as a tool for training to improve digital citizenship knowledge, creative problem solving, and digital media creation. The students' learning outcomes were assessed using the pre-test/post-test method.

The average pre-test score is 57.40 (n=40) and the average post-test score is 83.93 (n=40), both of which are used to calculate the Effectiveness Index: E.I., which indicates the students' development. With an E.I. of 0.5596, the result could indicate that the trainees' knowledge increased by 55.96%, which meets the objective. The learning outcome was also assessed by 5 specialists using a rubric scoring tool. The results of the challenge-based training model in digital citizenship knowledge, creative problem solving, and digital media creation were very satisfactory, with the average class score of 95.45 out of 100 (S.D. = 4.03, n=40). The overall satisfaction of the trainees was also assessed, and the result was 'very satisfied,' with an average score of 4.65 out of 5 (S.D = 0.47, n=40).

7. Discussion

According to Chanin [8], students typically learn more and are more engaged when they are required to integrate their experience and personal circumstances into the lesson. This makes the challenge-based approach the superior method of education. In addition, the use of challenges kept students motivated to find answers, making the learning process more enjoyable and less tedious. Furthermore, Treffinger [10] claims that creative problem solving (CPS) can help solve problems or identify opportunities when conventional thinking fails. CPS encourages individuals to broaden their horizons and think outside the box in order to devise a strategy to overcome obstacles and achieve their objectives.

Lai et al. [7] also investigated the impact of an online training course designed to provide students with pedagogical rationale for self-directed technology utilization for learning, strategic foundation for pairing technology choice with learning objectives and selecting technological tools effectively [14]. The essential skills include technical, audio-visual, behavioural, critical, and social skills. The results of this study are also in accordance with Hobbs [14] which stated that students are in high demand for the ability to create digital media that complies to digital media principles.

8. Conclusion

The online challenge-based learning training model to enhance digital citizenship knowledge, creative problem solving and digital media creation in high school students consists of three steps (1) 'Engage' (2) is 'Investigate', and (3) 'Act'. Elements of an online training model consist of eight components as follows: trainer, trainees, contents, online training tools, learning outcomes, training methods, learning assessment and community. All five specialists agreed that the online challenge-based learning training model to enhance digital citizenship knowledge, creative problem solving and digital media creation for high school students meets the quality criteria.

From all findings and implementation evaluation, it can be concluded that using an online training model based on challenge-based learning can lead to the promotion of digital citizenship knowledge creative use of problem-solving abilities and creating creative digital media in students. It is almost certain that a growing trend toward online learning environments will result in future research examining various forms of online training in order to facilitate further development.

Acknowledgements

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