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THE EFFECT OF REFLECTION THROUGH EDUCATIONAL BLOGGING ON STUDENTS' LEARNING PERFORMANCE

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ABSTRACT

Aim/Purpose

Despite the growing interest in reflection, there is an issue regarding how to fortify the linkages between a learning experience and the reflection activity that follows it, as experience on its own is not the key to learning. In addition, studies have also shown that students are not able to transfer the newly acquired knowledge through experience into a new situation. Besides that, it is revealed that students have a generally poor learning performance in computer-supported courses. This can be attributed to the difficulty in comprehending lessons. These problems then bring to the fore the question of what specific elements are needed to turn experience into learning and enable educators to enhance students' learning performance through reflection activities. Therefore, this study was undertaken to design the reflection environment through educational blogging and examine its effect on students' learning performance in a computer-supported course; that is, an Authoring System course.

Background

Incorporating reflection as an integral part of the curriculum and learning process can be challenging. It involves dedicating time and effort to foster a reflective culture. Therefore, a reflective blogging environment needs to be designed by incorporating structured and interactive reflective thinking activities. This learning environment should also be able to integrate theoretical and practical aspects while encouraging active engagement in social collaborative learning to build knowledge and comprehension in learning computer-supported courses. Furthermore, leveraging blogging technology by embedding it with effective

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	pedagogy is also necessary to nurture students, and is critical in knowledge acquisition.
Methodology	A one-group pre-test post-test type of research design was adopted, using quantitative data of students' learning performance. A purposive sampling technique was employed to select a sample of 18 postgraduate students enrolled in the Authoring System course in the Faculty of Education. The reflection through the educational blogging environment was designed according to the ICCEE (Identify, Choose, Create, Engage, and Evaluate) instructional design model. The learning performance test was analysed using inferential statistics, specifically, the Wilcoxon ranked test, effect size, and power analysis.
Contribution	This study highlights that reflection through blogging remains relevant for learning among postgraduate students when its pedagogical design is carefully planned to align with learning and teaching goals. Leveraging the advantages of blogs as student-centred learning environments can encourage discussion and debate-like activities, which, in turn, positively affects students' overall learning performance. The design of the reflective learning environment also gives us an understanding of how the reflection approach can be better conducted to improve students' learning performance.
Findings	The reflection through the educational blogging environment was successfully designed based on the five in-depth steps of the ICCEE instructional design model. The learning performance indicates that there was a statistically significant difference between the pre-test and post-test scores. Thus, it can be concluded that reflection through blogging, which acted as an intervention, had a significant influence on students' performance in learning in the Authoring System course.
Recommendations for Practitioners	Given the technical nature of this study, instructors, especially those teaching online, must exhibit greater creativity in bridging the gap between theory and real-world applications to enhance students' cognitive engagement with the learning materials. As technical learning is frequently associated with poorer cognitive learning outcomes, it is crucial for instructors to bridge the gap between theory and practical applications to achieve better results.
Recommendations for Researchers	Researchers can ensure that students perceive learning and teaching as constructivist activities by leveraging the advantages of blogs as student-centred learning environments and minimising the presence of instructionalist activities. This approach encourages discussion and debate-like activities, which, in turn, positively enhances students' overall learning performance.
Impact on Society	This study highlights that educational blogging remains significant for postgraduate students when its pedagogical design is carefully planned to align with learning and teaching goals.
Future Research	Future work is necessary to validate the findings, particularly concerning different computer-supported courses, with larger and more diverse samples. Additionally, the learning performance pathways can be analysed via data mining using qualitative data to provide valuable insights into patterns related to the types of feedback that foster the growth of specific levels of reflective thinking skills. Linking students' performance with other probable learning processes/outcomes, such as learning styles, interaction posts, demographic details, and response time, can provide a better understanding of the computer-supported competencies among students from a summative approach.

Keywords reflection, educational blogging, learning performance

INTRODUCTION

Reflection can be described as the capacity to comprehend specific issues in practice by critically contextualising, observing, and analysing them, leading to the generation of new knowledge and insights that can improve one's practice (Zwozdiak-Myers, 2018). For many years, reflection has been considered good practice across various fields, such as medical education (Donohoe et al., 2022), nursing (Grech, 2021), business education (Ferguson et al., 2016), and pre-service teacher programmes (McGarr, 2021), to name a few. This might be attributed to the opportunity this concept offers individuals to make sense of their experiences, viewing them as thoughts that can shape their comprehension and decision-making. Despite the growing interest in reflection, the issue that arises at this point is how to fortify the linkages between a learning experience and the reflection activity that follows it, since Dewey (1933) warned that experience on its own is not the key to learning. In addition, studies have also shown that students are not able to transfer the newly acquired knowledge through experience into a new situation (Kose, 2010). These problems then bring to the fore the question of what specific elements are needed to turn experience into learning and make it possible to enhance students' learning performance through reflection activities.

The incorporation of 21st-century technology is seen as a crucial factor in the effort to enhance both reflection and learning performance in students. Technology and reflection are interconnected in a mutually beneficial relationship; technology offers a platform for acquiring knowledge and skills from diverse digital resources and interactions, while reflection empowers students to deepen their understanding and to effortlessly share and apply their acquired knowledge (Cheng et al., 2020). The process of reflection via discussion forums, online journals, and multimedia content encourages students to engage more openly in reflective practices and critically analyse their experiences, connect them to theoretical concepts, and make meaning out of the knowledge gained (Cheng et al., 2020).

Prior research has highlighted how blogging has a significant value in educational environments, especially in supporting systematic reflection and engaging students in reflective thinking skills (Kurt & Yildirim, 2021; Mohamad & Tasir, 2023) due to its pedagogical uses, which are both interactive and reflective (Sulistyo et al., 2019). Blogs serve as suitable platforms for offering these advantages given that individuals have the ability to read and provide comments that foster meaningful discussions on topics of both common and unique interest. Since reflection may sometimes be limited in scope, focusing on other individuals' experiences and diverse perspectives is essential for a more comprehensive understanding of complex issues. This can be done by engaging in interactive discussions with peers (Novakovich, 2016). In addition, by harnessing the advantages of blogs as student-centred learning environments, the paradigm shift from instructivist to constructivist delivery can take place in the learning process since discussion and debate can be encouraged which, in turn, positively affects students' overall learning performance.

As recorded in the literature, many studies have been conducted on the practices of reflection through educational blogging, regardless of discipline, in order to examine its effects on learning. Computer-supported courses form one of the disciplines in which such research has been carried out (Durak, 2018; Mohamad & Tasir, 2023; Mohamad et al., 2013; Ozyurt & Ozyurt, 2020; Tzafilkou et al., 2020). For the context of this study, computer-supported courses are defined as courses that involve hands-on practice where the primary focus is on utilising computers, programming software, or digital technologies to code and instruct computers to perform specific tasks. Note that computer-supported courses can support students develop and gain various 21st-century skills, such as creativity, critical thinking, problem-solving, communication and collaboration, social-intercultural skills, productivity, and responsibility (Durak & Guyer, 2018).

However, many reports have revealed students' poor performance in learning on computer-supported courses (Malik & Coldwell-Neilson, 2017; Tzafilkou et al., 2020). This can be attributed to the

difficulty in comprehending the lessons (Denner et al., 2012) and the high mental effort required (Durak, 2018). In the context of this research, the Authoring System course is a type of computer-supported course in which students learn about multimedia and web development. This course involves the use of basic action scripts and programming and demands the ability to internalise theories learned through solving activities. Designing animations and web development requires a blend of mental and physical processes, which comprise creative construction and dilemma handling rather than passive thinking. If this course is delivered in a conventional way – procedural standard and memorising standards – students are likely to face difficulty in making connections and fully engaging in meaningful learning.

Since learning on computer-supported courses requires strategy, planning, and thinking skills, especially in debugging, handling technical problems, dealing with structural concepts, and more, there is a clear need for an effective reflection environment to facilitate the growth of reflective skills when encountering specific problems. Reflective thinking can be practised by identifying how computer-supported problems were solved, what mistakes were encountered, and how successes were achieved (Cash, 2017). Today's students must also be provided with authentic knowledge and must possess the ability to apply such knowledge effectively to novel real-life situations. For this reason, the reflective learning environment should be able to bring together theoretical and practical aspects, along with active involvement in social collaborative learning, to build knowledge and understanding for computer-supported courses. Investigating students' learning performance in computer-supported courses is also necessary to better assess the learning success they achieve through transferring knowledge via reflection and to demonstrate more evidence-based practices.

As this study aims to fortify the linkages between a learning experience and the reflection activity, the following research questions are formulated in order to know what specific elements are needed to enhance students' learning performance through reflection:

- How should a reflection environment be developed for learning in the Authoring System course?
- What is the effect of reflection through educational blogging on students' learning performance?

THEORETICAL BACKGROUND

REFLECTION AND CONSTRUCTIVISM

Dewey (1933) proposed that when an individual encounters a problem during an activity, they contemplate various lines of action and use thinking to guide and direct their own actions, aiming to solve the problem at hand. This concept of reflection necessitates being self-aware about one's own thinking, continually assessing what one knows (drawn from prior experiences and beliefs), and considering how this understanding would be applied in making judgments in specific situations (Dewey, 1933). Meanwhile, the role that reflection plays in learning has undergone constant changes in line with the huge transformation in education. A substantial body of studies also provides several strategies, methods, and tools to channel effective reflection in learning. Individuals who are reflective about what they are doing make fewer errors, are more critical and learn more in their work compared to non-reflectors (Lindh & Thorgren, 2016). Through reviewing and reflecting on peers' reflections as well as their own, students can attain diverse outlooks that may preclude them from generalising their own experiences to all circumstances (Epp et al., 2019), and thus they have an opportunity to learn about how certain decisions are made. What makes the reflection activity constructivistic is that learners play an active role among themselves in creating their own meaning (Jenlink & Kinnucan-Welsch, 1999). Noddings (1990), in his view of constructivism, was also convinced that certain knowledge and understanding are constructed via the reflection process. Hence, from the constructivist point of view, helping students learn how to solve problems is important for encouraging reflexivity. Therefore, instructors need to avoid the act of rote memorisation and focus on encouraging

individuals to step back, rethink, relate, and adapt to their prior experience and knowledge. This, in turn, will help them to develop different perspectives and strategies to be applied in complex situations and problems, and can also begin to reform the learning process based on a constructivist epistemology.

Educational Blogging Environment and Social Constructivism

According to Vygotsky (1978), deep understanding can be developed through collaboration with more knowledgeable peers rather than relying solely on one's own abilities. This can be achieved by activating prior knowledge derived from personal experiences and the experiences of others, as well as existing knowledge (McRobbie & Tobin, 1997). Hence, to support this notion, the use of electronic environments, such as blogs, is highly relevant, especially to augment the learning experiences of today's digital learners, where reflection, social collaboration, and user-generated content might become more viable (Lam et al., 2020). In terms of practicality, blogs, which have shared affordances of social constructivism principles, predominantly with regard to collaborative cognitive communication (Noel, 2015), are ideal to showcase and record students' reflections and thoughts related to learning experiences on the Authoring System course. As blogs can relay information electronically, students can have the freedom to create and read posts without limitations (Fatimah et al., 2020). Additionally, blogs empower students to inquire, exchange ideas, and offer feedback (Meinecke et al., 2013) by engaging in discussions with their peers through blog posts and comments. When essential features, such as commenting, replying, post archiving, blogrolls, and 'follow' and 'like' buttons are utilised, students can create a community space, fostering social interaction, receiving notifications, and minimising the time needed to find specific blogs and posts (Rettberg, 2014). In this manner, students gain access to specific information, allowing them to co-construct understanding (Halic et al., 2010), resolve conflicting ideas (Wang & Hsua, 2008), and establish new connections between ideas (Buasuwan, 2018; Noel, 2015).

Feedback and Social Constructivism

Studies have revealed that students often struggle with and lack the motivation to engage with reflective writing if they are not provided with clear support and direction to aid them in establishing connections between their learning experiences and the theories they have learned (Lee, 2018). Prilop et al. (2020) claimed that leveraging the power of feedback will have a positive impact on reflection. Liu and Carless (2006) described feedback as "a communication process through which learners enter into dialogues related to performance and standards" (p. 280). In other words, it is a kind of response that is rich with detailed comments. The social constructivism theory underpins many studies on feedback (Bakar et al., 2010; Carless & Boud, 2018) probably due to their shared perspectives. Additionally, there is a changing attitude towards viewing feedback from the perspective of behaviourist theory, where learners are often punished for the errors they have made, rather than there being a more tolerant reaction to learning how to learn within the framework of communication (Subagyo, 2015). Social constructivism also emphasises that knowledge is constructed and progressed through social interaction among learners, which requires active engagement with others (Vygotsky, 1978). As this theory is reliant on social interactions between learners and instructors, any disengaged or shy participants may achieve limited learning outcomes (Pena et al., 2017). Previous research has also found that the exchange of feedback among students is limited (Yiu et al., 2021). One possible explanation for the difficulty in providing feedback could be the lack of adequate support in fostering effective feedback practices (McLoughlin & Hollingworth, 2002). Instructors must therefore encourage students to engage while maintaining a safe and trustworthy learning milieu. The practical application of the social constructivism theory highlights the importance of incorporating feedback as part of a dialogic process (Orsmond et al., 2013) in helping an individual construct his or her knowledge (Pear & Crone-Todd, 2002).

Case-Based Learning and Social Constructivism

Case-based learning is a learning approach where students apply their knowledge to real-world scenarios (McLean, 2016). This learning strategy is often used by instructors to enhance the development of reflective thinking skills (Golaghaie et al., 2019) and give students the opportunity to explore and apply skills and theories they have learned in their field of study (Williams et al., 2017). As stated by Conway (1999), case-based learning is beneficial, since it "(a) encourages reflective practice and deliberate action, (b) involves students in their own learning, and (c) promotes the creation of a community of learners" (p. 20). This shows that case-based learning aligns with the principles of social constructivism theory. This learning strategy emphasises the significance of realistic learning contexts that integrate theoretical and practical aspects, along with active involvement in social collaborative learning, to build knowledge and understanding (Hunter, 2015). Nevertheless, cases related to computer-supported matters pose a significant challenge in terms of real-world settings since students' access to the actual environment is limited compared to disciplines like law, medicine, or business. The cases should, at the very least, elicit feelings, thoughts, and engagement from students as if they were in a real-life situation. Within the umbrella of social constructivism theory, case-based learning may become operationalised in two ways:

1. Case-based learning requires students to engage in collaboration and take ownership in solving the cases' activities. In a collaborative learning setting, students are expected to participate actively by expressing their thoughts and emotions, practising negotiation and communication skills, and articulating various perspectives. These interactions can facilitate the integration of knowledge and understanding. This highlights the significance of social interaction in facilitating reflective skills among students.
2. Students are not provided with knowledge in a spoon-fed manner, as is often seen in conventional teaching methods. Instead, in this learning strategy, students receive sufficient knowledge from formal lectures in class to kickstart discussions on the cases. From there, they actively seek information within the cases to collaboratively solve problems and construct shared understanding. This demands that students take on an active role and engage in reflective thinking, eventually developing their knowledge and understanding of the problems or situations. Again, this aligns with the principles of social constructivism theory, as it emphasises the collaborative construction of knowledge by each student based on relevant past experiences, and this knowledge is open to interpretation, with no single right answer.

In summary, it is important to highlight that elements such as blogging, feedback, and a case-based learning strategy form an important basis for the development of reflective thinking skills. During the early practice of reflection, journal writing was paper-based. One of the obvious patterns found when implementing traditional journal writing is that it was done in isolation and was not social, since the approach did not allow for interaction with others in a community of learners (Yancey, 2016). This might limit the construction of knowledge and thinking skills, which cannot be effectively interweaved solely via books or directly from self-introspection but also need communication and sharing with others (Stahl et al., 2006). Hence, blogging might somehow offset the oft-mentioned difficulties in developing reflective thinking skills in traditional offline/isolated approaches, namely, limited views and responses received and an unsatisfactory communication process. Supported with features like hyperlinks, an RSS feed, and comments, blogs are able to promote collaborative reflection within a learning community (Deng & Yuen, 2011), thus fulfilling one of Dewey's criteria, which is that reflection should occur in a community; that is, in interaction with others. Nevertheless, blogging cannot benefit the reflection process if it is not coupled with effective instructional support, such as feedback, from either peers or the instructor, and also the issues/problems that they need to reflect upon. Hall (2018) worried that without feedback, blogging would be likely to result in students merely describing their practice or viewing it as an assignment to be completed. Hence, both blogging and structured instructional pedagogy are mutually important, and when one factor is missing, it will present tension among students, as they are unable to reflect more deeply. Authentic tasks also

need to be well developed to assist with collaborative reflection among students so that meaningful and reflective thinking skills can be applied. Through the case-based learning strategy, the instructor and students work together to avoid tangential discussion; nevertheless, students have control when analysing cases. Instructors can interrupt and provide guiding questions to bring the discussion back on track to ensure that correct answers are known (McLean, 2016). Students, meanwhile, are expected to participate and undertake advance preparation, and to ask questions directly related to cases (McLean, 2016).

METHODOLOGY

A cohort of postgraduate students, which consisted of 18 students, was chosen as the sample for this study. The purposive sampling method was utilised since that was the only cohort of students enrolled in the computer-supported course, that is the Authoring System, at the Faculty of Education of a university in Peninsular Malaysia. An *a priori* statistical power analysis was conducted to determine the ideal number of participants that should be selected in order to achieve certain power levels (see Table 1, Figure 1). Even though the results indicated that a sample size of 24 would be required to achieve a high power-value target (i.e., 81%), the total number of participants used in this study (i.e., n = 18) was deemed appropriate to assess students' performance/knowledge gain in learning on the Authoring System course at an approximately 70% power value (Serdar et al., 2021). Some studies also claim that the 80% threshold of power value is unattainable when considering studies with inherently small samples (Bababekov et al., 2019). In the case of this study, the number of master's students enrolled in the educational technology programme specifically under the coursework mode is small, that is, between 10-20 students.

Table 1. *A priori* power analysis

***A priori* statistical power analysis**	**Target power (1-β)**	**Target effect size, Cohen's *d***	**Minimum sample size required, n**
	0.81	0.621	24

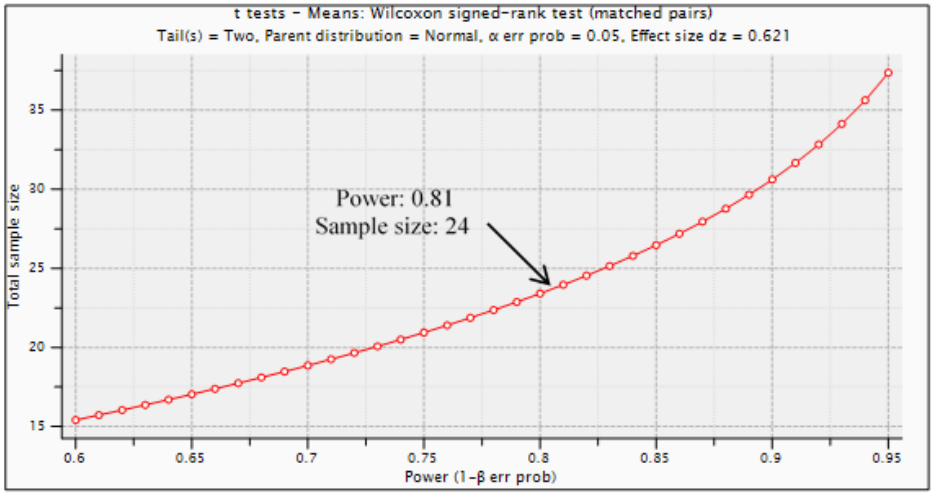


Figure 1. Plot for *a priori* statistical power analysis

In terms of research design, this study used a one-group pre-test post-test design, where only one group is pre-tested (O1), subjected to a treatment (X), and finally post-tested (O2) (Campbell & Stanley, 1963). The one-group pre-test post-test design is suitable when the primary goal is to assess changes within a single group over a specific time frame. This design is relatively straightforward to

implement and analyse, making it practical for many research settings. It allows researchers to measure the impact of an intervention on the same group of participants without the complexities associated with control groups (Paulus et al., 2013). In research related to the use of online learning, where users can access blogs at any time and from anywhere, any direct or indirect contact between the experimental group and the control group might lead to contamination of the design (Rhoads, 2011) and cause a possible leak of information that is supposed to be learned not by those included in the control group but only by those in the experimental group. The design of this study was specifically implemented to evaluate students' learning performance after they had undertaken the reflection process in the blogging environment as a treatment (14 weeks). All students were pre-tested (Pre-test 1) in order to establish their level of prior knowledge of Adobe Flash software. On week 7, students were given the post-performance test (Post-test 1) on the Adobe Flash topic to evaluate their performance. During week 9, students were again pre-tested (Pre-test 2) to establish their level of prior knowledge on the Adobe Dreamweaver topic. On week 14, all students were given the post-performance test (Post-test 2), which covers the Adobe Dreamweaver topic, to assess their knowledge performance. One threat concerning the one-group pre-test and post-test design is testing; it is described as changes in the performance in the post-test due to the earlier administration of the pre-test (Campbell & Stanley, 1963). To avoid this threat, the post-test was only administered seven weeks after the pre-test for each main topic (i.e., Adobe Flash and Adobe Dreamweaver). This is because, after more than one week, students would probably be unable to remember the test questions. Students were also prevented from making a digital copy of the test given during the pre-test sessions.

The learning performance test, which comprised six open-ended short essay questions, was developed by the researchers prior to the intervention process to mirror the level of difficulty of the final exam questions of the Authoring System course (see Appendix A). The first three questions were related to animation topics, whereas the remainder were related to web development topics. The post-test questions were similar to the pre-test questions; however, small changes were made in terms of the question arrangement and the images used. This was to avoid any possible threats to the validity from the instruments used (Campbell & Stanley, 1963). Basically, when the post-test questions are changed, the changes applied should mirror the pre-test in terms of the level of difficulty. When the level of difficulty is no longer the same, then the instrumentation threat will arise. Hence, in this study, no changes in the instrument were made except that the order of the questions was re-arranged, and different images were used for those questions that involved images. Moreover, the same standard scheme was used to assess both tests. In this way, this instrumentation threat can be avoided.

For content validity, the performance test items were vetted by two senior lecturers who had experience in teaching the Authoring System course. They were required to assess whether the items designed for the performance test matched the syllabus content and were in line with the characteristics of case-based learning and hence were useful to support the provision of feedback and the development of reflective thinking skills.

Item validity was also measured after the test items had been piloted in order to assess each item's performance. The sampling for the pilot study for item validity was based on the purposive sampling method by choosing a cohort of students who were enrolled in the Authoring System course in the previous semester. Initially, 12 students were identified as a potential sample; nevertheless, only 8 students were able to commit to the research during the pilot testing process. This particular pilot testing was carried out by administering the performance test to the respondents twice at different times (see Table 2).

The quality of the performance test items was evaluated based on the difficulty index (P) and the discrimination index (D). Item difficulty is determined to establish how hard or easy the performance items are (Senocak et al., 2013). For subjective questions, item difficulty was measured using the following formula (Shanmugam et al., 2020):

P (difficulty index) = $\sim fX - nX / n (X_{max} - X_{min})$,

where,

X_{min} is the smallest item score possible;

X_{max} is the highest item score possible;

~fX is the total number of points earned by all students on the question;

n is the number of students.

Table 2. Pilot test data

Student	Test 1	Test 2
Student 1	33	36
Student 2	39	39
Student 3	33	35
Student 4	37	36
Student 5	21	21
Student 6	50	47
Student 7	19	20
Student 8	36	36

Based on the index gathered, the question items can be categorised into several levels (Nitko, 1996): easy (P: 0.61-0.80), medium (P: 0.41-0.60), and difficult (P: 0.21-0.40). Difficulty can also be defined as follows: the higher the difficulty index (P > 0.8), the lower the difficulty of an item, while the lower its difficulty index (P < 0.2), the greater the difficulty of an item (Nitko, 1996).

The item discrimination index, meanwhile, was calculated to determine how well an item is able to differentiate between students with higher and lower levels of knowledge (Senocak et al., 2013). For subjective questions, item discrimination was measured using the following formula (Ji, 1999):

D (discrimination index) = $P_U - P_L$

where,

P_U and P_L are the difficulty indices described above for the upper (U) and lower (L) groups

To describe the discrimination between high and low-scoring students, it is important to first determine the two groups. In this study, students who scored 36 and above were grouped under the upper category, whereas students who scored 35 and below were grouped under the lower category. Based on the index gathered, the question items can be categorised into the following indices (Mitra et al., 2009): poor item – to be revised (D: 0.0-0.19), acceptable (D: 0.2-0.29), good (D: 0.3-0.39), excellent (D: > 0.4). The findings for the difficulty and discrimination indices and their levels are tabulated in Table 3.

The results show that four items (Items 1, 2, 3, and 6) of the performance test were considered easy, while the other two items (Items 4 and 5) were of medium difficulty. Nitko (1996) suggests that items with a difficulty index between 0.2 and 0.4 or between 0.6 and 0.8 should be rejected, as they are too easy or too difficult. However, it was later decided that questions with a difficulty index between 0.6 and 0.8 would also be included, as long as the discrimination level was adequate (Gelerstein et al., 2016). All items in the performance test had positive discrimination since the high-scoring group obtained a higher average score on the items than the lower-scoring group. Based on Mitra et al.'s (2009) discrimination index range, four items (Items 1, 2, 5, and 6) from the performance test were considered as good, while the other two items (Items 3 and 4) were weighed as acceptable. Hence, as a conclusion, based on both the difficulty and the discrimination indices, it was confirmed that the existing performance test could be used for the real study and needed no further changes.

Table 3. Item difficulty and discrimination index and level

Item number	Difficulty index	Difficulty level	Discrimination index	Discrimination level
Item 1	0.7	Easy	0.3	Good
Item 2	0.7	Easy	0.3	Good
Item 3	0.7	Easy	0.2	Acceptable
Item 4	0.5	Medium	0.2	Acceptable
Item 5	0.5	Medium	0.4	Good
Item 6	0.7	Easy	0.3	Good

Lastly, test-retest reliability was also measured using the Pearson correlation analysis across the scores for the two tests. The value attained for this test-retest coefficient reliability was 0.986. Based on Leech et al. (2011), this value was acceptable, as any value above 0.70 can be considered reliable.

RESULTS

REFLECTION LEARNING ENVIRONMENT FOR LEARNING AUTHORING SYSTEM THROUGH EDUCATIONAL BLOGGING

A systematic instructional design and delivery process known as ICCEE (Chen, 2016) was used to develop the reflection learning environment in learning on the Authoring System course through educational blogging (see Figure 2).

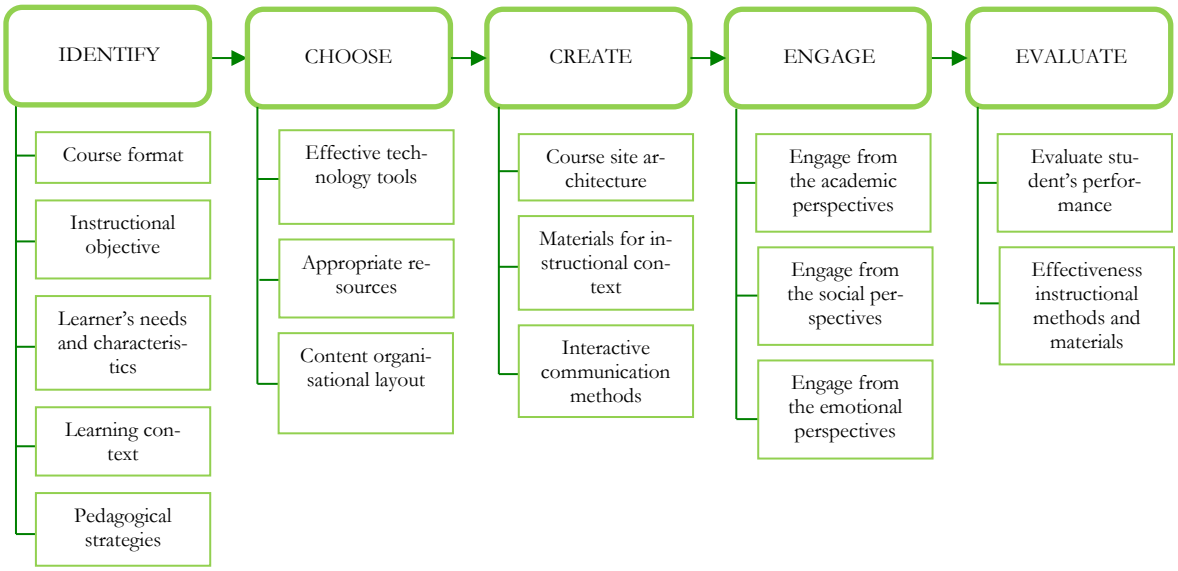


Figure 2. ICCEE online instructional design model (Chen, 2016)

Phase 1: Identify

There are five main aspects that first need to be identified to maximise the efficiency of designing an online instruction course delivery; namely, (1) course format, (2) instructional objective, (3) learners' needs and characteristics, (4) learning context, and (5) pedagogical strategies. In the context of this study, an Authoring System course which was taught at a university in Peninsular Malaysia was selected as the learning subject for developing reflective thinking skills among students through educa-

tional blogging. This course incorporates a mixed-learning approach, where a combination of physical presence and online presence is required, with educational materials and interaction via an online medium that can be accessed flexibly at one's own time, place, and pace.

This course's general instructional objective is to expose students to basic action scripts, programming, and authoring tools that are essential in developing animations and web development. For that purpose, two types of authoring software are used; namely, Adobe Flash and Adobe Dreamweaver. As learning this course requires reflective and active learning practices, students' learning needs and characteristics must be identified to ensure a smooth process. Through a survey conducted during the first meeting of the class, the majority of students acknowledged that they had no prior experience in blogging, and only one-third of them had any experience in using the authoring software. This later led the instructor to explain and assist the students with the process of creating blog accounts using Wordpress.com for blogging and reflection purposes. Moreover, each student possessed a laptop, and a technician helped them to install the authoring software. The students also confirmed that they had stable internet connections at home. This is essential, as this course requires more learning time to be spent through the online mode. Hence, a comfortable and safe online learning context is necessary.

For pedagogical strategies, this course demands the ability to internalise theories learned through developing and solving multimedia application and web development design activities, which involves creative construction and dilemma handling as opposed to mere thinking, reflective activity via educational blogging emerges as a potential pedagogy. Additionally, two main learning theories – constructivism and social constructivism theories – were used to guide the execution of reflective learning through the provision of feedback via educational blogging (see Figure 3). To create well-written and effective cases in this context, the four case-based learning characteristics suggested by Herreid (1997) were followed; thus, it was hoped that the cases would have a positive impact on students' development of their reflective thinking skills. Apart from that, the use of a questioning approach by utilising question prompts can support the feedback strategy to enhance the development of reflective thinking skills among students (Bradley et al., 2008; Ertmer et al., 2011; Zingaro, 2012) (see Appendix B). This type of question prompt was chosen because it has been used to influence the quality of online discussion.

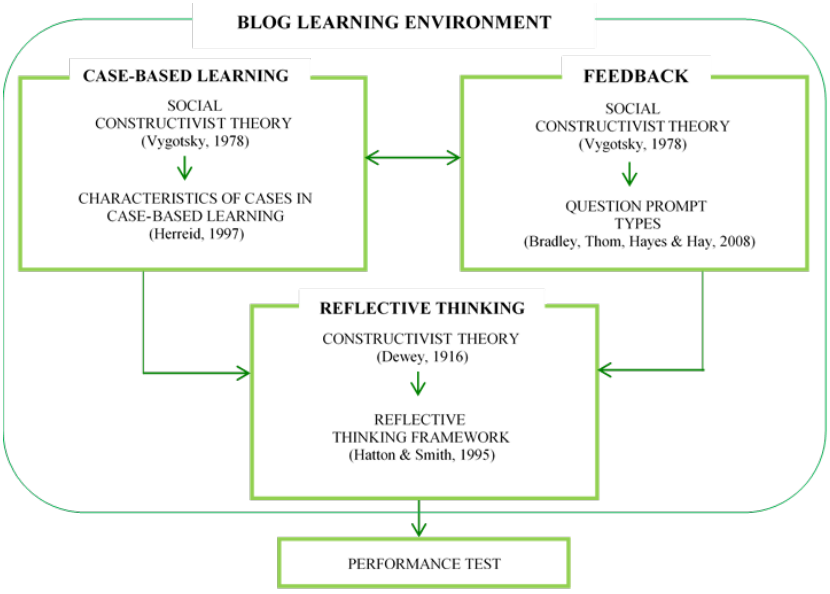


Figure 3. Theoretical framework

Next, to assess students' reflective thinking skills from the meanings they made of their experiences, an assessment model was needed. This study used the one developed by Hatton and Smith (1995) due to its specific focus on assessing reflective thinking skills. The model comprises four levels, beginning with descriptive writing, followed by descriptive reflection, dialogic reflection, and critical reflection (see Appendix B). The model was also given to the students as guidance for them on how to do reflection.

Finally, a connection with students' learning performance was made through the performance test instrument.

Phase 2: Choose

In this phase, effective technology tools were chosen to facilitate the online activities – materials/information presentation, reflection, interaction, and communication. A user-friendly technology reduces students' anxiety and promotes dynamic online activities (Chen, 2016). Table 4 provides a summary of the technology tools chosen for conducting this study.

Appropriate curriculum-related resources include materials like lecture notes for the Authoring System course syllabus, e-books on Flash and Dreamweaver, and previous examples of multimedia and website products. These materials were deployed in the e-learning Moodle so students could access them easily.

Finally, regarding the content organisation layout, students were first introduced to and were then engaged in the classroom setting, where formal lectures were given by the appointed lecturers. The lectures took around three hours for each meeting and were ongoing for 14 weeks. After each week's class meeting, students were required to proceed with the online learning tasks via the blogging environment. Online sessions were partly guided by the instructor and peers and required the students to be more independent.

Table 4. Technology tools for online activities

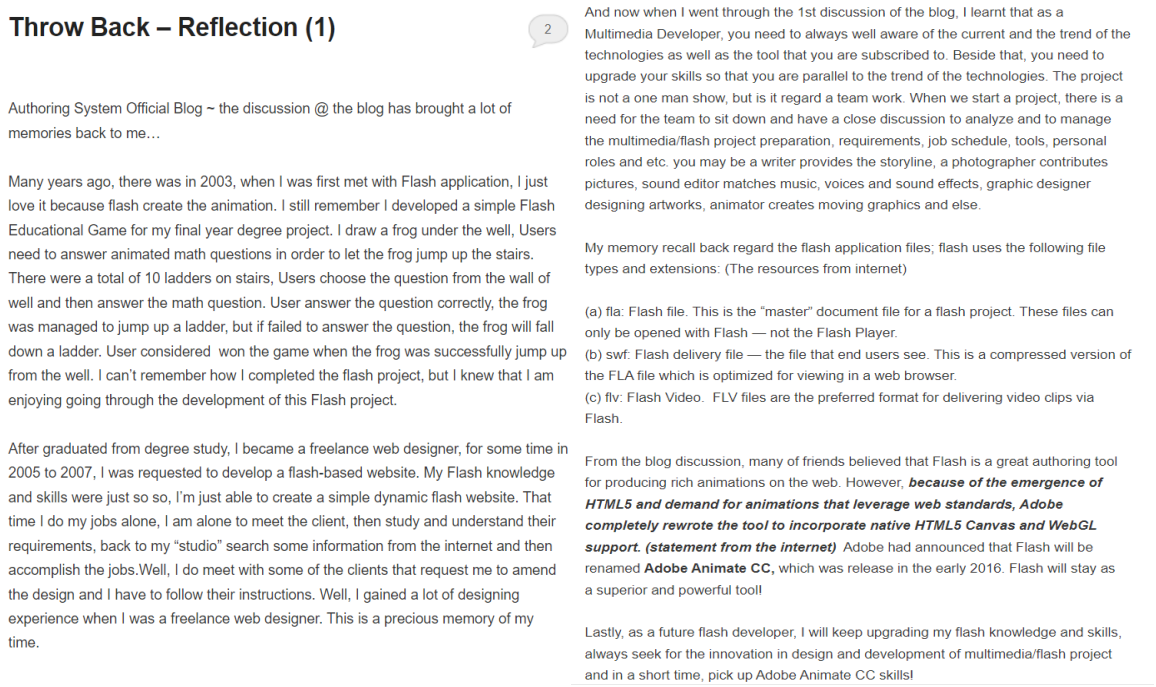
Technology tool	Purpose
WordPress.com	For reflection, interaction, and communication - WordPress.com was used.
Moodle	For repository purposes - instructional materials, class general information.
Adobe Flash	Software to develop multimedia applications.
Adobe Dreamweaver	Software to develop static and dynamic web applications.
XAMPP	Supplementary software for dynamic web application.
Google Site	Repository site for students to store their multimedia applications and later embed the generated link into Wordpress.com for a better view of their multimedia application products.
YouTube	Repository site for students to store their multimedia applications and later embed the generated link into Wordpress.com for a better view of their multimedia application products.
WordPress App	WordPress App can be optionally installed on students' smartphones to ease the process of receiving notifications, composing entries, commenting, etc.
WhatsApp	For general class-related announcements.

Phase 3: Create

During this phase, the course site architecture was designed for running the actual study in order to enhance students' reflection activities; this was achieved by following the previous design of the content organisational layout. Next, the instructional materials and interactive communication methods were developed to support the development of reflective thinking skills through educational blog-

ging. The instructional materials in the form of cases were developed following the case-based learning principles proposed by Herreid (1997). These include: (1) the case mirrors the subject-matter objective; (2) the case portrays an authentic situation; (3) the case narrates a story involving an issue/dilemma; and (4) the case encourages decision-making. Case-based learning was selected to enhance the development of reflective thinking due to the following reasons: "(a) encourages reflective practice and deliberate action, (b) involves students in their own learning, and (c) promotes the creation of a community of learners" (Conway, 1999; p. 20). Six cases were created, namely: (1) Flash test drive; (2) To animate or not to animate camp: frequently asked questions; (3) My idea of Flash; (4) It's a house … it's a condominium … it's a website; (5) Trouble is a business, for some; and (6) Where does security lie? Details of the cases can be found in Mohamad and Tasir (2023). The discussion of cases took place in the course blog, and students gathered together to exercise their reflective thinking skills to solve the problems; to give their perspectives, feedback, and questioning; and to make decisions. In addition, students were not separated into small groups so that they could be exposed to others' views without any restrictions; however, they were expected to make contributions with regard to answering all the cases and commenting on each other's views.

As well as solving the cases, students were obligated to post reflections on their learning in their own blogs. This was done individually. The themes of reflection often posted by the students in their own blogs included personal information, what and how-to tutorials, expressions of feelings, seeking help, sharing outside resources/notes, and recollection of own experiences. Figure 4 shows an example of a reflection done by one of the students.



Throw Back – Reflection (1)

2

Authoring System Official Blog ~ the discussion @ the blog has brought a lot of memories back to me…

Many years ago, there was in 2003, when I was first met with Flash application, I just love it because flash create the animation. I still remember I developed a simple Flash Educational Game for my final year degree project. I draw a frog under the well, Users need to answer animated math questions in order to let the frog jump up the stairs. There were a total of 10 ladders on stairs, Users choose the question from the wall of well and then answer the math question. User answer the question correctly, the frog was managed to jump up a ladder, but if failed to answer the question, the frog will fall down a ladder. User considered won the game when the frog was successfully jump up from the well. I can't remember how I completed the flash project, but I knew that I am enjoying going through the development of this Flash project.

After graduated from degree study, I became a freelance web designer, for some time in 2005 to 2007, I was requested to develop a flash-based website. My Flash knowledge and skills were just so so, I'm just able to create a simple dynamic flash website. That time I do my jobs alone, I am alone to meet the client, then study and understand their requirements, back to my "studio" search some information from the internet and then accomplish the jobs.Well, I do meet with some of the clients that request me to amend the design and I have to follow their instructions. Well, I gained a lot of designing experience when I was a freelance web designer. This is a precious memory of my time.

And now when I went through the 1st discussion of the blog, I learnt that as a Multimedia Developer, you need to always well aware of the current and the trend of the technologies as well as the tool that you are subscribed to. Beside that, you need to upgrade your skills so that you are parallel to the trend of the technologies. The project is not a one man show, but is it regard a team work. When we start a project, there is a need for the team to sit down and have a close discussion to analyze and to manage the multimedia/flash project preparation, requirements, job schedule, tools, personal roles and etc. you may be a writer provides the storyline, a photographer contributes pictures, sound editor matches music, voices and sound effects, graphic designer designing artworks, animator creates moving graphics and else.

My memory recall back regard the flash application files; flash uses the following file types and extensions: (The resources from internet)

(a) fla: Flash file. This is the "master" document file for a flash project. These files can only be opened with Flash — not the Flash Player.
(b) swf: Flash delivery file — the file that end users see. This is a compressed version of the FLA file which is optimized for viewing in a web browser.
(c) flv: Flash Video. FLV files are the preferred format for delivering video clips via Flash.

From the blog discussion, many of friends believed that Flash is a great authoring tool for producing rich animations on the web. However, ***because of the emergence of HTML5 and demand for animations that leverage web standards, Adobe completely rewrote the tool to incorporate native HTML5 Canvas and WebGL support. (statement from the internet)*** Adobe had announced that Flash will be renamed **Adobe Animate CC,** which was release in the early 2016. Flash will stay as a superior and powerful tool!

Lastly, as a future flash developer, I will keep upgrading my flash knowledge and skills, always seek for the innovation in design and development of multimedia/flash project and in a short time, pick up Adobe Animate CC skills!

Figure 4. Example of reflection (type: recollection of own experiences)

Phase 4: Engage

One of the major issues in online learning is low retention, either in physical or cognitive terms (Casimiro, 2016). Among the factors that contribute to this issue are isolation, technological problems, course difficulty, inadequate support, learning skills, and peer evaluation (Onah et al., 2014). Chen (2016) further classified that students can be engaged more effectively in online settings through three aspects: academic, social, and emotional.

In relation to this study, students were encouraged to engage in the academic aspect in several ways: (1) they were given brief training by the researchers in using the WordPress blogging environment for reflection purposes; (2) facilitation in regard to technical issues was provided during the reflective thinking process; and (3) examples of giving feedback through questioning were provided for students to follow.

Meanwhile, with regard to the social aspect, a positive online learning community was built through: (1) conducting a discussion on cases or reflection via a discussion board/forum; (2) setting online etiquette guidelines for students to follow during the discussion, and reflection sessions; (3) appointing different moderators among students every week to facilitate the discussion and reflection sessions; and (4) constant monitoring of the discussion and reflection sessions by the researchers.

Lastly, for the emotional aspect, students' confidence was encouraged by giving credit for and showing appreciation for their work and performance. Every week, an outstanding student's work on reflection (weekly best blog) and moderating tasks (weekly best moderator) were announced in the classroom so that other students would take notice and improve the next time.

Phase 5: Evaluate

The final phase of this instructional design model is evaluation. For the scope of this study, the evaluation process covers the learning performance test only. The learning performance test was evaluated using the normality test, Wilcoxon ranked test, effect size, and power analysis. Prior to that, the learning performance test was vetted by two experts in educational technology and evaluated via test-retest analysis.

Effect of Reflection Through Educational Blogging on Students' Learning Performance

This study incorporated pre-test and post-test analyses to establish students' learning performance on the Authoring System course, which was derived from their prior knowledge and the knowledge they had gained by the end of the course. The data in Table 5 depict the comparison of the students' overall pre-test and post-test total marks, including their increment marks, levels, categories, means, and standard deviations. A detailed classification of increment categories can be found in Appendix C. The results demonstrate that there was a sharp rise in the knowledge gained between the pre-test and the post-test, with all students showing growth in performance. The overall mean score for the pre-test was 3.67, with a standard deviation of 2.72, compared with a mean score of 37.2 for the post-test, with a standard deviation of 7.07. The difference between the pre-test and post-test means was 33.5, and the difference between the standard deviations was 4.35.

Judging by the pre-test marks, from the six main open-ended questions (19 sub-questions), the highest score recorded was 8 out of 50 (equivalent to 16%) and the lowest was 0. This clearly shows that students lacked prior knowledge/experience of the course. Higher marks and categories in the post-test, meanwhile, signify that those students had good theoretical and practical knowledge/experience of the course content after they had been through the intervention process (min marks = 27; min percentage = 54%; max marks = 49; min category = P3; max category = P5). This is also clearly evident in Figure 5, where the majority of the students belonged to the higher categories, i.e., HA and O (n = 13; 72%), and none were the lowest categories, i.e., P and W, since 100% of them managed to shift forward drastically to MA, HA, and O with categories P3, P4, and P5 (see Figure 6). In other words, this promising finding demonstrates that students performed better, showing from average to higher levels, and reflection through blogging had a strong effect on students' knowledge gain in learning in the Authoring System course.

Table 5. Students' performance level

Students	Pre-test		Post-test		Increment		
	Marks	Category	Marks	Category	Marks	Level	Category
S1	1	P	30	MA	29	+3	P3
S2	7	P	40	O	33	+5	P5
S3	2	P	33	HA	31	+4	P4
S4	4	P	49	O	45	+5	P5
S5	4	P	40	O	36	+5	P5
S6	6	P	34	HA	28	+4	P4
S7	5	P	47	O	42	+5	P5
S8	1	P	27	MA	26	+3	P3
S9	0	P	35	HA	35	+4	P4
S10	0	P	35	HA	35	+4	P4
S11	3	P	28	MA	25	+3	P3
S12	8	W	43	O	35	+4	P4
S13	5	P	28	MA	23	+3	P3
S14	6	P	36	HA	30	+4	P4
S15	6	P	47	O	41	+5	P5
S16	0	P	43	O	43	+5	P5
S17	7	P	31	MA	24	+3	P3
S18	1	P	43	O	42	+5	P5
Mean	3.67	-	37.2	-	33.5	-	-
SD	2.72	-	7.07	-	4.35	-	-

Legend:
P = poor (0-7 marks); W = weak (8-15 marks); LA = low-achiever (16-23 marks); MA = medium-achiever (24-31 marks); HA = high-achiever (32-39 marks); O = outstanding (40-50 marks); P3 = +3 improvement; P4 = +4 improvement; P5 = +5 improvement

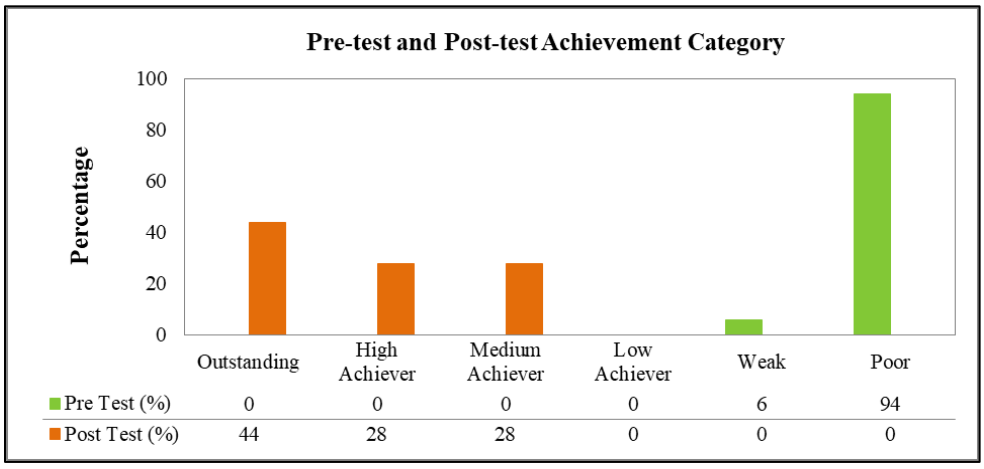


Figure 5. Classification of pre-test and post-test level of achievement category

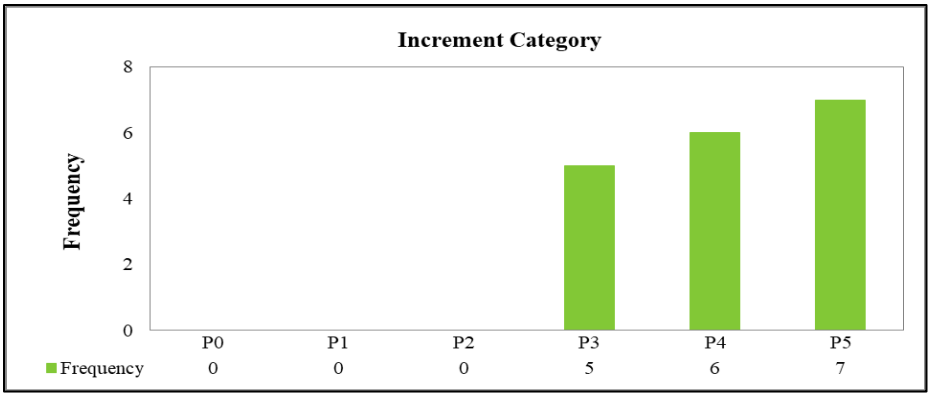


Figure 6. Classification of performance test increment category

Before determining the significance of the differences between the pre-test and post-test scores through a Wilcoxon signed-rank test, a normality test was performed to ensure that the pre-test and post-test scores were not normally distributed. The normality test results for both the pre-test and post-test scores acquired by students are shown in Table 6.

Table 6. Normality test for pre-test and post-test scores

	Kolmogorov-Smirnov			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Pre-test Score	0.170	18	0.183	0.913	18	0.099
Post-test Score	0.129	18	0.200	0.940	18	0.294

The *Shapiro-Wilk* test was selected as a means of measuring the normality of the data used, as it is a powerful test in comparison to other tests, such as the *Kolmogorov-Smirnov* test, the *Lilliefors* test, and the *Anderson-Darling* test (Razali & Wah, 2011). Apart from that, this test is appropriate for samples of fewer than 50 respondents. Hence, it was appropriate for the 18 respondents employed in this study. The significant values of the *Shapiro-Wilk* normality test for the pre-test and post-test scores were 0.099 and 0.294, respectively. Both values were higher than the alpha level, which is 0.05; therefore, the null hypothesis could not be rejected. The result suggests that both the pre-test and post-test scores followed a normal distribution, hence violating the normality assumption for the Wilcoxon signed-rank test.

Nevertheless, the Wilcoxon signed-rank test was still utilised to analyse the pre-test and post-test scores due to the small sample size of this study, which had 18 respondents. Tables 7 and 8 depict the results obtained from the Wilcoxon signed-rank test analysis to determine the mean difference between the pre-test and post-test scores and thus evaluate the result from the perspective of statistical significance (the extent to which the pre-test and post-test scores can be explained by chance).

Based on the data in Table 8, it is shown that the Sig. (p-value) is equal to 0.000, which is less than 0.05. The small p-value indicates that there is very little chance of obtaining data like those observed (or even more extreme) if the null hypothesis were true. More specifically, there was a less than 0.1% chance ($0.000 < 0.001 = 0.1\%$) of seeing such a difference by chance. Subsequently, this indicates that there was a statistically significant difference between the pre-test and post-test scores, and thus, there was enough evidence to reject the null hypothesis (H_0) in favour of the alternative hypothesis (H_1). Hence, it can be concluded that reflection through blogging, which acted as an intervention, had a significant influence on students' learning performance in the Authoring System course. This result, nevertheless, is not sufficient until it is assessed from the practical perspective (the magnitude/strength of the result); that is, through effect size.

Table 7. Wilcoxon ranks

		N	Mean rank	Sum of ranks
Post – Pre	Negative Ranks	0[a]	0.00	0.00
	Positive Ranks	18[b]	9.50	171.00
	Ties	0[c]	-	-
	Total	18	-	-

a. post < pre
b. post > pre
c. post = pre

Table 8. Wilcoxon signed-rank test statistics

	Post-Pre
Z	-3.726
Asymp. Sig. (2 tailed)	0.000

To determine the strength of the intervention effect, effect size was computed using Cohen's *d* formula. The effect size was derived by dividing the z value of 3.726 by the square root of the sample size value of 36. This gave a *d* value of 0.621, which indicated that the intervention had a medium effect (Leech et al., 2011) on students' performance/knowledge gain in their learning on the Authoring System course. Finally, a *post hoc* statistical analysis test was also carried out using the *G*Power* software, version 3.1.9.2, in order to know the power value based on the specified number of participants. Based on the results presented in Table 9, the data revealed that the power value of this analysis was 70% for the effect size of 0.621 to detect the mean difference before and after the intervention. More information on ranges of values for different parameters of numbers of participants in determining certain powers can be found in Figure 7.

Table 9. *Post hoc* power analysis

Post hoc statistical analysis	Achieved power (1- β)	Achieved effect size, Cohen d	Real sample, n
	0.7	0.621	18

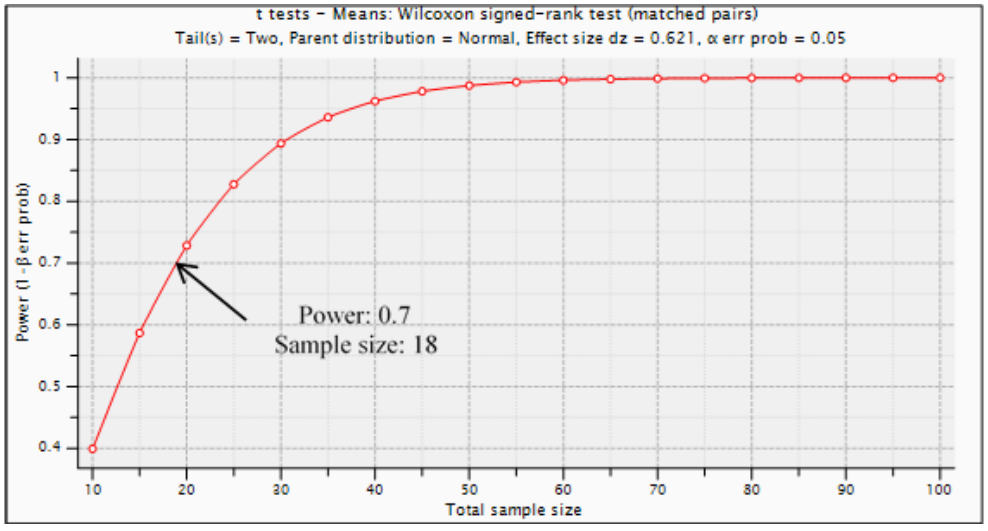


Figure 7. Plot for *post hoc* statistical power analysis

DISCUSSION

Since online learning is pertinent for teaching and learning in higher education institutions, partly due to the capability of the technologies, creating quality instruction of course content is a difficult task for instructional designers and instructors on online courses (Scoppio & Luyt, 2017). Incorporating reflection as an integral part of the curriculum and the learning process can be challenging. It involves dedicating time and effort to foster a reflective culture. Learning through an online medium that lacks clear instruction and efficient applications will cause online learners to focus on the technology rather than on the learning itself (Chen, 2016). Therefore, the integration of a systematic instructional design model that is able to support instructors and professional developers in structuring the online course design – how teachers educate, how learners are evaluated, how knowledge is built, etc. – is vital to achieving the most effective learning outcomes (Morrison et al., 2013). Thus, it is necessary to adapt to the new instructional design models, such as ICCEE, which are compatible with the characteristics of the online learning environment, active teaching, and learning, how teachers educate, how learners are evaluated, how knowledge is built, etc., for today's learning needs (Chen, 2016). As a result, five case-based learning activities and a learning performance test were designed and executed in the blogging environment based on weekly lesson plans (14 weeks) to understand better how a reflection approach can be conducted to improve students' learning performance in a computer-supported course, i.e., animations and web development, through transferring knowledge via reflection. From the informal unstructured interview session that was conducted in Week 14, some students volunteered to express their views regarding their experiences in learning through the reflection approach. Among the documented responses are the following:

> Student 3: "*At first, I was quite sceptical about the idea of using reflection as a learning tool for practical subjects like animation and web development. These subjects felt very hands-on, and I thought reflection might be more suitable for theoretical or abstract topics. So, looking back, I have to say that my scepticism about reflection in practical subjects like Authoring System was misplaced*".
>
> Student 12: *"I must say that my friends have found my blog to be a valuable resource, especially when they have technical questions related to the cases that we need to solve. So, when my friends pose questions on my blog, I often take a cue from our instructor's approach. Instead of directly providing answers, I use question prompts in order to create more room for reflection at my peers' end as well as to trigger their reflective thinking skills".*
>
> Student 9: "*The activities that mimic real-world scenarios allow for a deeper understanding of the subject matter. I also perceive that [the] feedback approach in reflection is a game-changer, especially when it came to addressing cases related to animation and web development. This should be done in every semester, for every course, if possible."*
>
> Student 5: "*Besides learning animation and website development, I've also been able to sharpen my blogging skills. Since there's no rigid format for writing our reflections, I sometimes base them on my experiences. However, most of the time, I create step-by-step tutorials. To be honest, it takes a lot of my time at night, but I genuinely enjoy every moment of it.*"
>
> Student 18: *"The cases designed in comic form are quite refreshing for me. I can understand the situations better in this format rather than reading plain long text. The instructions given by the instructor every week are also clear. And I also refer to the question prompt a lot during my turn as the moderator, that thing helps me a lot."*

From those responses, the overall process of designing the pedagogical approach to learning the course through the ICCEE model has shown positive results for students. These include how the activities and the materials provided were useful in helping them to reflect and give feedback to their peers.

Next, learning performance tests serve as diagnostic tools to identify weak and strong students, and to establish what they already know and do not know, through the knowledge gain observed on repeated tasks such as pre- and post-tests. Overall test marks were better in the post-test, where all of the students scored just above average and none were in the low achievers' category, with five students recording +3 improvement, six students at +4 improvement, and seven students at +5 improvement (see Table 5). This implies that the students were able to comprehend learning based on the applied reflection approach, thus reflecting good development in the cognitive test. Prior studies have also established that active engagement in reflection leads to better conceptual understanding and thus improved learning performance (Novakovich, 2016; Tracey et al., 2014). For example, Novakovich (2016) found that the pre- and post-tests revealed significant differences, as the reflection-mediated peer feedback increased the learning outcomes of essay writing. Furthermore, Menekse (2020) also examined the effectiveness of generic prompts of reflection-informed learning and instruction on college students' learning performance. The results indicated that students who used generic prompts performed significantly better in exams. Drawing from that, this study believes that the power of reflection which is directly integrated with the feedback approach did produce higher test scores for the Authoring System course. Apart from that, from the social constructivism perspective, the impact of student-student and student-instructor interaction when giving reflection and feedback provides opportunities for students to emulate the same actions, and thus results in positive changes in test performance. Additionally, increasing the opportunity for peers to view and comment on reflections created by others could enhance their knowledge levels in a test (Yang & Chang, 2012). This is supported by students' views as follows:

> Student 2: "*In our recent case discussion, we had a reflection session where we discussed what went well and what could have been done differently. Just by reading my peers' insights, as well as the instructor's feedback, gave me a better understanding of the case's objectives. It wasn't just about getting a grade-it was about learning from each other.*"
>
> Student 7: "*Yeah, I believe that student-student and student-instructor interaction during reflection and feedback sessions can definitely lead to positive changes in our test performance. You see, this is not merely focusing on memorising facts; it's about truly understanding the subject matter and applying it effectively.*"

Although this study had a medium effect size of 0.62 for a total of 18 participants to detect the mean differences before and after the intervention, it signifies an important result. In other words, incorporating reflection is not just about slightly better grades; it is about making a substantial, positive impact on students' learning performance. So, in simpler terms, effect size shows how much better the students are performing because of the reflection activities. Perhaps future studies can replicate this study and achieve a better effect size. Nevertheless, as advised by some scholars, it is not wise to demand a large effect size when it comes to studies related to social sciences because there is much variation in cognition, emotion, or behaviour (De Boeck & Jeon, 2018; Gelman, 2019).

Apart from the effect size, this study also had a 70% chance of detecting an actual significant difference between the exam scores (see Table 9 and Figure 7). This also means that we should pay attention to the remaining 30% chance of not being able to detect an actual significant difference between the test scores. As suggested by studies such as Madjarova et al. (2022) and Serdar et al. (2021), the power value can be increased by increasing the sample size. Nevertheless, it is not always feasible to increase the sample size with certain kinds of research or subject populations (Finkel et al., 2017), as this can delay the completion of the study activities and increase the monetary cost of executing the study (Madjarova et al., 2022; Serdar et al., 2021). Moreover, it is impossible to rule out some potential factors that can dynamically influence students' learning performance and challenge the significant intervention result. For example, studies have suggested that mood and motivational changes can affect student performance and cognitive processes, which can then lead to students performing poorly on tests (Wong et al., 2013; Zhu et al., 2022); however, in this study, we did not directly observe the changes in students' mood and motivation when they were taking the tests

Last but not least, as the number of unanswered questions declined in the post-test, it is still unclear why students performed badly on Question 3, which was associated with an action script problem. This question was, in fact, labelled as easy based on the item difficulty index. This situation may relay an assumption that questions designed in the course blog should also be focussed more on action script troubleshooting compared to concept-based and real-world transfer types of questions, as the latter type incurred better scores on the test. Although the researchers had designed cases related to action scripts, such as in Cases 2 and 3, those questions are much too general and might have had little impact on the learning performance test. It might also be the case that this action script type of question is not appropriate to be answered in paper-based form but rather should be answered through lab tests using the appropriate software and computer due to the provision of supporting features, such as a debugger, colour-coding, code-lining, and syntax error highlights, which would provide students with the exact learning experience and memory recall (Jamil & Isiaq, 2019).

CONCLUSIONS

This study offers valuable insights into the needs of academics and learners in promoting reflection as a pertinent and attainable objective within higher education institutions' learning and teaching processes. Also, this study highlights that educational blogging is appropriate for postgraduate students when its pedagogical design is carefully planned to align with learning and teaching purposes. Educators can ensure that students perceive learning and teaching as constructivist activities by leveraging the advantages of blogs as student-centred learning environments and minimising the presence of instructionalist activities. This approach encourages discussion and debate-like activities, which, in turn, positively affects students' overall learning performance.

Reflection and feedback play a key role in stimulating students' learning performance as evident in the overall post-test marks, where all of the students scored just above average, and none were in the low achievers' category. The medium effect size also connotes an important result, as manipulation of reflection integrated with feedback was able to produce a medium effect on the test score for the computer-supported course within one semester. However, a lack of information on the observation of students means it is not possible to predict the other possible factors that may dynamically challenge the significant intervention result. As suggested by the literature, possible factors could include students' mood and motivation.

Future research is needed to validate this finding, particularly focusing on different computer-supported language courses, utilising larger samples, and considering diverse demographic characteristics. This is due to the relatively limited attention given to the application of reflective thinking in computer-supported language courses when compared to other courses. Apart from that, the learning performance pathways can also be analysed analytically via data mining using the qualitative data in the blog environment to shed valuable insights into patterns related to the types of feedback that foster the growth of specific levels of reflective thinking skills and their connection with students' learning performance. As studies have agreed that the use of summative assessment is necessary due to the need to lessen the risk of plagiarism (Sheard et al., 2013), despite being considered an improper way to measure computer-supported performance among students, perhaps future studies might respond to this dispute by linking students' performance with other probable learning processes/outcomes, such as learning styles, interaction posts, demographic details, and response time, in order to derive a better sense of the computer-supported competencies among students based on the summative approach. Last but not least, perhaps an automated recommender system/plugin could be adopted and embedded in the blogging environment. This may allow for the systematic and instant provision of early intervention for at-risk students by the instructor. Ultimately, a good understanding of learners' data and needs will help universities to raise the overall university experience of learners attending their institutions.

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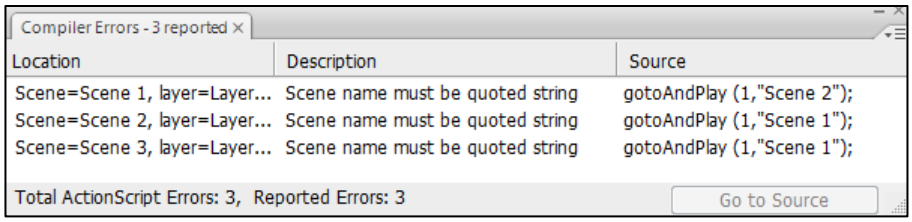
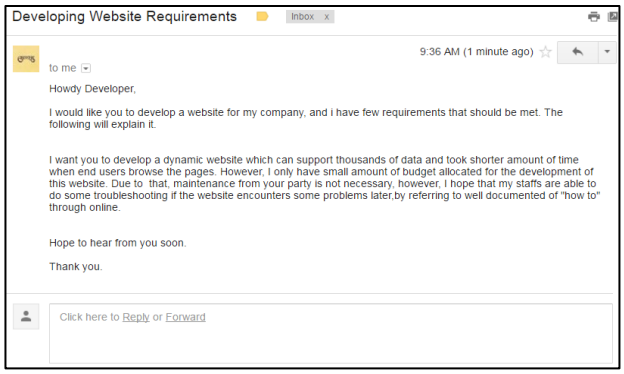
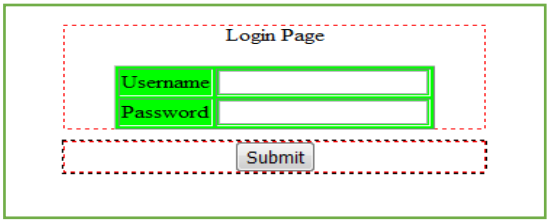
APPENDICES

APPENDIX A. LEARNING PERFORMANCE TEST QUESTIONS

No.	Questions
1	Rashdan would like to create a simple animation of volcano eruption for courseware which involves the use of shape tweening concept. However, before he designs the animation using the real materials, he plans to recall his knowledge regarding shape tweening. So he started to morph a text to a star symbol by drawing an appropriate design like the one depicted in Figure 1.  Figure 1: Morphing a text to a symbol He then tried to apply shape tweening setting by right clicking on the timeline. However, Adobe Flash fails to allow the action. He tried again by choosing shape tweening at the properties section, but still nothing happened. He was uncertain about what causes the problem. Rashdan later look up to you for some advice about the problem. So now, what do you think about the possible root cause of the problem? (1M) Is there any rule of thumb that Rashdan should apply when it comes to do shape tweening? And how the rule stated previously works? (2M) Let say Rashdan was able to fix the problem with your assistance. He then proceeds with the next steps and finally tested the movie. Everything seems to be working however, the morphing effect is not very smooth and it is too fast. So what could Rashdan do in order to get a smooth morphing effect? Provide also the explanation for your suggestion. (2M) It is known that Adobe Flash allows the creation of several types of animation; that is motion tween, shape tween and frame-by frame animation. Motion tweening is useful and more practical, compared to frame-by-frame animation, if one wants to develop an animation which has a small file size. However, what is the purpose of having motion tweening if shape tweening can provide the motion effect? Provide some rationale justification by comparing the way motion tweening and shape tweening works. (3M)
2	Kate was absent during the first introduction of ActionScript lesson. Now, she needs to complete the class assignment that is, Multiple Choice Question, which of course involve the use of ActionScript, and have to submit it before 12 o'clock tonight. When she refers the tutorial given, she feels confused and lost with all the ActionScript programming required and didn't know where to start. As time drawing near, she feels the need to ask for help from her classmate as to help her in completing the assignment and in the end able to grasp the concept of producing interactive animation using ActionScript. As a friend to Kate, you feel the obligation to help her to understand the concept of ActionScript in developing Multiple Choice Question animation. Perhaps, you can start with some explanation regarding the steps involve. This should include all necessary layers, buttons and etc. (6M) And, if you were to advice Kate on things like tips and tricks, regarding developing MCQ interactive animation, what would that be? You could perhaps start with layer structure and variable naming style. (2M)

No.	Questions
3	Abdillah was tasked by Palm Oil Company in Johor to transform a typical type of PowerPoint presentation into a Flash style. The staff from the company already prepared the content of the presentation and now it is up to Abdillah to convert it into Flash version. The Flash version should behave just the same like typical PowerPoint, where the presenter would be able to move one slide to another when the buttons are clicked. Abdillah plans to use ActionScript 2.0 since the task is not really complicated. So he starts with the first three slides (which mean three scenes in Flash) as to ensure things are working accordingly. Then, he typed ActionScript stop(); as to prevent the scenes from playing continuously without stop. Next, he inserted the following ActionScript behind the buttons in Scene 1, 2 and 3 as to allow the presenter to navigate to the next slide when the buttons are clicked. on(release){gotoAndPlay (1, "Scene 1"); } After that, Abdillah tested the movie and to his surprised the following errors emerged.  Figure 2: Reported Errors Abdillah cannot figure the problem out and the descriptions of the errors are not really helpful. So he turns straight to the online forum and asks the community members to shed some light on the problem. As one of the community members, you are able to spot the error and wanted to let Abdillah knows about it. So what is actually the problem that prevents the Flash file from working properly? (1M) Besides pointing out the problem, you should be able to fix and explain the suggested solution too. (3M) Then, you also advice Abdillah to not using scene as it can cause problem when one wants to do editing later as it is hard to identify the frame numbers. However, Abdillah can still proceed with scene technique if he follows one trick. What could the trick be and explain why it is necessary. (2M) The company later asks Abdillah to add one more function where the slides will change if the presenter presses any key on the keyboard. So what is the additional code that Abdillah should type? (1M) And explain how the code works. (1M) List one type of event handler that Adobe Flash can recognize besides the one listed above. (1M)

No.	Questions
4	Read the following client's requirements carefully:  Figure 3: Client's Requirement Clearly you have been given a job to develop a new website application. Before you go on with the next move, you have to first digest the requirements and suggest which technology you should use in order to develop such website. As someone who has been in this field for 13 years, this is surely nothing to you but weekly argument between all technologies that available for making websites. So, explain in details regarding which technology that you opt to use over the other and provide some reasonable justifications by making comparison between the technologies and associates it back with the client's requirements. (8M)
5	A crucial feature in dynamic website is login function. A simple login page often include username, password and submit button. The purpose of having login function is to allow users to register and use your website. Let say you are trying to create your own login function and the final output for that is just like the following figure.  Figure 3: Login Design Once finished with the design, you keyed-in the necessary data for the username and password fields and hit the submit button. However, you later encountered a problem saying that the database cannot be displayed. You checked again the variable name of username and password text fields as to ensure that they carry the same variable as defined in database however everything seems to be working just fine. You then feel exhausted after wasting your precious two hours trying to figure out the problem and now you are seeking an advice from your buddy. By embracing the role of a friend, you should first identify the problem that leads to the error stated above (1M). Then, discuss in details how to fix the error. (2M) Other concepts that related with login feature are Authentication and Authorization. What are they and provide an appropriate example for each concept. (4M) Finally, suggest two ways that you can do in order to protect your sensitive information which you often transfer over the internet. (2M)

No.	Questions
6	Previously, in building static website, Abid has learned that he can put the files which associated with static website pretty much anywhere that he prefers. Now, he was tasked to develop a website which supports online questionnaire survey feature. So he started to develop the website and created a local root folder on his desktop as to deploy all website files. Once he previewed his website files (.php) through the internal server, that is Apache, he has been prompted with an error message which indicates that **NO WEB SERVER IS RUNNING**. Abid was very confused because the Apache service is actually up and running. So he tried again and again and again including searching for the error through Google in order to fix the problem but still to no avail. Finally he turned to his friend and asked for some help regarding the matter. Assuming that you are Abid's friend, what seems to be the root cause of the error when you diagnosed the underlying problem? (1M) Then, explain thoroughly the first step of creating dynamic website. This should include the configuration of local web server using Adobe Dreamweaver CS3. (2M) In addition to that, assuming the initial problem has been solved, then give details on how to create online questionnaire survey using Adobe Dreamweaver CS3. (5M)

APPENDIX B. DESCRIPTION OF QUESTION PROMPT AND REFLECTIVE THINKING MODEL

Types		Descriptions
Reflective thinking skills (Hatton & Smith, 1995)	Descriptive writing (DW)	Not reflective; description of events that occurred; no reasons/justification for events. For example, "*I like this problem-solving activity*".
	Descriptive reflection (DR)	Reflective, not only a description of events but some attempt to provide reason justification for events or actions but in a reportive or descriptive way, based on personal judgment or reading. For example, "*I chose this problem-solving activity because I believe that students should be active rather than passive learners*".
	Dialogic reflection (DLR)	Stepping back from events; discourse with self; analytical and/or integrative of multiple perspectives; recognizing inconsistencies; weighing competing claims and viewpoints; exploring alternative solutions. For example, "*while I had planned to use mainly written text materials, I became aware very quickly that a number of students did not respond to these. Thinking about this now there may have been several reasons for this. A number of students, while reasonably proficient in English, even though they had been NESB learners, may still have lacked some confidence in handling the level of language in the text. Alternatively, a number of students may have been visual and tactile learners. In any case I found that I had to employ more concrete activities in my teaching*".
	Critical reflection (CR)	The events are related to historical and sociopolitical contexts; considering ethical and cultural outcomes and influences; means and ends. For example, "*what must be recognised, however, is that the issues of student management experienced with this class can only be understood within the wider structural locations of power relationships established between teachers and students in schools as social institution based upon the principle of control*".

Types		Descriptions
Feedback types (Bradley et al., 2008)	Direct link (DL)	Referring to a specific aspect of the article, such as a quotation, and asking students for their interpretation or analysis. For example, *"Parents are past, peers are future" (p. 124) [specific aspect of article] Why is this quotation important to the premise about the influence of peers in one's life? [analysis]".*
	Course link (CL)	Referring to specific information from the course to be integrated with a topic from the article. For example, *"Using Family Systems Theory [course concept], explain how children's personalities affect parenting styles [topic from article]".*
	Brainstorm (B)	Generation of ideas or solutions to an issue. For example, *"How would you encourage [generation part] parents and teachers to emphasise praising children's effort more than their intelligence? [issue]".*
	Limited focal (LF)	Presenting an issue with two or more alternatives and asking students to take a position and justify it. For example, *"Which should schools emphasise more in its curriculum [issue]: social skill development or academic skill development? [alternatives]".*
	Open focal (OF)	Presenting an issue with no alternatives and asking students for their opinions. For example, *"Should schools be held accountable for student performance even if it means losing funding? [issue, no specific alternatives]".*
	Application (A)	Providing a scenario and asking students to respond to the scenario using information from the article. For example, *"The Baileys have two children. One child displays a fearful personality while the other displays a stubborn personality [scenario]. What parenting style is most appropriate for each child? Justify your response [apply information from article]".*

APPENDIX C. LEVEL OF LEARNING PERFORMANCE INCREMENT

Achievement in pre-test	Achievement in post-test	Final achievement	Code
Poor, P1	Poor, P2	Static	S
Weak, W1	Weak, W2		
Low-Achiever, LA1	Low-Achiever, LA2		
Medium-Achiever, MA1	Medium-Achiever, MA2		
High-Achiever, HA1	High-Achiever, HA2		
Outstanding, O1	Outstanding, O2		
Poor, P1	Weak, W2	+1 Improvement	P1
Weak, W1	Low-Achiever, LA2		
Low-Achiever, LA1	Medium-Achiever, MA2		
Medium-Achiever, MA1	High-Achiever, HA2		

Achievement in pre-test	Achievement in post-test	Final achievement	Code
High-Achiever, HA1	Outstanding, O2		
Poor, P1	Low-Achiever, LA2	+2 Improvement	P2
	Medium-Achiever, MA2	+3 Improvement	P3
	High-Achiever, HA2	+4 Improvement	P4
	Outstanding, O2	+5 Improvement	P5
Weak, W1	Medium-Achiever, MA2	+2 Improvement	P2
	High-Achiever, HA2	+3 Improvement	P3
	Outstanding, O2	+4 Improvement	P4
Low-Achiever, LA1	High-Achiever, HA2	+2 Improvement	P2
	Outstanding, O2	+3 Improvement	P3
Medium-Achiever, MA1	Outstanding, O2	+2 Improvement	P2

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