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The Effect of Educational Activities through the Flipped Classroom on Students with Low Metacognitive Thinking

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Abstract

The "flipped classroom" approach has gained popularity in the field of education, especially in the post- Covid-19 era. The flipped classroom approach involves a variety of instructional activities that take place both inside and outside the classroom. Therefore, it is crucial to determine the most efficient way for organizing flipped classroom activities. As metacognitive thinking skills are one of the basic skills required for learning in the context of digital technologies, the current research aimed to investigate the impact of two type of flipped classroom activities, namely self-directed activities (SDA), and sequence task activities (STA), on metacognitive thinking skills. This investigation was conducted in recognition of the fundamental role that metacognitive thinking skills play in the process of learning within the realm of digital technologies. The research used a quasi-experimental methodology to conduct a comparative analysis of the two experimental groups. The first experimental group utilized a flipped classroom approach which is characterized by self-directed activities, whereas the second experimental group utilized a flipped classroom model centered on sequential tasks. The study sample included (60) high school students who were assigned to the two research groups using a random distribution method. A metacognitive thinking scale was devised, including three distinct dimensions: planning, monitoring, and assessment. The findings of the study demonstrated that flipped classrooms, which include self-directed activities, exhibit a higher level of efficacy in fostering the development of metacognitive thinking abilities. The study suggested the need of enhancing the structure of flipped classrooms based on the self-directed activities framework.

Keywords: *Flipped classroom, self-directed activities (SDA), sequence task activities (STA), metacognitive thinking.*

Introduction

The flipped classroom is an educational approach that is predicated on the establishment of a learning environment that prioritizes the needs and interests of the learner. This particular paradigm is a kind of blended learning, whereby digital settings are integrated with traditional contexts in a unified entity, in order to extend the learning environment including outside and inside classroom activities (Goh & Ong, 2019). This approach exemplifies a framework for reorganizing and reconfiguring the operations of conventional educational settings. It involves the delivery of instructional material in two distinct phases, with the first phase occurring outside the classroom setting and relying mainly on digital platforms, mostly those centered around video-based content. The second phase takes place in the classroom, where learners engage in discussions pertaining to the visual content they have been exposed to. Additionally, learners are provided with opportunities to develop advanced skills related to the educational material, surpassing the levels of remembering and understanding as classified by Bloom (Awidi & Paynter, 2019).

The provision and management of flipped classrooms pose challenges in the absence of educational activities since these activities serve as the primary catalyst for facilitating teaching and learning processes within the flipped classroom model. When examining the design of educational activities in a flipped classroom setting, two fundamental patterns emerge: the Self-directed approach (SDA) and the Sequence Task approach (STA) are identified as the primary frameworks for designing such activities. The design of flipped classroom activities, rooted in the self-directed learning method, entails giving learners the

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autonomy to engage with the activity, establish their own priorities, and exercise control over all aspects of the activity. This approach entails the learner taking the initiative to identify their educational needs and select suitable strategies for achieving the desired learning outcomes. Additionally, the learner is responsible for evaluating these outcomes, enabling them to attain them autonomously and without any specific temporal limitations (Louws et al., 2017). Self-directed learning provides learners with the ability to exert control over learning events and assume personal responsibility for managing the learning process. This shift in control from a teacher-centered to a learner-centered approach, as well as from external to internal control by the learner, has been highlighted by scholars such as Beach (2017) and Cheng and Lee (2018). In order to achieve this objective, the use of the self-directed learning necessitates that the learner possess a proactive consciousness to strategically design and assess the learning process within a structured framework that facilitates the attainment of the overall learning objectives (Louws et al., 2017). In a flipped classroom setting, digital video clips created in adherence to the self-directed learning approach exhibit features that grant learners complete control over the content. This includes the ability to skip specific segments, select the portions they wish to focus on for learning, and disregard sections they deem unnecessary. According to Kon et al. (2015), they are also regarded as a highly suitable medium for effectively facilitating self-directed learning processes. Several research have shown that the use of digital video clips into instructional design might enhance self-directed learning processes, resulting in improved knowledge, comprehension, and overall motivation among learners (Ali, 2010; Post et al., 2016).

In relation to the design of flipped classroom activities using the sequential tasks approach, the concept of sequential tasks is derived from sequential learning. Sequential learning pertains to the progression by which learners develop an increased awareness of the organization of learning materials and events. It is important to note that any deviation from a logical implementation of the sequential process may result in various challenges in achieving the desired learning outcomes (Henderson & Warmington, 2017). According to Lindgren et al. (2016), the sequential task approach involves a learning process that follows the concept of step-by-step learning. This principle is particularly significant when acquiring skills or knowledge that possess a structural relationship. The significance of video as a crucial digital asset in flipped classroom systems necessitates a thorough investigation into the optimal design of its organization based on sequential or step-by-step learning principles. This was the primary focus of Kant et al.'s (2017) study, which emphasized the examination of task sequencing in videos. This examination encompassed the arrangement of tasks in a sequential manner, as well as the succession of tasks in relation to one another, and their connection to other components such as examples and explanations that may be incorporated within digital video clips. Numerous studies have provided empirical support for the adoption of a sequential approach in designing learning activities. One such study, conducted by Ibáñez et al. (2014), underscored the significance of employing sequential tasks to foster the acquisition of conceptual knowledge in educational contexts. Wang (2017) conducted a research study that elucidated the significance of augmented reality in enhancing the performance aspect of learners via the use of sequential activities. According to the findings of Kugelmann et al. (2018), the integration of augmented reality into an active learning system should be implemented via a series of sequential activities. This approach is suggested as a means to enhance the educational experience of medical college students and facilitate their acquisition of advanced levels of information.

Accordingly, in light of the divergent findings in the existing literature, wherein certain studies have advocated for educational activities grounded in the self-directed approach while others have favored those rooted in the sequential tasks approach, it is imperative to undertake further research to address the ongoing discourse surrounding the optimal form of educational activities within the flipped classroom. This observation is in line with the ongoing investigation conducted by the research team on the attributes of students in the general education level, particularly at the secondary education level. The findings indicate a noticeable decrease in students' metacognitive thinking abilities, highlighting the need to enhance the proficiency of metacognitive thinking. This is particularly crucial because metacognitive thinking skills have emerged as fundamental prerequisites. The availability of the resource is crucial for contemporary students. Various instructional methods, such as the implementation of flipped classrooms, need learners to acquire and develop metacognitive thinking abilities in order to effectively regulate and oversee their own learning within the context of this particular instructional approach (Van Vliet et al., 2015). Various forms of

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instructional activities, such as sequential task-based vs self-directed, might have distinct effects on metacognitive thinking abilities in flipped classrooms, however, the goal of the present study was to address the following primary query.

(RQ1) What is the impact of varying educational activities in flipped classrooms, namely self-directed activities vs sequential tasks activities, on the degree of metacognitive thinking shown by secondary school students?

Thus, the present study aims to test the veracity of the existing notion.

(H1) The average scores of students in the first experimental group (self-directed activities) and the second experimental group (sequential tasks activities) do not exhibit a statistically significant difference at a significance level of ≥ 0.05 in terms of metacognitive thinking.

Literature Review

Flipped Classroom

The fundamental concept behind flipped classrooms is to optimize class time by limiting the allocation of instructional hours to theoretical lectures. Instead, the focus is shifted towards using class time to provide learners assistance and facilitate their engagement in advanced learning techniques and tactics via a diverse range of appealing and enjoyable activities (DeLozier & Rhodes, 2017). The primary objective of flipped classrooms is to optimize the utilization of classroom time, allowing teachers to gather feedback from students and provide instant help throughout class (Lo et al., 2018). The instructional approach involves the use of pre-recorded video lectures to provide concise overviews of the subject matter prior to the primary class session. This allows the main class time to be dedicated to interactive discussions and the cultivation of advanced cognitive skills and understanding (Lo & Hew, 2017).

The successful adoption of flipped classrooms is contingent upon four key components that need thorough consideration when implementing flipped classes (Chen et al., 2014):

Flexibility Environment: The flipped learning environment should possess a flexible nature, allowing learners to engage in learning activities at their preferred time and location. Furthermore, it is essential to include a variety of teaching techniques and strategies to enhance the learning experience.

Learning Culture: It is important to establish an educational culture that embraces a transition from a teacher-centered approach to a learner-centered approach. This entails allocating classroom time towards delving into more profound educational subjects and offering enhanced educational prospects.

Intentional Content: It is important for educators to meticulously choose appropriate information that is conducive to self-directed learning for remote students, as well as content that is delivered during face-to-face interactions in the traditional classroom setting.

Professional Educators: These educators are essential for the successful implementation of flipped classroom systems. They possess the necessary skills to effectively manage the learning processes and provide guidance and support to learners. This is crucial since the dispersed learning processes, whether conducted at home or in the classroom, need expert facilitation.

Self-Directed Activities (SDA)

Self-directed Activities (SDA) is a pedagogical approach wherein the learner assumes an active role in restructuring educational materials, assimilating the knowledge embedded within these materials, and connecting it to their pre-existing knowledge. This process enhances the learner's cognitive framework, rendering it more robust and enduring over extended periods of time. Self-directed learning is an educational approach characterized by the learner's proactive identification of educational needs, formulation of goals, and determination of suitable strategies to achieve learning objectives independently

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and without temporal constraints (Yasmin & Sohail, 2017). Designing flipped classroom activities in alignment with the self-directed learning approach entails providing learners with increased autonomy and authority over their learning experiences. This approach involves a shift in the traditional roles of teacher and learner, allowing the learner to assume a more active and controlling role in the learning process. Consequently, this shift promotes the development of internal control mechanisms while reducing the reliance on external control exerted by the teacher. However, the implementation of educational practices centered on flipped classrooms necessitates more engagement and self-directedness on the part of the student. This engagement is shown by the learner's autonomy in both the planning and assessment phases of their educational goals and achievements (Chakkaravarthy et al., 2018). The construction of self-directed flipped classroom activities necessitates the careful design of an environment that can effectively enhance motivation, foster goal independence, and cultivate a sense of self-efficacy for learners. Furthermore, it is worth noting that this environment typically operates with a clear focus on achieving specific objectives (Yasmin & Sohail, 2017).

Sequence Task Activities (STA)

Sequence task activities (STA) refer to a category of activities that must be carried out in a predetermined sequence, with each step being mandatory and none of them being allowed to be omitted. Furthermore, it is essential that all pathways within this category be followed in a strictly ascending order, as outlined by San Anton et al. (2018). The significance of aligning learning activities with the completion of sequential educational tasks lies in its potential to yield numerous educational benefits. This alignment enhances the levels of interaction involved in task implementation and fosters a positive performance mindset (Lindgren et al., 2016). According to Sampaio and Almeida (2016), the use of sequential task activities has been shown to enhance students' ability to do educational tasks, enhance their comprehension of learning materials and processes, augment student motivation, and foster a state of flow that promotes the seamless transition between tasks. The organization of educational activities based on the sequential task approach entails several steps. First, it is essential to define the overarching educational task that needs to be organized and learned. Next, this task is divided into its constituent elements, which are then specified. Subsequently, the prerequisites for each element of the educational task are determined. Finally, these elements and their prerequisites are organized hierarchically, starting with the acquisition of basic skills. According to Han et al. (2018), the less difficult skill is situated at the lower end of the learning hierarchy. The implementation of sequential learning processes using modern technologies necessitates adherence to technical procedures and methods that guarantee the learner's adherence to the prescribed path. It is imperative to employ tools that prevent content skipping and facilitate the assessment of the learner's proficiency in each section of the material (Mota et al., 2018). Most models for sequential assignments typically consist of several key components. These components include the introduction to the assignment, the objectives of the assignment, a detailed description of the assignment, the assignment processes, the applications, and resources utilized within the assignment, and the evaluation of the students' work and outcomes (Dodge, 2001; Ellis, 2009).

Metacognitive Thinking

The notion of metacognition thinking, first introduced by Flavell (1979), pertains to an individual's understanding and arrangement of their cognitive processes. It is often categorized into two primary constituents, namely metacognitive knowledge, and metacognitive control (Schraw & Dennison, 1994). Metacognitive knowledge encompasses an individual's comprehension of their own cognitive processes, recognition of various learning techniques, and awareness of the appropriate timing and manner in which to use these tactics (Toraman et al., 2020). Sart (2014) posits that metacognitive thinking is the pinnacle of cognitive engagement, as it enables individuals to retain self-awareness while actively contemplating problem-solving strategies. Tsai et al. (2018) posit that metacognitive thinking is associated with various cognitive processes that pertain to comprehending a problem or situation prior to attempting to resolve it. These processes encompass planning, monitoring, and regulating, in addition to the connection between metacognitive thinking and self-regulatory behaviors. In the process of problem-solving, effective communication with oneself involves assuming several roles, such as idea generation, planning, critical

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analysis, progress monitoring, and behavioral guidance, all aimed at facilitating the attainment of a solution. According to Connor et al. (2019), the authors suggest that the inclusion of educational activities aligned with metacognitive thinking is essential for facilitating effective teaching and learning. The capacity to enhance one's awareness of learning and gained experience is a characteristic inherent to human beings.

The present study examines planning, monitoring, and assessment skills as fundamental components of metacognitive abilities. This investigation is supported by the works of Caselli et al. (2018) and Kralik et al(2018).

- Planning skills refer to the ability to propose and establish objectives, ascertain the nature of a problem, select appropriate strategies for implementation, systematically arrange the fundamental components pertaining to a subject matter, sequence the necessary processes and steps, identify potential obstacles and errors, devise approaches for addressing challenges and errors, and anticipate desired or anticipated outcomes.
- Monitoring skills refer to the capacity to retain a clear objective, adhere to a sequential order of actions, establish connections between new and existing knowledge, recognize the accomplishment of sub-goals, choose whether to go to the next step, and identify and overcome any barriers that may arise.
- Evaluation skills encompass a range of specialized abilities that pertain to assessing the degree of goal attainment, appraising the accuracy of outcomes, evaluating the appropriateness of employed methodologies, as well as assessing strategies for addressing obstacles and errors, and evaluating the efficacy of the plan and its execution

Theoretical Framework

Self-directed learning activities are underpinned by several theories. According to Motivation Theory, the internal motivation of the learner plays a crucial role in fostering enjoyment and engagement in the learning process. This aligns with the principles of self-directed learning, which emphasize the learner's internal motivation as a driving force for taking initiative in the learning process (Georgiou & Kyza, 2018; Krapp, 2005). Based on the theory of self-determination, it is posited that the educational setting should embody the principles of autonomy, competence, and relatedness in order to facilitate the learner's attainment of educational objectives. Consequently, activities grounded in the self-directed learning approach possess the capacity to engender these aforementioned attributes. The use of this form of activity is seen as a favorable indication due to its unique characteristics that foster learner autonomy and enhance learning effectiveness within a context of interpersonal relatedness (Rauschnabel et al., 2017; Ryan & Deci, 2000).

The Hierarchical Theory, as applied to activities involving sequential tasks, emphasizes the significance of maintaining a hierarchical sequence of information, without any abrupt jumps among different segments of the content. This approach ensures a smooth progression from simpler concepts to more complex ones, as well as from individual components to the entirety of the subject matter (Riegeluth, 1999). As for Cognitive Load Theory, it is suggested that sequential tasks may be the most suitable approach. This is because sequential tasks allow for the control of resources presented to the learner, ensuring a balanced and sequential manner of delivery that prevents overwhelming cognitive loads (Sweller et al., 1998). The Information Processing Theory is grounded on the concept of segmenting information and ordering it into a structure that maintains the constrained capacity of short-term memory. This underscores the need of doing activities in a sequential manner (Almasseri & AlHojailan, 2019). According to the Constructivism Theory, activities that include sequential tasks are seen most suitable. This preference arises from the fact that such tasks emphasize an ordered progress, starting with simpler presentations in the first stages and gradually increasing complexity as the activity unfolds. (Takaya, 2008)

Materials and Methods

Research Approach

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The present study employed a quasi-experimental design to examine the impact of different forms of the independent variable, namely educational activities within flipped classrooms including self-directed activities vs sequential task-based activities, on the dependent variable of metacognitive thinking abilities. It also used a descriptive approach throughout the phases of investigation, analysis, and design. This approach enables us to examine research pertaining to flipped classrooms, develop instructional exercises, and ascertain indicators of metacognitive cognition.

Research Design

A two-group experimental design was used, whereby the first experimental group engaged in learning via the utilization of flipped classrooms that were centered on self-directed activities. Whereas, the second experimental group receives instruction via the implementation of flipped classrooms, which are structured upon sequential task activities. Table 1 presents the experimental design used in this study.

Table 1. Experimental Research Design

Research Groups	Independent Variable	Dependent Variable
First experimental group	Flipped classroom based on self-directed activities	Metacognitive thinking skills
Second experimental group	Flipped classroom based on sequence task activities	

The quasi-experimental method has been used in the current research to reveal the relationship between the following variables

Independent variable: self-directed activities versus sequential task-based activities in flipped classroom approach.

Dependent variable: metacognitive thinking

Sample

The study included a sample of 60 high school students who were enrolled in the first semester of the academic year 2023/2024. The participants in this study were selected from a group of 300 students who were administered the metacognitive thinking scale. The participants in this study were chosen from a population of students who scored in the lowest percentile on the metacognitive thinking scale. The participants of the study were randomly assigned to two groups, with each group comprising 30 students. The first group engaged in flipped classrooms that utilized self-directed activities, while the second group participated in flipped classrooms that employed sequence task activities.

Measures

In order to construct the metacognitive thinking scale, an extensive examination was conducted on a range of measures that specifically addressed metacognitive thinking abilities (Fleming & Lau, 2014; Jacobs & Paris, 1987; Judy Shih & Huang, 2022; Ozturk, 2017; Rahnev, 2021). The development of the metacognitive thinking scale was influenced by the underlying metacognitive themes of the previous scales, as well as the specific characteristics of learning in flipped classrooms. This scale was constructed based on three key themes: planning, monitoring and control, and assessment. Each of the four themes consisted of 10 statements, resulting in a combined total of 30 statements. The scale was administered to a panel of specialists in order to establish the validity and consistency of the assertions. The students were instructed to assess each statement based on a five-point rating scale, ranging from "always" to "often," "sometimes," "rarely," and "never." Prior to implementation, the scale's stability was established by confirmation of the Cronbach's alpha coefficient, which yielded a value of 0.84. The mean reliability of reapplication was found to be 0.82.

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Procedures

Prior to commencing the experiment, an analysis was conducted on the features of the students included in the study sample in order to ascertain their proficiency in utilizing digital platforms. The results of the research revealed that the students exhibited proficient capabilities in utilizing digital platforms, with a particular emphasis on video-based platforms. This may be attributed to the valuable experience gained during the Covid-19 epidemic, which served as a catalyst for enhancing their proficiency in digital technology utilization in the context of educational instruction and knowledge acquisition. The researchers additionally used the metacognitive thinking scale to assess the pre-measurement behavior with respect to metacognitive thinking abilities. The scale was administered to a larger sample of 300 students. Based on the results of the scale application procedure, the participants for the study sample were chosen from a population of students who ranked in the lowest quartile based on their scores on the metacognitive thinking scale.

The selection of the study's subject matter was made using the flipped classroom approach, which involves the reversal of traditional teaching methods. The chosen topic for investigation pertained to data representation and logic gates within the computer science curriculum, specifically targeting students attending international schools. The determination of educational objectives for each subject was undertaken, resulting in the attainment of a total of 12 objectives. A cohort of pedagogical initiatives was formulated. The total count of these activities has reached four, with an equal distribution of two activities per educational topic.

The implementation of the flipped classroom is usually carried out in a two-phase approach. In the initial stage, which occurs beyond the confines of the traditional classroom setting, instructional materials in the form of video content are disseminated and educational activities are facilitated through the utilization of the Edpuzzle platform. In the subsequent phase, a collection of educational activities is administered in the classroom. In both stages of implementing flipped classroom, the educational activities and videos disseminated via the platform were intentionally tailored to align with the varying forms of the independent variable. Specifically, the activities implemented during the initial treatment were designed to be self-directed, while the activities administered during the subsequent treatment were structured around sequential tasks. An activity connected to the platform outside the classroom and another educational activity conducted inside the classroom were included for every educational subject.

During the first phase of learning in the flipped classrooms as facilitated by the platform, the presented content and videos were specifically tailored to align with the attributes of self-directed activities and sequence tasks, as seen in Table 2.

Table 2 illustrates the method in which the information on the platform is structured as based on the differentiation between two distinct categories of SDA and STA.

Table 2. The Differentiation Between the Two Distinct Categories of SDA And STA.

Self-Directed Approach	Sequence Task Activates
▪ The themes are sequentially mannered; however, the student has the flexibility to choose the topic or section with which he would want to start their studies. ▪ Responding to the intra-test administered at the conclusion of each subject is discretionary and not obligatory.	▪ Successive subjects and sequences are mandatory for all subjects. ▪ The answer to the intuitive test at the end of each subject is mandatory and not optional. ▪ No student can skip any part and move on to another subject. ▪ Students cannot skip any interstitial test.

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▪ The learner has the option to bypass any section and go to a different section. ▪ The student has the option to omit any intermediate exam and refrain from providing a response. ▪ The clip including all subtopics may be revisited.	▪ You can re-watch each sub-clip individually.

The platform's functionalities were employed to divide video clips into segments and enable the activation of the anti-skipping feature through a series of task-oriented activities. In self-directed activities, students were granted autonomy to navigate, select, and engage with the formative questions embedded within the video clips. The option of quizzes has been enabled and integrated into the video clips. Each educational topic was allocated a study week, resulting in a total of two study weeks. The Progress list has been designed to facilitate the tracking of student engagement by providing information on the number of views per student and their completion status for each section. This data may be used to guide students towards specific content based on their progress statistics.

In the second phase and upon returning to customary school seats in the classroom, brief reviews were designed for every learning subject, including those that were assigned outside to be completed outside the classroom, and emphasizing the fundamental components of each topic. Small groups of three to four students are intended for use in classroom learning groups. The activities conducted in the room were self-directed in the first treatment, as determined by the research techniques. Students were granted the opportunity to initiate discussions and establish the mechanisms for interaction and discussion regarding learning topics. This was in contrast to the second treatment, which involved the establishment of a predetermined sequence for all learning tasks within the classroom.

In order to address the research question and validate the hypothesis related to the comparison of the two experimental groups, the "t" test was applied to determine the significance of the differences between the two experimental groups. The outcomes of the "t" test for participants in the two research groups are presented in Table 3.

Results

In order to address the research question and validate the hypothesis related to the comparison of the two experimental groups, the "t" test was applied to determine the significance of the differences between the two experimental groups. The outcomes of the "t" test for participants in the two research groups are presented in Table 3.

Table 3. The Arithmetic Mean, Standard Deviation, And "T" Value for The Total Skills of Metacognitive Thinking Skills (MT)

Group	N	Mean	SD	t	df	sig
G1-**SDA** **Self-Directed Activities (STD)**	30	137.97	3.22	41.34	58	0.000
G2 - **STA** **Sequence Task Activities (STA)**	30	104.43	3.60			

The favorable results of the first experimental group, which engaged in self-directed activities, are evident when extrapolating the data from Table 3, as opposed to the second experimental group, which performed sequential task activities. Figure 1 illustrates the comparison in the average total of metacognitive reasoning abilities between the two experimental groups.

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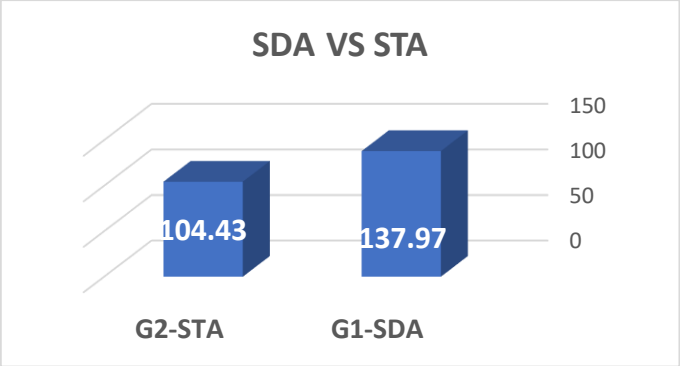

Figure 1. Difference Between SDA & STA In the Overall Skill Group of Metacognitive Thinking (MT).

The significance of the differences between both experimental groups was also verified with regard to the sub-skills that make up metacognitive thinking skills, namely Planning, Monitoring, and Evaluation, as shown in Table 4.

Table 4. The Arithmetic Mean, Standard Deviation, And "T" Value for The Metacognitive Thinking Sub-Skills

Skill	group	N	Mean	SD	t	DF	sig
Planning	G1-SDA	30	46.77	1.72	29.35	58	0.000
	G2-STA	30	35.33	1.27			
Monitoring	G1-SDA	30	48.77	1.96	26.62	58	0.000
	G2-STA	30	37.47	1.25			
Evaluation	G1-SDA	30	42.43	1.95	19.47	58	0.000
	G2-STA	30	31.63	2.33			

The data presented in Table (4) indicates that there are statistically significant differences in the three fundamental skills between the first experimental group (G1-SDA), which utilized self-directed activities, and the second experimental group (G2-STA), which executed sequence task activities in all three fundamental aspects of metacognitive thinking: planning, monitoring, and evaluation.

Figure (2) Shows the Comparison Between the Two Experimental Groups in Each Theme of Metacognitive Thinking (MT) Skills.

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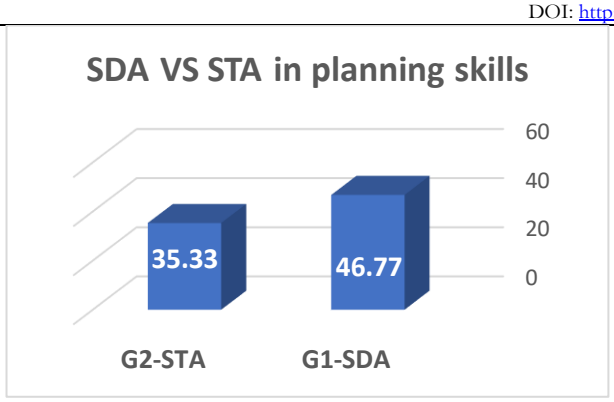

Fig 2A. SDA VS STA in planning skills

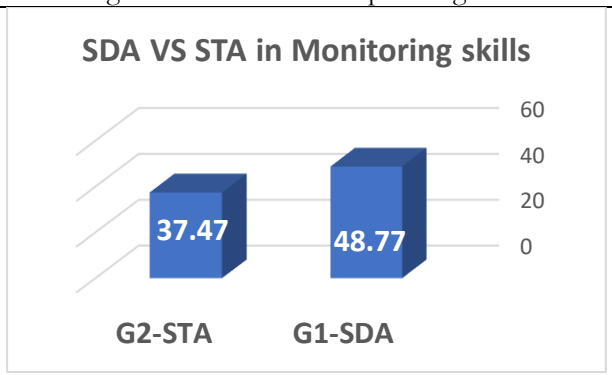

Fig 2B. SDA VS STA in Monitoring skills

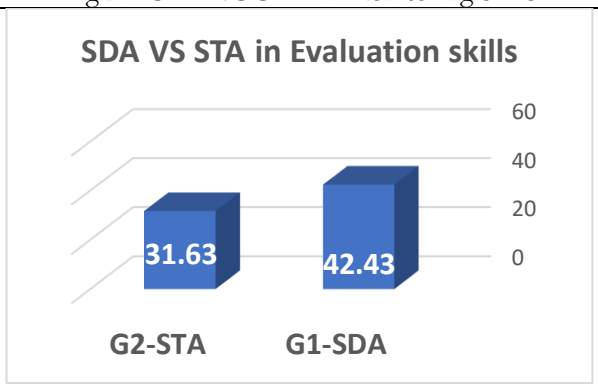

Fig 2C. SDA VS STA in Evaluation skills

Figure 2. The Comparison Between the Two Experimental Groups in Each Theme of Metacognitive Thinking (MT) Skills.

Discussions

The findings of the present study suggest that self-directed activities are more effective than sequential task-based activities in fostering the development of metacognitive thinking skills. This can be attributed to the autonomy afforded to students in the self-directed activities, allowing them to navigate through different content components and acquire the essential points that cater to their individual learning needs. The implementation of self-directed activities effectively addressed the specific requirements of the participants, hence enhancing the planning abilities of the experimental group members in relation to self-directed activities. This is contrasted with the experimental group that required on the active engagement and participation of the students. The traversal of extensive regions may not readily provide the necessary assistance in a timely manner. Undoubtedly, the student's capacity to regulate the presented content facilitates the development of control and monitoring skills. This stands in contrast to the experimental treatment, which emphasized sequential tasks wherein the student lacked full control over the content. It is observed that as the student's ability to control the displayed content diminishes, their performance tends

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to increase. This phenomenon results in a noticeable decrease in the student's capacity to effectively monitor their own learning progress. This is in contrast to the experimental group, which relied on sequential tasks. However, the process of addressing learners' cognitive demands is rarely characterized by sudden or rapid changes. Rather, students must go through substantial steps that may not instantly align with their specific needs. Undoubtedly, the student's capacity to regulate the content presented to them facilitates the development of control and monitoring skills. This stands in contrast to the experimental treatment, which emphasized sequential tasks where the student's control over the content was limited. It is observed that when the student's control over the displayed content diminishes, their performance tends to increase. This phenomenon results in a noticeable decrease in the student's capacity to effectively oversee and evaluate their own learning progress.

By engaging in a self-directed learning approach, a student assumes the role of the primary agent and determines his own needs and priorities. This approach often leads to the exclusion or omission of content that is deemed irrelevant, thereby reducing the cognitive effort required to process the presented material. Naturally, this approach facilitates the enhancement of students' performance in assessment procedures, as opposed to sequence task activities that may impose a higher cognitive load on learners by necessitating their complete engagement with all the material offered in the video clips. This implies that engaging in sequence task activities may result in having weariness while attempting to comprehend knowledge that may not effectively enhance performance, thereby diminishing capacity to assess educational resources and materials.

The implementation of self-directed activities instills in students a range of advantageous attributes, such as initiative, autonomy, tenacity in acquiring knowledge, self-assurance, and the capacity to independently structure their learning experiences. These characteristics encompass the learner's assumption of responsibility for their own learning, a profound inclination to acquire knowledge and undergo transformation, as well as approaching problems as opportunities rather than hindrances. Furthermore, they entail proficiency in employing effective study techniques, adept organization of activities, and the capacity to appropriately gauge the pace of progress in implementing educational endeavors. Additionally, they involve formulating enjoyable and goal-oriented plans to successfully accomplish educational tasks (Jossberger et al., 2010). However, according to the study team, this entirely reflects well on the metacognitive thinking abilities pertaining to planning, monitoring, and assessment.

From a broad standpoint, interactive technology offers learners significant opportunities and capabilities to independently guide their own learning. These environments enable learners to have control over the presentation of resources, the selection of educational materials, and the management and effective utilization of information (Fahnoe & Mishra, 2013). Several studies have suggested a connection between the utilization of technology in educational settings and the promotion of self-directed learning. This correlation is based on the alignment between technological tools and the key attributes of self-directed learning. The combined impact of these factors has been found to have a positive influence on learners' academic achievements (Rashid & Asghar, 2016). According to Kazan and Schiopca (2014), the significance of incorporating the self-directed learning approach in the design of learning activities stems from the observation that a majority of learners possess self-regulated learning skills, albeit to varying extents. Consequently, it becomes crucial and imperative to provide an environment that supports the self-directed learning approach, promote self-motivation, enhance metacognitive thinking processes, and develop self-regulation abilities among learners.

Betrancourt and Benetos (2018) emphasize the significance of aligning the design of digital video clips with the principles of self-directed learning. This is particularly relevant in the context of integrated systems, such as flipped classrooms, which aim to foster learner autonomy and provide opportunities for independent content exploration. Such an approach facilitates the construction of a robust cognitive framework. The use of self-directed design is a prominent methodology that may effectively optimize the benefits of using digital video media inside educational environments. Consequently, the process of creating digital video clips in alignment with the self-directed learning approach entails granting learners complete autonomy over the displayed content. Learners are empowered to selectively skip segments of

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the video clip, while also emphasizing the inclusion of non-intrusive questions that assess their progress towards achieving their objectives. In order to facilitate the ongoing process of learning, it is essential to provide learners with the autonomy to choose the subject they want to start with, as suggested by Beach (2017), Kleftodimos and Evangelidis (2016), Rabidoux and Rottmann (2018), and Shelton et al. (2016)

The incorporation of augmented reality activities in accordance with the self-directed learning approach aligns with various theoretical frameworks, including the theory of motivation. This theory posits that students are more engaged and invested in their learning experiences when driven by internal motivation, leading to a sense of enjoyment and fulfillment in their endeavors. Self-directed activities facilitate this by empowering students to take initiative and pursue content exploration, thereby constructing learning outcomes that align with their internal desires and motivations. This approach enables students to promptly initiate learning tasks, as supported by the works of Georgiou and Kyza (2018) and Krapp (2005). This aligns with the assertion made by Krapp (1999) that the design of the learning environment should provide a significant level of autonomy for students, enabling them to choose activities that align with their individual interests and are connected to their internal motivations. The extent to which students are granted autonomy in managing their learning environment positively correlates with an increased motivation to engage in the learning process and attain optimal learning outcomes.

Throughout a relevant framework, the theory of fundamental psychological needs posits that there exists an ensemble of requirements that must be present throughout diverse educational settings. Among these requirements are independence, competence, and relatedness. It is evident that self-directed activities have the capacity to fulfil these requirements by fostering autonomy via the provision of opportunities. Student experience a sense of volition and autonomy in executing tasks according to their preferred order, without being constrained by a predetermined sequence. Furthermore, it enhances efficiency by instilling in the learner a perception of efficacy in job completion and the capacity to exert impact on the surrounding environment via seamless navigation and unfettered mobility across different sections of the material. Ultimately, the establishment of a connection is facilitated by the reciprocal interaction between the self-directed augmented reality environment and the learner's technological requirements, as well as the responsiveness of digital classroom systems to the student's preferences. (Rauschnabel et al., 2017; Ryan & Deci, 2000).

The self-determination theory also lends support to the practice of designing activities in alignment with the self-directed learning approach. This is due to the theory's underlying assumption that students are driven by a set of internal motives while engaging in tasks. The aforementioned motivations serve as driving forces for individuals, enabling them to exercise independence over their destiny and behaviour, as well as establish their priorities based on their internal aspirations and inclinations. Consequently, it is crucial for the educational setting to provide an environment that facilitates students in making decisions lined up with their personal requirements and congruent with their motivational factors (Biard et al., 2017; Gagné & Deci, 2005; Ryan & Deci, 2000).

Flow theory is a theoretical framework that aligns with the concept of self-directed design. Flow theory posits that individuals experience optimal engagement when they are fully absorbed in tasks and derive pleasure from tackling challenges and seeking information and knowledge that align with their intrinsic desires. As a result, the design of the learning environment should be congruent with this state of flow, encouraging students to immerse themselves in the learning process and navigate it freely, without prescribed sequencing or imposed limitations on the learner (Groh, 2012; Nakamura & Csikszentmihalyi, 2009).

The findings of the present study align with prior research that has demonstrated the efficacy of flipped classrooms in augmenting metacognitive cognitive abilities, as well as the significance of engaging in self-directed learning activities to enhance metacognitive thinking processes (Khodaei et al., 2022; Van Vliet et al., 2015; Yilmaz & Baydas, 2017). The findings of various studies support the notion that incorporating digital technologies within a systemic framework is necessary to improve the quality of learning outcomes in line with the demands and contexts of the present era (Abd El Bakey et al., 2023; Al-Hafdi & Alhalafawy,

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2024; Al-Hafdi & AlNajdi, 2024; Al-Nasheri & Alhalafawy, 2023; Alanzi & Alhalafawy, 2022a, 2022b; Alhalafawy et al., 2021; Alhalafawy & Tawfiq, 2014; Alhalafawy & Tawfiq Zaki, 2024; Alhalafawy & Zaki, 2022; Alhalafawy & Zaki, 2019; Alnimran & alhalafawy, 2024; Alsayed et al., 2024; Alshammary & Alhalafawy, 2022, 2023; Alzahrani & Alhalafawy, 2023; Alzahrani & Alhalafawy, 2022; Alzahrani et al., 2023; Alzahrani et al., 2022; Najmi et al., 2024; Najmi et al., 2023; Saleem et al., 2024; Zeidan et al., 2017; Zeidan et al., 2015).

Limitation

The scope of metacognitive thinking assessment in the present study was restricted to evaluating the frequency of metacognitive thinking shown throughout the process of learning in flipped classrooms. Hence, new investigations might be undertaken to broaden the range of applications pertaining to the metacognitive thinking scale. The participants in the research study consisted only of male students. This was owing to the constraints imposed by the educational community in the Kingdom of Saudi Arabia, where gender segregation is practiced in learning settings. As a result, the research team was unable to include students of both genders in their study. It is essential to do more research within the same framework, taking into account the gender variable as a significant determinant of the study outcomes.

Conclusions

The primary objective of the present study was to investigate the optimal instructional activities for flipped classroom models through analyzing the impact of self-directed activities vs sequence task activities on the development of metacognitive thinking abilities. According to recent study, it has been determined that self-directed activities are the most suitable approach for facilitating teaching and learning processes in the context of flipped classrooms. The present study has also revealed indications of metacognitive thinking within the context of flipped classroom situations. The findings contribute to the advancement of initiatives aimed at promoting the use of flipped classrooms in pre-university educational settings. E-learning centers may use the findings of contemporary research to adhere to established guidelines while developing educational activities in the context of flipped classroom settings. Potential future research endeavors may include the undertaking of systematic reviews that center on the examination of educational activities within the context of flipped classrooms. The examination of the processes involved in the development of educational activities using digital stimuli may also be conducted within the context of the flipped classroom paradigm.

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References

Abd El Bakey, F. M., Abo Shadi, G. I., & El-Refai, W. Y. (2023). A Mobile Training Context for In-Service Teachers: Methods of Training and Task Practice to Enhance E-Content Production Skills. International Journal of Emerging Technologies in Learning (iJET), 18(19), pp. 205-226. https://doi.org/10.3991/ijet.v18i19.37685

Alanzi, N. S., & Alhalafawy, W. S. (2022a). Investigation The Requirements For Implementing Digital Platforms During Emergencies From The Point Of View Of Faculty Members: Qualitative Research. Journal of Positive School Psychology (JPSP), 9(6), 4910-4920.

Alanzi, N. S., & Alhalafawy, W. S. (2022b). A Proposed Model for Employing Digital Platforms in Developing the Motivation for Achievement Among Students of Higher Education During Emergencies. Journal of Positive School Psychology (JPSP), 6(9), 4921-4933.

Al-Hafdi, F. S., & Alhalafawy, W. S. (2024). Ten Years of Gamification-Based Learning: A Bibliometric Analysis and Systematic Review. International Journal of Interactive Mobile Technologies (iJIM), 18(7), 1-25. https://doi.org/10.3991/ijim.v18i07.45335

Al-Hafdi, F. S., & AlNajdi, S. M. (2024). The effectiveness of using chatbot-based environment on learning process, students' performances and perceptions: A mixed exploratory study. Education and Information Technologies. https://doi.org/10.1007/s10639-024-12671-6

Alhalafawy, W. S., & Tawfiq Zaki, M. Z. (2024). The impact of augmented reality technology on the psychological resilience of secondary school students during educational crises. Ajman Journal of Studies & Research, 23(1).

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DOI: https://doi.org/10.62754/joe.v3i4.3770

Alhalafawy, W. S., & Tawfiq, M. Z. (2014). The relationship between types of image retrieval and cognitive style in developing visual thinking skills. Life Science Journal, 11(9), 865-879.

Alhalafawy, W. S., & Zaki, M. Z. (2019). The Effect of Mobile Digital Content Applications Based on Gamification in the Development of Psychological Well-Being. International Journal of Interactive Mobile Technologies (iJIM), 13(08), 107-123. https://doi.org/10.3991/ijim.v13i08.10725

Alhalafawy, W. S., & Zaki, M. Z. (2022). How has gamification within digital platforms affected self-regulated learning skills during the COVID-19 pandemic? Mixed-methods research. International Journal of Emerging Technologies in Learning (iJET), 17(6), 123-151. https://doi.org/10.3991/ijet.v17i06.28885

Alhalafawy, W. S., Najmi, A. H., Zaki, M. Z. T., & Alharthi, M. A. (2021). Design an Adaptive Mobile Scaffolding System According to Students' Cognitive Style Simplicity vs Complexity for Enhancing Digital Well-Being. International Journal of Interactive Mobile Technologies, 15(13). https://doi.org/10.3991/ijim.v15i13.21253

Ali, A. Z. M. (2010). Effects of teacher controlled segmented-animation presentation in facilitating learning. Journal of Educational Multimedia and Hypermedia, 19(4), 367-378.

Almasseri, M., & AlHojailan, M. I. (2019). How flipped learning based on the cognitive theory of multimedia learning affects students' academic achievements. Journal of computer assisted learning, 35(6), 769-781.

Al-Nasheri, A. A., & Alhalafawy, W. S. (2023). Opportunities and Challenges of Using Micro-learning during the Pandemic of COVID-19 from the Perspectives of Teachers. Journal for ReAttach Therapy and Developmental Diversities, 6(9s), 1195-1208.

Alnimran, F. M., & alhalafawy, w. s. (2024). Qualitative Exploration of the Opportunities and Challenges of Online Training According to the Behavioral Intention Variables of the Most Trained Teachers During the COVID-19 Pandemic. Journal of Infrastructure, Policy and Development, 8(8). https://doi.org/10.24294/jipd.v8i8.4837

Alsayed, W. O., Al-Hafdi, F. S., & Alhalafawy, W. S. (2024). Non-Stop Educational Support: Exploring the Opportunities and Challenges of Intelligent Chatbots Use to Support Learners from the Viewpoint of Practitioner Educators. Journal of Ecohumanism, 212-229. https://doi.org/10.62754/joe.v3i3.3331

Alshammary, F. M., & Alhalafawy, W. S. (2022). Sustaining Enhancement of Learning Outcomes across Digital Platforms during the COVID-19 Pandemic: A Systematic Review. Journal of Positive School Psychology, 6(9), 2279-2301.

Alshammary, F. M., & Alhalafawy, W. S. (2023). Digital Platforms and the Improvement of Learning Outcomes: Evidence Extracted from Meta-Analysis. Sustainability, 15(2), 1-21. https://doi.org/10.3390/su15021305

Alzahrani, F. K. J., & Alhalafawy, W. S. (2022). Benefits And Challenges Of Using Gamification Across Distance Learning Platforms At Higher Education: A Systematic Review Of Research Studies Published During The COVID-19 Pandemic. Journal of Positive School Psychology (JPSP), 6(10), 1948-1977.

Alzahrani, F. K. J., Alhalafawy, W. S., & Alshammary, F. M. (2023). Teachers' Perceptions of Madrasati Learning Management System (LMS) at Public Schools in Jeddah. Journal of Arts, Literature, Humanities and Social Sciences(97), 345-363. https://doi.org/10.33193/JALHSS.97.2023.941

Alzahrani, F. K. J., Alshammary, F. M., & Alhalafawy, W. S. (2022). Gamified Platforms: The Impact of Digital Incentives on Engagement in Learning During Covide-19 Pandemic. Cultural Management: Science and Education (CMSE), 7(2), 75-87. https://doi.org/10.30819/cmse.6-2.05

Alzahrani, F. K., & Alhalafawy, W. S. (2023). Gamification for Learning Sustainability in the Blackboard System: Motivators and Obstacles from Faculty Members’ Perspectives. Sustainability, 15(5), 4613. https://doi.org/doi.org/10.3390/su15054613

Awidi, I. T., & Paynter, M. (2019). The impact of a flipped classroom approach on student learning experience. Computers & Education, 128, 269-283. https://doi.org/10.1016/j.compedu.2018.09.013

Beach, P. (2017). Self-directed online learning: A theoretical model for understanding elementary teachers' online learning experiences. Teaching and Teacher Education, 61, 60-72. https://doi.org/10.1016/j.tate.2016.10.007

Bétrancourt, M., & Benetos, K. (2018). Why and when does instructional video facilitate learning? A commentary to the special issue "developments and trends in learning with instructional video". Computers in Human Behavior, 89, 471-475. https://doi.org/10.1016/j.chb.2018.08.035

Biard, N., Cojean, S., & Jamet, E. (2017). Effects of segmentation and pacing on procedural learning by video. Computers in Human Behavior. https://doi.org/10.1016/j.chb.2017.12.002

Caselli, G., Fernie, B., Canfora, F., Mascolo, C., Ferrari, A., Antonioni, M., Giustina, L., Donato, G., Marcotriggiani, A., Bertani, A., Altieri, A., Pellegrini, E., & Spada, M. M. (2018). The Metacognitions about Gambling Questionnaire: Development and psychometric properties. Psychiatry Research, 261, 367-374. https://doi.org/10.1016/j.psychres.2018.01.018

Cazan, A.-M., & Schiopca, B.-A. (2014). Self-directed Learning, Personality Traits and Academic Achievement. Procedia - Social and Behavioral Sciences, 127, 640-644. https://doi.org/10.1016/j.sbspro.2014.03.327

Chakkaravarthy, K., Ibrahim, N., Mahmud, M., & Venkatasalu, M. R. (2018). Predictors for nurses and midwives' readiness towards self-directed learning: An integrated review. Nurse Education Today, 69, 60-66. https://doi.org/10.1016/j.nedt.2018.06.030

Chen, Y., Wang, Y., Kinshuk, & Chen, N.-S. (2014). Is FLIP enough? Or should we use the FLIPPED model instead? Computers & Education, 79, 16-27. https://doi.org/10.1016/j.compedu.2014.07.004

Cheng, A., & Lee, C. (2018). Factors affecting tertiary English learners' persistence in the self-directed language learning journey. System, 76, 170-182. https://doi.org/10.1016/j.system.2018.06.001

Connor, C. M., Day, S. L., Zargar, E., Wood, T. S., Taylor, K. S., Jones, M. R., & Hwang, J. K. (2019). Building word knowledge, learning strategies, and metacognition with the Word-Knowledge e-Book. Computers & Education, 128, 284-311. https://doi.org/10.1016/j.compedu.2018.09.016

DeLozier, S. J., & Rhodes, M. G. (2017). Flipped classrooms: a review of key ideas and recommendations for practice. Educational Psychology Review, 29(1), 141-151.

Journal of Ecohumanism
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Volume: 3, No: 4, pp. 2476 – 2491
ISSN: 2752-6798 (Print) | ISSN 2752-6801 (Online)
https://ecohumanism.co.uk/joe/ecohumanism
DOI: https://doi.org/10.62754/joe.v3i4.3770

Dodge, B. (2001). FOCUS: Five rules for writing a great WebQuest. Learning and leading with technology, 28(8), 6-9.

Ellis, R. (2009). Task-based language teaching: Sorting out the misunderstandings. International Journal of Applied Linguistics, 19(3), 221-246.

Fahnoe, C., & Mishra, P. (2013). Do 21st century learning environments support self-directed learning? Middle school students' response to an intentionally designed learning environment. Society for Information Technology & Teacher Education International Conference,

Flavell, J. H. (1979). Metacognitive and cognitive monitoring: A new era of psychological inquiry. American psychologist, 34, 906-1111.

Fleming, S. M., & Lau, H. C. (2014). How to measure metacognition. Frontiers in human neuroscience, 8, 443.

Gagné, M., & Deci, E. L. (2005). Self-determination theory and work motivation. Journal of Organizational behavior, 26(4), 331-362.

Georgiou, Y., & Kyza, E. A. (2018). Relations between student motivation, immersion and learning outcomes in location-based augmented reality settings. Computers in Human Behavior, 89, 173-181. https://doi.org/10.1016/j.chb.2018.08.011

Goh, C. F., & Ong, E. T. (2019). Flipped classroom as an effective approach in enhancing student learning of a pharmacy course with a historically low student pass rate. Currents in Pharmacy Teaching and Learning. https://doi.org/10.1016/j.cptl.2019.02.025

Groh, F. (2012). Gamification: State of the art definition and utilization. Institute of Media Informatics Ulm University, 39.

Han, S., Li, X., Yan, L., Liu, Z., & Guan, X. (2018). Game-based hierarchical multi-armed bandit learning algorithm for joint channel and power allocation in underwater acoustic communication networks. Neurocomputing, 289, 166-179. https://doi.org/10.1016/j.neucom.2018.02.003

Henderson, L. M., & Warmington, M. (2017). A sequence learning impairment in dyslexia? It depends on the task. Research in Developmental Disabilities, 60, 198-210. https://doi.org/10.1016/j.ridd.2016.11.002

Ibáñez, M. B., Di Serio, Á., Villarán, D., & Delgado Kloos, C. (2014). Experimenting with electromagnetism using augmented reality: Impact on flow student experience and educational effectiveness. Computers & Education, 71, 1-13. https://doi.org/10.1016/j.compedu.2013.09.004

Jacobs, J. E., & Paris, S. G. (1987). Children's metacognition about reading: Issues in definition, measurement, and instruction. Educational psychologist, 22(3-4), 255-278.

Jossberger, H., Brand-Gruwel, S., Boshuizen, H., & Van de Wiel, M. (2010). The challenge of self-directed and self-regulated learning in vocational education: A theoretical analysis and synthesis of requirements. Journal of vocational education and training, 62(4), 415-440.

Judy Shih, H.-c., & Huang, S.-h. C. (2022). EFL learners' metacognitive development in flipped learning: A comparative study. Interactive Learning Environments, 30(8), 1448-1460.

Kant, J. M., Scheiter, K., & Oschatz, K. (2017). How to sequence video modeling examples and inquiry tasks to foster scientific reasoning. Learning and Instruction, 52, 46-58. https://doi.org/10.1016/j.learninstruc.2017.04.005

Khodaei, S., Hasanvand, S., Gholami, M., Mokhayeri, Y., & Amini, M. (2022). The effect of the online flipped classroom on self-directed learning readiness and metacognitive awareness in nursing students during the COVID-19 pandemic. BMC nursing, 21(1), 1-10.

Kleftodimos, A., & Evangelidis, G. (2016). An interactive video-based learning environment supporting learning analytics: Insights obtained from analyzing learner activity data. In State-of-the-Art and Future Directions of Smart Learning (pp. 471-481). Springer.

Kon, H., Botelho, M. G., Bridges, S., & Leung, K. C. M. (2015). The impact of complete denture making instructional videos on self-directed learning of clinical skills. Journal of Prosthodontic Research, 59(2), 144-151. https://doi.org/10.1016/j.jpor.2015.01.004

Kralik, J. D., Lee, J. H., Rosenbloom, P. S., Jackson, P. C., Epstein, S. L., Romero, O. J., Sanz, R., Larue, O., Schmidtke, H. R., Lee, S. W., & McGreggor, K. (2018). Metacognition for a Common Model of Cognition. Procedia Computer Science, 145, 730-739. https://doi.org/10.1016/j.procs.2018.11.046

Krapp, A. (1999). Interest, motivation and learning: An educational-psychological perspective. European journal of psychology of education, 14(1), 23-40.

Krapp, A. (2005). Basic needs and the development of interest and intrinsic motivational orientations. Learning and Instruction, 15(5), 381-395.

Kugelmann, D., Stratmann, L., Nühlen, N., Bork, F., Hoffmann, S., Samarbarksh, G., Pferschy, A., von der Heide, A. M., Eimannsberger, A., Fallavollita, P., Navab, N., & Waschke, J. (2018). An Augmented Reality magic mirror as additive teaching device for gross anatomy. Annals of Anatomy - Anatomischer Anzeiger, 215, 71-77. https://doi.org/10.1016/j.aanat.2017.09.011

Lindgren, R., Tscholl, M., Wang, S., & Johnson, E. (2016). Enhancing learning and engagement through embodied interaction within a mixed reality simulation. Computers & Education, 95, 174-187.

Lo, C. K., & Hew, K. F. (2017). A critical review of flipped classroom challenges in K-12 education: possible solutions and recommendations for future research. Research and Practice in Technology Enhanced Learning, 12(1), 4.

Lo, C. K., Lie, C. W., & Hew, K. F. (2018). Applying "First Principles of Instruction" as a design theory of the flipped classroom: Findings from a collective study of four secondary school subjects. Computers & Education, 118(Supplement C), 150-165. https://doi.org/10.1016/j.compedu.2017.12.003

Louws, M. L., Meirink, J. A., van Veen, K., & van Driel, J. H. (2017). Teachers' self-directed learning and teaching experience: What, how, and why teachers want to learn. Teaching and Teacher Education, 66, 171-183. https://doi.org/10.1016/j.tate.2017.04.004

Mota, J. M., Ruiz-Rube, I., Dodero, J. M., & Arnedillo-Sánchez, I. (2018). Augmented reality mobile app development for all. Computers & Electrical Engineering, 65, 250-260. https://doi.org/10.1016/j.compeleceng.2017.08.025

Journal of Ecohumanism
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Volume: 3, No: 4, pp. 2476 – 2491
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DOI: https://doi.org/10.62754/joe.v3i4.3770
Najmi, A. H., Alameer, Y. R., & Alhalafawy, W. S. (2024). Exploring the Enablers of IoT in Education: A Qualitative Analysis of Expert Tweets. Journal of Infrastructure, Policy and Development, 8(8).
Najmi, A. H., Alhalafawy, W. S., & Zaki, M. Z. T. (2023). Developing a Sustainable Environment Based on Augmented Reality to Educate Adolescents about the Dangers of Electronic Gaming Addiction. Sustainability, 15(4), 3185. https://doi.org/10.3390/su15043185
Nakamura, J., & Csikszentmihalyi, M. (2009). Flow theory and research. Handbook of positive psychology, 195-206.
Ozturk, N. (2017). Assessing metacognition: Theory and practices. International Journal of Assessment Tools in Education, 4(2), 134-148.
Post, P. G., Aiken, C. A., Laughlin, D. D., & Fairbrother, J. T. (2016). Self-control over combined video feedback and modeling facilitates motor learning. Human Movement Science, 47, 49-59. https://doi.org/10.1016/j.humov.2016.01.014
Rabidoux, S., & Rottmann, A. (2018). Re-envisioning the Archaic Higher Education Learning Environment: Implementation Processes for Flipped Classrooms. International Journal on E-Learning, 17(1), 85-93.
Rahnev, D. (2021). Visual metacognition: Measures, models, and neural correlates. American psychologist, 76(9), 1445.
Rashid, T., & Asghar, H. M. (2016). Technology use, self-directed learning, student engagement and academic performance: Examining the interrelations. Computers in Human Behavior, 63, 604-612. https://doi.org/10.1016/j.chb.2016.05.084
Rauschnabel, P. A., Rossmann, A., & tom Dieck, M. C. (2017). An adoption framework for mobile augmented reality games: The case of Pokémon Go. Computers in Human Behavior, 76, 276-286. https://doi.org/10.1016/j.chb.2017.07.030
Riegeluth, C. (1999). The elaboration theory: guidance for scope and sequence decisions. Instructional Design Models: Am Overview of their current status, 2, 425-453.
Ryan, R. M., & Deci, E. L. (2000). Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. American psychologist, 55(1), 68.
Saleem, R. Y., Zaki, M. Z., & Alhalafawy, W. S. (2024). Improving awareness of foreign domestic workers during the COVID-19 pandemic using infographics: An experience during the crisis. Journal of Infrastructure, Policy and Development, 8(5). https://doi.org/10.24294/jipd.v8i5.4157
Sampaio, D., & Almeida, P. (2016). Pedagogical Strategies for the Integration of Augmented Reality in ICT Teaching and Learning Processes. Procedia Computer Science, 100, 894-899. https://doi.org/10.1016/j.procs.2016.09.240
San Anton, E., Cleeremans, A., Destrebecqz, A., Peigneux, P., & Schmitz, R. (2018). Spontaneous eyeblinks are sensitive to sequential learning. Neuropsychologia, 119, 489-500.
Sart, G. (2014). The Effects of the Development of Metacognition on Project-based Learning. Procedia - Social and Behavioral Sciences, 152, 131-136. https://doi.org/10.1016/j.sbspro.2014.09.169
Schraw, G., & Dennison, R. S. (1994). Assessing Metacognitive Awareness. Contemporary Educational Psychology, 19(4), 460-475. https://doi.org/10.1006/ceps.1994.1033
Shelton, C. C., Warren, A. E., & Archambault, L. M. (2016). Exploring the use of interactive digital storytelling video: Promoting student engagement and learning in a university hybrid course. TechTrends, 60(5), 465-474.
Sweller, J., Van Merrienboer, J. J., & Paas, F. G. (1998). Cognitive architecture and instructional design. Educational Psychology Review, 10(3), 251-296.
Takaya, K. (2008). Jerome Bruner's theory of education: From early Bruner to later Bruner. Interchange, 39(1), 1-19.
Toraman, Ç., Orakci, S., & Aktan, O. (2020). Analysis of the relationships between mathematics achievement, reflective thinking of problem solving and metacognitive Awareness. International Journal of Progressive Education, 16(2), 72-90.
Tsai, Y.-h., Lin, C.-h., Hong, J.-c., & Tai, K.-h. (2018). The effects of metacognition on online learning interest and continuance to learn with MOOCs. Computers & Education, 121, 18-29. https://doi.org/10.1016/j.compedu.2018.02.011
Van Vliet, E. A., Winnips, J. C., & Brouwer, N. (2015). Flipped-class pedagogy enhances student metacognition and collaborative-learning strategies in higher education but effect does not persist. CBE—Life Sciences Education, 14(3), ar26.
Wang, Y.-H. (2017). Exploring the effectiveness of integrating augmented reality-based materials to support writing activities. Computers & Education, 113, 162-176. https://doi.org/10.1016/j.compedu.2017.04.013
Yasmin, M., & Sohail, A. (2017). Realizing learner autonomy in Pakistan: EFL Teachers' beliefs about their practices. International Journal of English Linguistics, 8, 153-162.
Yilmaz, R. M., & Baydas, O. (2017). An examination of undergraduates' metacognitive strategies in pre-class asynchronous activity in a flipped classroom. Educational Technology Research and Development, 65, 1547-1567.
Zeidan, A. A., Alhalafawy, W. S., & Tawfiq, M. Z. (2017). The Effect of (Macro/Micro) Wiki Content Organization on Developing Metacognition Skills. Life Science Journal, 14(12).
Zeidan, A. A., Alhalafawy, W. S., Tawfiq, M. Z., & Abdelhameed, W. R. (2015). The effectiveness of some e-blogging patterns on developing the informational awareness for the educational technology innovations and the King Abdul-Aziz University postgraduate students' attitudes towards it. Life Science Journal, 12(12).