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The effect of self-regulated learning in higher education with online project-based collaborative learning models

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Abstract: This study investigates the effect of implementing an online project-based collaborative learning model on students' self-regulated learning in higher education, particularly in media development courses. Using a quantitative approach with a one-group pretest–posttest design, data were collected from 34 undergraduate students selected randomly from three different majors. A self-regulated learning questionnaire was administered before and after the intervention over one semester. The findings revealed a significant improvement in students' self-regulated learning following the application of the model (Sig. = 0.000 < 0.05), with mean scores increasing from 58.94 (pretest) to 73.74 (posttest). These results indicate that online project-based collaborative learning fosters critical components of self-regulation, such as goal setting, monitoring, strategy use, and reflection. The study highlights the potential of integrating project-based and collaborative online approaches to enhance independent learning, communication, and problem-solving skills in digital learning environments. Further research is recommended to explore the model's effectiveness across various educational levels and disciplines and its integration with other instructional strategies to optimize learning outcomes.

Keywords: *Online learning, Online project collaborative learning, Project-based learning, Self-regulated learning, Video media development.*

1. Introduction

With everything connected and technologically sophisticated in the twenty-first century, higher education faces challenges. Students must acquire relevant and in-depth material in order to increase their abilities, flexibility, and adaptability to be prepared for the rapidly changing workplace of the future [1]. The ability to work collaboratively is one of the traits of 21st-century learning. Working together is called collaboration. In educational practice, collaborative learning requires students to cooperate with their peers in small groups or pairs to accomplish common learning objectives rather than learning alone [2]. Interactive pairs or small groups are specifically intended to be used for collaborative learning. When it comes to helping students critically sift and make sense of the deluge of information we are currently confronted with, these lectures are not particularly helpful [3].

Through the completion of worthwhile assignments and the creation of beneficial products, project-based learning, an inquiry-based teaching methodology, engages students in the production of knowledge [4]. Based on the constructivist learning theory, students actively build their understanding by working on pertinent real-world problems. Learning is context-specific, and they accomplish their objectives by interacting with others and exchanging information [5]. The project-based learning strategy involves providing children with real-world, contextualized challenges to solve [6, 7]. This assignment-giving technique can be characterized as a teaching strategy in which instructors train students to support active learning in both individual and group settings [8]. Under the project-based learning paradigm, students work on projects that require applying concepts and methods they have learned [9]. Students must develop, solve difficulties, make judgments, perform investigative activities,

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and provide opportunities for individual work in order to complete complex projects based on extremely difficult questions and challenges [10]. Students gain an understanding of the procedure's theory as well as its practical application in a relevant setting through this experience [11, 12]. Project-based learning is becoming increasingly popular since it not only provides students with an engaging educational experience but also enhances their motivation to learn [13].

In online learning, self-regulation skills mastery is also essential [14]. The ability of students to use self-directed learning techniques to control their own learning progress is known as self-regulation. Effort management, critical thinking, peer learning, task value beliefs, and help-seeking techniques are some examples of self-learning techniques [15]. Furthermore, the focus on (a) sets the self-regulated learning theory of academic accomplishment apart from other learning and teaching approaches. It emphasizes how pupils choose, arrange, or construct a conducive learning environment for themselves, and (b) how they schedule and manage the quantity of their own education [16]. Students are individuals who aim to address learning challenges by engaging with learning products, as they will ultimately be responsible for both teaching and facilitating learning. One of these advantages is a result of learning mediation. This is particularly relevant for students enrolled in educational technology coursework. The demands on students studying educational technology are constantly evolving, and their performance is affected accordingly.

It takes specialized knowledge for a teacher to package learning models like the online project collaborative learning model, which employs internet technology to allow students to collaborate on a planned project. Project-based learning and online collaborative learning are combined to create the online project collaborative learning approach [17]. With the exception of group sessions conducted synchronously or asynchronously over the internet, online collaboration is a virtual counterpart of traditional in-class collaborative learning [18]. Despite the time and place constraints, this method allows students to communicate with one another [19]. Online collaborative learning fosters community building and student interaction, which enhances student learning, their capacity to adjust to various educational philosophies, and their motivation and contentment [20]. Online collaborative learning should be viewed as a comprehensive approach to education that fosters ongoing knowledge acquisition, not just a single activity [21]. One online learning model that emphasizes communication and teamwork to improve learning is online collaborative learning [22]. Similar to in-person collaborative learning, online collaborative learning is a popular method of teaching and studying in distance education [23]. However, group meetings are conducted either synchronously or asynchronously over the internet [24]. Online collaborative learning's implementation point centers on cooperative communication and knowledge development via the internet, guiding students to collaborate in identifying and enhancing their understanding, then putting it into practice to solve problems and execute their developed plans [25]. Project-based learning will help students learn collaboratively and further develop their self-regulation abilities.

Through the given online platform, they can collaborate to finish work, share ideas, and update each other on project progress [26]. Under this paradigm, students collaborate in groups to complete a pre-established assignment while exchanging information and communicating via the internet [27]. Because this model enables students to actively use a variety of online resources, it necessitates self-regulated learning in addition to the development of strong collaboration and communication skills. Additionally, self-regulated learning, also known as "self-directed learning," occurs when knowledge-building techniques are shared [16]. An essential conceptual framework for comprehending the emotional, motivational, and cognitive facets of learning is self-regulated learning (SRL) [28]. Since the earliest publications in which researchers started to differentiate between SRL and metacognition, SRL has significantly influenced educational psychology [29]. Self-regulation is a mindset and process where people concentrate on achieving their objectives, including managing their emotions and thoughts, and being proactive and introspective about their self-monitoring [30]. Students' capacity and inclination to be "active participants in their own learning" are key components of self-regulated learning [31]. The term "self-regulated learning" describes self-generated ideas, emotions, and behaviors that are

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connected to reaching particular learning objectives, such as evaluating a reading assignment, preparing for a test, or producing a paper.

The importance of certain self-regulation activities for college students' learning and achievement has been demonstrated by researchers. Self-regulated learning is the process by which individuals learn interactively, manage, and evaluate their actions [32]. Regarding the issues that arise, the online project collaborative learning model should be used to help students become more self-reliant, particularly in courses on video and television media development. Additionally, it will create students who can work together, seek out and use information, and learn independently, creatively, and ethically.

2. Methods

Experimental research, which is experimental research carried out on a single group, known as the experimental group, without a comparison or control group, is the form of research employed in this study. The methodology is a quantitative technique with a one-group pretest-posttest design, which is an experimental design where just one randomly chosen group is given the beginning test (pretest) and the end test (posttest). Pre-tests given prior to treatment and post-tests given following treatment are used to measure this one-group pre-test post-test research design.

Table 1.
One Group Pre-test Post-test Design.

Pre-Test	Treatment	Post-Test
Class	X	Class

Tests (pretest-posttest) and observation were the methods used to collect data. Planning and goal-setting, self-evaluation and monitoring, strategy implementation and monitoring, outcome monitoring, and strategy refinement are indicators of self-regulated learning that the researcher modified to create the test instrument. The SPSS program was used to analyze the study data. A questionnaire was employed as the data-gathering method to gauge children's motivation for learning. The questionnaire instrument included items such as desire to succeed, support and requirements for learning, aspirations for future objectives, appreciation for learning, engaging learning activities, and a favorable learning environment. Data analysis methods included the use of Levene's Statistic test for homogeneity, the Kolmogorov-Smirnov test for normality, and the Paired Sample T-test for hypothesis testing.

Table 2.
Self-Regulated Learning Instrument Validity Results.

No.	r Count	r Table	Description	No	r Count	r Table	Description
1	0.564	0.359	Valid	11.	0.719	0.359	Valid
2	0.468	0.359	Valid	12.	0.544	0.359	Valid
3	0.617	0.359	Valid	13.	0.508	0.359	Valid
4	0.621	0.359	Valid	14.	0.722	0.359	Valid
5	0.621	0.359	Valid	15.	0.660	0.359	Valid
6	0.594	0.359	Valid	16.	0.660	0.359	Valid
7	0.483	0.359	Valid	17.	0.634	0.359	Valid
8	0.496	0.359	Valid	18.	0.634	0.359	Valid
9	0.565	0.359	Valid	19.	0.598	0.359	Valid
10	0.719	0.359	Valid	20.	0.598	0.359	Valid

3. Results

3.1. The Results of the Validity and Reliability Test of the Self-Regulated Learning Test Instrument

The researcher conducted validity and reliability testing by summarizing the findings of the self-regulated learning instrument's validity test from 34 individuals (N) who answered the questionnaire at the 5% significance level. The data was then tallied and examined using SPSS and Pearson's product-

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moment validity test. The table below displays the findings of the writing concept knowledge instrument's validity test:

The validity test yielded r (table) = 0.359 based on the number of respondents, which was 34 students from the class of 2023 who had taken video/television media development courses, with df = N-2, i.e., df = 34-2 = 32, using a significance level of 5% (α = 0.05). The rule states that an item is considered valid if r (count) > r (table), and invalid if r (count) < r (table). Therefore, all 20 items that were assessed for validity are deemed valid based on Table 2.

Table 3.
Reliability Results of the Self-Regulated Learning Instrument.

Reliability Statistics	
Cronbach's Alpha	**Number of Items**
0.905	20

Table 3 shows that the self-regulated learning instrument has a Cronbach's alpha value of 0.905, which is above 0.6, indicating that the instrument is reliable and can be used to measure self-regulated learning.

3.2. Descriptive Statistical Results of Pre-test and Post-test Mean Score Test of Self-regulated learning Data and t Test results

Table 4.
Descriptive Statistical Results of Pre-test and Post-test Mean Score Test of Self-regulated Learning Data and t-Test Results

Paired Samples Statistics					
		Mean	**N**	**Std. Deviation**	**Std. Error Mean**
Pair 1	Pre-test SLR	58.94	34	8.068	1.384
	Post-test SLR	73.74	34	4.895	0.839

Table 5.
Pre-test and Post-test t-test of Self-Regulated Learning.

Paired samples test									
		Paired differences							
					95% confidence interval of the difference				
		Mean	**Std. deviation**	**Std. error mean**	**Lower**	**Upper**	**t**	**df**	**Sig. (2-tailed)**
Pair 1	Pre-test SLR - Post-test SLR	-14.794	5.709	0.979	-16.786	-12.802	-15.110	33	0.000

Given that the mean score for the pre-test was 58.94 and the mean score for the post-test was 73.74, as determined by the mean calculation in Table 5, the t-test calculation yielded a sig value <0.05 (0.00<0.05). Since online project collaborative learning is the only factor that makes a difference in the learning process, the treatment is what causes the difference between the pre-test and post-test outcomes. Analysis of the pre-test and post-test data indicates that online project collaborative learning can improve self-regulated learning in the execution of video/TV media development courses in the UPR S-1 Educational Technology degree program. This reasoning leads to the conclusion that self-regulated learning can be effectively enhanced by the online project collaborative learning paradigm..

4. Discussion

In accordance with the problem formulation in Chapter I, the researcher will evaluate the effectiveness of the learning model in enhancing students' self-regulated learning during the odd semester of 2024/2025 in the video/TV media development course. This assessment considers various theories and prior research findings. A learning management system is employed to facilitate the

implementation of this online project-based collaborative learning paradigm. There are two types of online learning environments: synchronous and asynchronous. Interactions within a virtual classroom are asynchronous, meaning they do not occur in real time. The study utilizes the online project collaborative learning paradigm in the final group. The paired-samples t-test was conducted using SPSS software, and decisions were based on the analysis results. If the computed significance value (p-value) is less than 0.05, the online project collaborative learning model is considered effective in improving students' self-regulated learning. Conversely, if the p-value exceeds 0.05, the paradigm is deemed ineffective in enhancing self-regulated learning among students.

The positive effects of project-based learning and collaborative learning models are inextricably linked to the efficacy of online project-based collaborative learning models. Other research findings also highlight their advantages, which include promoting individual communication, critical thinking, problem-solving, creativity, invention, information and media literacy, collaboration, teamwork, and leadership skills [33]. PjBL allows students to collaborate across disciplines. PjBL unites students from various backgrounds, enabling them to work together, exchange viewpoints, and hone their collaboration and communication abilities [34]. Other advantages include teaching students to think more broadly about issues in life that need to be accepted; giving them hands-on practice and familiarity with critical thinking and practical skills; and assisting them in adapting to contemporary principles whose application requires developing students' abilities through theory, practice, and application [35]. Because early childhood abilities differ from those of older levels, children acquire the ability to work effectively in diverse teams and gain a deeper understanding of a wealth of information through this collaboration. These skills are crucial in today's interconnected world, even if they are small. PjBL gives students the freedom to learn by combining different scientific disciplines for investigation. Since there are fewer strict guidelines than in traditional learning, students should be more inclined to use project activities to explore who they are [36].

The benefits of PjBL are among the instructional strategies used to improve conceptual comprehension [37, 38]. Since PjBL is a method of instruction that links academic material with real-world situations in line with 21st-century expectations, it can engage students in the planning of their education and spark their interest in solving problems and making decisions. PjBL involves students answering real-world questions or solving issues through an inquiry-based learning method, which fosters their creativity and critical thinking while also motivating them to collaborate as a team [39, 40]. PjBL can also foster an atmosphere that supports students' acquisition of meaningful knowledge, active participation in student-centered learning, collaboration, and problem-solving using pertinent knowledge and abilities [41].

PjBL can encourage the development of higher cognitive capacities and offers a range of performance evaluation techniques [42-44]. That PjBL can boost students' enthusiasm for studying science, enhance their ability to solve problems, and raise their academic performance [45]. The outcomes and attitudes of the visual arts lessons were positively and significantly impacted by the project-based learning approach [46]. Collaboration is the cornerstone of this approach, which enhances students' social and communication skills while simulating the complexities of teamwork in the real world. The reflection exercises included in this method encourage a growth mindset and allow teachers and students to assess and improve their learning processes [47, 48].

Because the learning process is integrated with the internet, online collaborative learning offers numerous benefits. Since each group member is responsible for their part and there is positive interdependence, online collaborative learning can enhance active contact with other group members. Students also perform better and are more engaged in small groups [49]. Students' perspectives on online collaborative learning, the resources utilized to facilitate it, and the instructor's capacity to adapt to students' requirements throughout learning exercises [50]. The potential for online collaborative learning to enhance education is enormous. It not only allows everyone to speak equally, but it also showcases the writings and contributions of the students [51]. Highlighted three benefits of online collaborative work: 1) the capacity to access peers' knowledge; 2) the availability of other students to

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offer comments; and 3) the chance to consider the messages shared [52]. Online collaborative learning acknowledges that information is constructed to fit reality and that online socialization, interaction, and cooperation impact learning and cognitive processes [53].

5. Conclusions

This study demonstrates how an online project-based collaborative learning strategy can enhance self-regulated learning. By employing an online project-based collaborative learning model, students learn video production techniques and develop valuable collaborative skills. The study also provides opportunities to explore the application of innovative teaching techniques across various contexts.

Transparency:

The authors confirm that the manuscript is an honest, accurate, and transparent account of the study; that no vital features of the study have been omitted; and that any discrepancies from the study as planned have been explained. This study followed all ethical practices during writing.

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