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Critical Thinking and Cognitive Engagement in Social Sciences: A Collaborative Experiential Model within a Seamless Learning Ecosystem

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ABSTRACT

Students' low thinking ability impacts their interpretation, analysis, and integration of new information. The 2018 international student assessment program indicates Indonesian students are at a minimum literacy level, ranking at PISA level 2. This study employs a combination of the Collaborative Experiential Model and the Seamless Learning Ecosystem model to enhance learning effectiveness and efficiency, leveraging technology to improve student abilities. An experimental method was used, incorporating face-to-face and online learning modalities. The analysis revealed significant validity ($p \le 0.05$) across 24 question items, with Cronbach's alpha values of 0.781 and 0.762, indicating high reliability. Both pre-test and post-test activities utilized these valid and reliable questions. Homogeneity tests showed significance values of 0.869 and 0.757 for cognitive participation and critical thinking variables, respectively. Consequently, the seamless learning ecosystem model demonstrably enhances critical thinking skills and learning outcomes.

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1. INTRODUCTION

The 2018 Programme for International Student Assessment (PISA) results demonstrate that Indonesian students predominantly fall within the minimum proficiency level (Level 2) in literacy, suggesting a fundamental deficiency in their overall competence (Fahlevi, 2021). This condition reflects their limited capacity in advanced cognitive functions, as manifested by difficulties in interpreting, analyzing, and integrating new information with prior knowledge (Paul & Elder, 2019). The observed low cognitive abilities among Indonesian students significantly impede their understanding of complex concepts, thereby restricting their analytical skills and the integration of new information with their existing knowledge base. Thus, addressing these educational challenges is imperative to enhance students' cognitive skills and promote a more effective learning environment. Critical thinking, a vital skill for problem-solving and decision-making, is essential for individuals to navigate and address life's various challenges and problems effectively (Kaleiloglu & Gulbahar, 2014). It involves the careful analysis of encountered arguments and issues, the identification of relevant evidence and optimal solutions, and the formulation of actions based on reasoned conclusions (Alsaleh, 2020). Encouraging active knowledge acquisition in the learning process can stimulate the development of critical thinking abilities (Renatovna, 2019), with education models that necessitate critical thinking skills yielding differentiated knowledge levels and reflective learning outcomes among students.

Improving students' critical thinking skills and learning outcomes can be achieved through the integration of media with suitable educational methods (Dilger et al., 2019). Experiential Learning, a model fostering creativity and engaging active learning, is particularly effective in this regard. As a cooperative learning approach, Experiential Learning encourages students to engage in information acquisition through direct experience actively. This model prioritizes a learning process that transcends passive information reception, demanding mental engagement, deep thinking, and active participation from the learners (Nurhasanah, 2017).

Integrating the Collaborative Experiential Model and the Seamless Learning Ecosystem model aligns with previous research findings that underscore the efficacy of experiential learning in cultivating practical skills and values (Clark et al., 2010). This approach resonates with the work of Boud et al. (1993), who identified experiential learning as a pivotal element in the foundation and stimulation of learning. Moreover, the emphasis on the totality of the human learning process, incorporating feeling, reflecting, thinking, and doing, reinforces the centrality of experience in learning (Clark et al., 2010).

While existing studies highlight the potential benefits of experiential learning models, a significant gap still needs to be addressed in addressing the integration of these models with the evolving Seamless Learning Ecosystem. The Seamless Learning Ecosystem leverages technology to provide a continuous and flexible learning experience, allowing students to engage with educational content anytime and anywhere (Chen et al., 2015). The gap lies in exploring how the Collaborative Experiential Model can be seamlessly integrated into this digital learning environment, creating a synergy that optimizes the effectiveness and efficiency of learning while catering to the contemporary needs of students.

This study centers on the research question: How does integrating the Collaborative Experiential Model with the Seamless Learning Ecosystem improve learning effectiveness and efficiency against the backdrop of advancing technology? This question underpins the investigation into the potential synergies between experiential learning and digital technologies, striving to address the gap identified in existing literature.

2. METHODS

The research followed an experimental design to investigate cause-and-effect relationships. Notably, there was no control group in this study, and the sampling method employed was nonprobability sampling using the saturated sample technique. The study involved high school students from SMP Kristen Larat, totalling 60 children, and the research procedure included both face-to-face and online learning models. To conduct the research, the G-Classroom platform was utilized for online learning, serving as a supplementary tool to face-to-face instruction. This platform was specifically chosen to provide preliminary knowledge before the face-to-face learning sessions. Additionally, observation sheets were employed to systematically record and analyze the learning process during online and face-to-face sessions. The assessment questionnaire served as a key data collection instrument, facilitating the evaluation of students' responses and perceptions.The data collection technique involved using assessment questionnaires and observation sheets to capture both qualitative and quantitative aspects of the learning process. The assessment questionnaire was administered to gather insights into students' understanding, while the observation sheets facilitated the systematic recording of behaviors, interactions, and engagement levels during both online and face-to-face learning.

Data analysis was conducted using a combination of qualitative and quantitative methods. Qualitative analysis focused on the observations made during the learning sessions, evaluating aspects such as student engagement, participation, and interaction. The quantitative analysis involved processing the data collected through the assessment questionnaires, utilizing statistical methods to derive meaningful insights into the effectiveness of the experimental approach. The absence of a control group was considered in the interpretation of results, acknowledging the limitations of the study design in establishing causal relationships. This research was conducted during five meetings. The categories of hybrid learning achievement in this study are grouped in the table below.

Table 1. Category of hybrid learning achievement

No	Criteria	Level of learning achievement
1	80% - 100%	Excellent
2	60% - 79%	Good
3	50% - 59%	Deficient
4	< 50%	Bad

2.1 Instrument Test

2.1.1 Instrument Validity Test

Before conducting the Hypothesis Test, the questionnaire underwent a validity and reliability assessment using the SPSS (Statistical Package for the Social Sciences) software. In this study, the validity was determined through the product-moment criterion in SPSS, which involves comparing the calculated item-total correlations (r-value) against the critical r-value at a 5% significance level (Ghozali, 2006). The criteria for validity are as follows:

a. Valid: when the calculated r-value is greater than the critical r-value.
b. Invalid: when the calculated r-value is less than the critical r-value.

2.2.2 Instrument Reliability Test

Reliability tests are carried out to determine whether a measuring instrument designed as a questionnaire is reliable. A measuring instrument is reliable if the measuring instrument is used repeatedly and will give relatively the same results (not much different). The Reliability Test in this study used the Cronbach Alpha formula at a significance level of 5% based on the following criteria:

a. Reliable: When the score of r_{11} > r tabel
b. Not Reliable: When the score of r_{11}< r tabel

2.2.3 Test of Classical Assumption

Classical assumption tests were performed to qualify for linear regression analysis. The classical assumption test in this study includes a normality test and a homogeneity test. According to Ghozali (2003), the normality test aims to test whether the disruptive or residual variables have a normal distribution in regression models. Statistical detection of normality is by using the Kolmogorov-Smirnov test. The Kolmogorov-Smirnov test was carried out with a significant rate of 0.05. Data is declared normally distributed if it has a Significance value of > 0.05.

2.2 Homogeneity Test

Homogeneity tests show that two or more groups of sample data are from populations that share the same variations. This univariate homogeneity test used *Levene's* experiment. *Homogeneity* testing criteria are as follows:

a. The data is homogeneous if the significance value (Sig) > 0.05.
b. If the significance value (Sig) < 0.05, then the data is not homogeneous.

2.3 Hypothesis Test

After verifying homogeneity and normality, the next step involves conducting a hypothesis test using two-way ANOVA (Analysis of Variance), a parametric statistical method. This factorial analysis, often referred to as two-way ANOVA, assesses the differences between group data from two or more independent variables. In this study, the hypothesis test aims to evaluate the impact of the Collaborative Experiential Model in Seamless Learning on students' critical thinking skills and cognitive engagement. The criteria for the hypothesis testing are as follows:

a. If the significance value (Sig) is less than 0.05, a significant difference exists between the pretest and posttest scores, indicating the effect of the intervention.
b. If the significance value (Sig) exceeds 0.05, no significant difference is observed between the pretest and posttest scores, suggesting the intervention did not have a measurable impact.

3. FINDINGS AND DISCUSSION

3.1 Instrument test results

The validity test is used as a gauge of whether the question can be said to be valid or not. The question is declared valid if the correlation value of Pearson's product moment is at least 0.66 with a significance level of ≤ 0.05 (Sugiyono, 2017).

Table 2. Instrument test result

Indicator		R counts	R table	Information
Critical Thinking	CT.1	0.556	0.250	Valid
	CT.2	0.593	0.250	Valid
	CT.3	0.563	0.250	Valid
	CT.4	0.508	0.250	Valid
	CT.5	0.470	0.250	Valid
	CT.6	0.553	0.250	Valid
	CT.7	0.533	0.250	Valid
	CT.8	0.484	0.250	Valid
	CT.9	0.675	0.250	Valid
	CT.10	0.651	0.250	Valid
	CT.11	0.531	0.250	Valid
	CT 12	0.699	0.250	Valid
Student Cognitive Participation	SCP.1	0.639	0.250	Valid
	SCP.2	0.578	0.250	Valid
	SCP.3	0.441	0.250	Valid
	SCP.4	0.655	0.250	Valid
	SCP.5	0.606	0.250	Valid
	SCP.6	0.590	0.250	Valid
	SCP.7	0.559	0.250	Valid
	SCP.8	0.675	0.250	Valid
	SCP.9	0.646	0.250	Valid
	SCP.10	0.629	0.250	Valid
	SCP.11	0.533	0.250	Valid
	SCP.12	0.534	0.250	Valid

The analysis showed that the *product moment person correlation* value of the 24 question items had a significance level of ≤ 0.05 and was declared valid. This result means that the question item has a strong level of validity.

Table 3. Product moment person correlation value

Variable	Cronbach's Alpha	N of Item	Information
Critical Thinking	0.781	12	Reliable
Student Cognitive Participation	0.762	12	Reliable

Based on the results of the data analysis, the Cronbach alpha values were obtained at 0.781 and 0.762, which means that the question item has a very strong level of reliability (p>0.6). The valid and reliable question items can be used in pre-test and post-test activities.

3.2 Test of Analysis Requirements

Table 4. The result of the test of analysis requirements

One-Sample Kolmogorov-Smirnov Test		
		Unstandardized Residual
N		60
Normal Parameters[a,b]	Mean	.0000000
	Std. Deviation	3.05037406
Most Extreme Differences	Absolute	.121
	Positive	.121
	Negative	-.061
Test Statistic		.121
Asymp. Sig. (2-tailed)		.155[c]
a. Test distribution is Normal.		
b. Calculated from data.		
c. Lilliefors Significance Correction.		

Based on the test results, the data were found to be normally distributed, evidenced by a significance (sig) score greater than 0.05. Subsequently, a homogeneity test will be conducted to assess if the variances across the data sets are equal. The data are considered homogeneous, with no significant difference in variance, if the significance level is 0.05 or higher. Conversely, if the significance level is less than 0.05, the data are deemed not homogeneous, indicating a difference in variance among the groups.

Table 5. Homogeneity test

No	**Variable**	**Levene Statistic**	**Sig.**	**Explanation**
1	Cognitive participation	0.869	0.141	Homogeneous
2	Critical thinking	0.757	0.152	Homogenous

The homogeneity test results revealed significance values of 0.869 for the Cognitive Participation variable and 0.757 for the Critical Thinking variable. Since these values are greater than the significance level of 0.05, it indicates that the data exhibit homogeneity, meaning there is no significant difference in variance across groups. Consequently, data analysis will proceed with the Independent Sample T-test.

3.3 Hypothesis Test

Table 6. Hypothesis Test

No	**Variable**	**t-statistic**	**T tabel**	**Sig.**	**Explanation**
1	Cognitive participation	1.786	0.167	0.000	Significant
2	Critical thinking	2.028	0.167	0.000	Significant

Based on the calculations' results, the value of the sig is known. Obtained from both variables <0.05, it can be concluded that there is a significant difference between the pretest-posttest in critical thinking ability and student cognitive participation.

Discussion

The findings demonstrate the positive effects of the seamless learning ecosystem on students' critical and cognitive thinking abilities, corroborating previous research that highlights the efficacy of digital learning environments in improving educational outcomes (Looi et al., 2009). The results are consistent with studies that praise the flexibility and adaptability of seamless learning, enabling students to interact with educational content on their own terms and across various settings (Chen et al., 2015). This adaptability is essential for accommodating diverse learning styles and preferences, thereby fostering active engagement, productivity, creativity, and collaboration among students (Looi et al., 2009).

The enhancement in critical and cognitive thinking skills is likely due to the seamless learning environment's provision of varied scenarios for active and engaged learning. This outcome is in line with experiential learning theory, which advocates for student exploration, reflection, and application of knowledge in practical situations (Dewey, 2018). Particularly in social studies, especially history, seamless learning has proven effective in promoting student interaction and cooperation, as supported by observational and questionnaire data. These results suggest practical applications for educational practice, where educators might utilize seamless learning ecosystems to devise dynamic, interactive lessons in social studies. By integrating diverse scenarios and promoting active engagement, teachers can facilitate a deeper comprehension of historical subjects and enhance critical thinking among students. Moreover, the focus on student interaction supports collaborative learning theories, suggesting that engaging in meaningful discussions and collective content exploration can improve learning outcomes (Bruffee, 2019). In summary, the successful implementation of the seamless learning model in social studies highlights its value as an educational resource. These insights emphasize the importance of adopting seamless learning strategies to develop critical thinking abilities and establish stimulating, student-centered learning environments as part of ongoing efforts to integrate technology into education.

Table 7. Collaborative Experiential Learning Process for Enhancing Digital Entrepreneurship

Syntax Collaborative Experiential Learning Process	**Meeting**					**Score**	**Maximal Score**
	1 (Offline)	2 Online	3 (Offline)	4	5		
Stimulation occurs when students actively engage in seeking pertinent material for their project or assignment through interaction, sharing experiences, trading ideas, and cooperating within their teams. This method enhances pupils' motivation for learning.	8	7	7	8	9	39	50
Exploration involves students investigating and discovering concepts related to their project through collaborative work with a specific purpose.	8	8	8	9	9	42	50
Knowledge sharing occurs when group members have positive learning experiences by exchanging knowledge and experience within their teams.	8	7	8	7	8	38	50
Adaptation: Students make changes, modifications, additions to ideas or concepts, and share information to conform with the collaborative plans.	6	7	8	8	9	38	50
Students from each group will present the concepts, plans, and processes to other groups and engage in exchanging ideas and perspectives.	8	8	8	9	9	42	50
						199	250
Percentage						79% (Good)	

The table above shows an analysis with a total score of 199 with a maximum score of 250. Thus, the learning implementation received 79%, placing it in the GOOD category. The number indicates that implementing a seamless learning ecosystem in social studies was successful. The pre-test and post-test results reveal that students' critical and cognitive thinking skills have significantly improved.

Compared to the pre-test results, which were initially low, the post-test received a fairly high score after given action in the form of a seamless learning ecosystem. During the descriptive test, the average scores of students' critical thinking ability were higher in post-test work than in pre-test work.

Table 8. Scores of students' critical thinking ability

No	Variable	Pre-test			Posttest			Sig.	Explanation
		Lowest Value	Highest Value	Average	Lowest Value	Highest Value	Average		
1	Cognitive participation	72	82	74,8	76	88	84,2	0.00	Significant
2	Critical thinking	65	87	76,5	78	92	89,4	0.00	Significant

The collaborative, experiential model within the seamless learning ecosystem showcases an integrated educational approach that emphasizes interactive, project-based, and experiential learning activities. This approach, where students collaborate, share experiences, and engage in group projects, adheres to the tenets of collaboration (Bruffee, 2019) and experiential learning, creating a vibrant and immersive learning environment. The increase in student enthusiasm for learning aligns with research indicating that collaborative and experiential settings boost student motivation. The social interaction inherent in collaborative learning fosters a supportive atmosphere that enhances intrinsic motivation (Johnson & Johnson, 2019). Moreover, the iterative cycle of refining ideas and exchanging feedback within groups epitomizes experiential learning's dynamic essence, wherein learners actively construct their understanding through ongoing interaction.

The integration of this model into the seamless learning ecosystem significantly enhances student cognitive engagement and critical thinking, as evidenced by the notable differences in pre-test and post-test scores. This aligns with studies underscoring experiential learning's positive influence on critical thinking abilities. Educators are encouraged to adopt collaborative, experiential models within seamless learning frameworks to boost engagement and critical thinking across various disciplines, reflecting the need for interactive and fluid learning experiences in today's educational landscape (Chen et al., 2015). Such practices are especially pertinent in social sciences, where critical thinking and contextual analysis are essential (Facione, 2011).

Moreover, this model highlights the need to merge abstract and practical learning experiences, advocating for an educational approach that marries theoretical knowledge with active, collaborative projects (Dewey, 1938). This balanced approach can lead to comprehensive student learning outcomes. The collaborative, experiential model, facilitated by a seamless learning ecosystem, emerges as an effective strategy for augmenting student cognitive engagement and critical thinking. As educational innovations continue to evolve, this model proves promising for fostering dynamic, engaging, and effective learning environments, particularly in social sciences. Echoing Kolb (2014), the construction of knowledge through experiential 'learning by doing' is crucial for student education. Similarly, Majid et al. (2013) highlighted that collaborative learning involves group members working together towards common goals, and constructing knowledge through interaction.

This consensus among experts underscores the intertwined roles of learning management and assessment in educational institutions, with Desai et al. (2018) linking collaborative experiential learning processes to academic progress and student success. Liu et al. (2019) posited that students engaged in systematic, continuous experiential learning can effectively assimilate and apply knowledge in real-world settings. The educational journey of students is marked by knowledge construction through reflection and comprehension. This study compared groups engaged in project-based learning with those taught through traditional methods, revealing significant differences in quiz scores and indicating that experiential learning enhances creativity, problem-solving, leadership, teamwork, and communication skills.

4. CONCLUSION

In conclusion, the research presents compelling evidence that the implementation of a seamless learning ecosystem markedly improves students' critical thinking skills and academic performance. The findings underscore the necessity for careful selection and organization of educational tools and materials to ensure the efficacy of this learning model. The data, highlighted by an evaluative comparison of pre-test and post-test scores, clearly shows a significant enhancement in critical thinking abilities among students, confirming the model's effectiveness. This study advocates for the wider adoption of seamless learning environments, suggesting that such an approach can lead to substantial educational advancements and better prepare students for future challenges.

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