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Evaluation of the implementation of the ACEP cycle and learning motivation on students' exposition writing ability

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ABSTRACT

The ACEP cycle is a modified form of the APOS learning theory, which is designed as a pedagogical strategy consisting of four main elements: (A) Activities, (C) Class discussion, (E) Exercises, and (P) Performance. This cycle modification is applied to improve students' writing skills, especially their writing skills. The main focus of this study is to evaluate the effectiveness of the ACEP cycle in improving students' expository writing skills, as well as to analyze the relationship between the application of the ACEP cycle and learning motivation towards improving these writing skills. The ACEP cycle implemented in two junior high schools in Bogor Regency was evaluated using a mix-method method. The research sample was taken from the total population using a random (probabilistic) sampling approach. The research tools (questionnaires, interviews, and writing assessments) have been previously validated. The results of this study can be seen from the results of ANOVA with a sig value = 0.036 and Fh = 4.639, so H_0 is rejected and H_1 is accepted. This means that there is a significant interaction effect of the ACEP cycle and learning motivation on students' exposition writing skills.

Introduction

Writing skills are one of the essential competencies that must be mastered in the context of formal education and language learning. In the language learning process, the emphasis is directed at developing students' abilities to communicate in writing using Indonesian appropriately, effectively, and according to the rules (Maulana, 2015). Writing activities are seen as complex cognitive processes (Susilo & Wahyuni, 2019; Rasyad et al., 2017); where according to Nunan (2003), this activity includes mental activities that involve formulating ideas, selecting delivery strategies, and compiling information into sentences and paragraphs that are communicative and easy for readers to understand. Therefore, every student is expected to have the ability to express their thoughts through writing (Susilo et al., 2024).

Exposition text is a type of text that aims to convey ideas or put forward a proposal supported by clear and strong arguments (Maulana, 2015). In the process of learning to write exposition texts, students are faced with several important cognitive activities that contribute to the development of logical, analytical, and systematic thinking skills (Nurlatifah & Yusuf, 2022; Kemala et al., 2020). Writing exposition texts requires in-depth analysis of the topics discussed and involves critical thinking skills, where students need to evaluate the reliability and relevance of the information they use.

In the Independent Curriculum, exposition writing skills play an important role in helping students build solid literacy skills. Exposition texts encourage students to think critically, organize ideas logically,

and convey information clearly and in a structured manner (Nurlatifah & Yusuf, 2022; Kemala et al., 2020). The focus of the Independent Curriculum on exposition writing skills creates a learning atmosphere that supports independence, innovation, and critical thinking. Therefore, an effective development framework is needed to improve students' writing skills (Chong & Lee, 2012; Hall & Grisham-Brown, 2011).

Based on the findings of research in Indonesia, the results of the exposition text writing skills test of class X students of MAN 1 Sarolangun were low (Gusrita, 2021). Difficulty writing expositions at SMAN 1 Pinangsor (Hasibuan et al., 2020). Lack of writing practice in schools causes difficulties in expressing ideas in written form, one of which is writing expositions (Kurniati, 2019). Difficulty in writing exposition texts: The difficulty is that students have difficulty finding ideas for writing (Dewi & Silva, 2018).

Learning motivation is an internal condition within an individual that drives him/her to act to achieve a certain goal. McDonald in Kompri (2016) defines motivation as a change in energy within a person accompanied by the emergence of affective (emotional) aspects and a tendency to respond to achieve goals. In this study, the theory of learning motivation used as a reference is the theory developed by Herzberg (1966), which distinguishes learning motivation into two types: intrinsic and extrinsic.

Based on the results of pre-researcher observations at junior high schools in Bogor Regency, several obstacles were found, one of which was learning motivation. Learning motivation is often an obstacle that affects students' success in writing. In line with the research of Rahayu & Gufron (2023), the lack of student learning motivation has a negative impact on learning. So, learning motivation needs to contribute to improving writing skills (Rozana et al., 2018).

The learning model is a systematic design that aims to help students achieve the learning objectives that have been set (Joyce et al., 2015). One of the pedagogical strategies applied is the ACEP cycle, which includes four main components: (A) activities, (C) class discussions, (E) exercises, and (P) performances or demonstrations. The ACEP cycle was developed from the APOS learning theory, a conceptual framework designed to understand various concepts in mathematics. The APOS theory is rooted in the basic ideas developed by Piaget (1973) and was later expanded and developed by Dubinsky (1984). Since then, this theory has developed significantly and is widely used by researchers, curriculum developers, and education practitioners in various countries.

The APOS theory refers to the cognitive models individuals form in their minds to understand mathematical concepts. The application of this theory has shown success in various studies, both as a systematic conceptual development framework (Breidenbach et al., 1992) as well as a sharp analytical tool for evaluating understanding (Dubinsky & Wilson, 2013) or a combination of both (Weller et al., 2011). Although originally designed for mathematics learning, several attempts have been made to adapt the APOS theory to other disciplines, such as computer science, physics, and developmental psychology (Arnon et al., 2014).

The author has conducted a meta-analysis study on applying the APOS learning model in language skills as a form of initial exploration for its application in the context of language learning (Hidayat et al., 2021). Based on the analysis results, this learning approach, which was originally intended for mathematics, is also relevant for developing language skills because language activities such as speaking, listening, reading, and writing also require complex cognitive processing. The development of this ability is in line with the principles in the APOS theory developed by Dubinsky (2002). The innovation in modifying the ACEP cycle is a new learning approach designed to improve students' writing skills. Most previous studies on APOS theory have focused more on understanding concepts than teaching aspects that can affect students' understanding.

Nurlaelah & Sumarno (2009) investigation of the transformation of the APOS learning model into M-APOS. From the perspective of APOS theory, research has been conducted on how the concept of vector space is constructed (Parraguez & Oktaç, 2010). Case study of mental construction research for learning from probability concepts (Ortiz & González, 2014). Research on the use of APOS theory as a framework for understanding slope (Nagle et al., 2019). Studies on the application of APOS-ACE theory to enhance students' comprehension of derivative graphs have been conducted (Borji et al., 2018). It can be concluded that this APOS theory can be a conceptual framework for the APOS learning model. These studies collectively demonstrate the versatility and effectiveness of APOS theory across various mathematical domains, providing a robust foundation for its application in educational settings.

Based on the description above, the purpose of this study is to evaluate the effectiveness of the implementation of the ACEP cycle in improving students' exposition writing skills. Analyze the role of learning motivation in the success of exposition writing learning. And identify the relationship between the implementation of the ACEP cycle and learning motivation on exposition writing skills.

Method

1. Research Design

Mixed research methods is an approach that integrates qualitative and quantitative methods in one study. This approach is to gain a more comprehensive understanding of a phenomenon by combining data to produce a series of features (Terrell, 2016). The qualitative approach is used to identify and understand a phenomenon by collecting data directly from teachers and students (Merriam, 2009). The descriptive approach can provide insight into the world of education based on the experiences of teachers and students (Saldana, 2011; Miles et al., 2014; Silverman, 2004). Research analysis focuses on observing interactions between teachers and students in the learning process; the learning models applied, and the evaluation of learning aids. In addition, in-depth interviews were conducted to understand the challenges of student learning motivation further.

The data analysis process in this study refers to the interactive analysis model developed by Miles et al. (2014), with stages adjusted as explained by Cohen et al. (2018). These steps include (1) analyzing the conditions of Indonesian language learning at the junior high school level in Bogor Regency, (2) determining materials and learning models that are relevant to student needs, and (3) verifying data through peer-debriefing techniques involving students and teachers as informants.

The experimental design in this study used the Pretest–pretest-posttest control Group Design (Terrell, 2016). The study used a two-group research design (Leavy, 2017; Creswell, 2014; Creswell & Clark, 2018). There was an experimental class and a control class (Bos, 2020). Both groups were given a pretest, with one as the control group and the other as the experimental group. The experimental group received treatment with the modified APOS learning model of the ACEP cycle. The control group received treatment with the conventional learning model. The two groups were compared at the end of the treatment to see how much difference there was in the achievement of the results from the posttest.

This study's data sources were interviews with teachers, students, and principals involved in evaluating learning models and student learning motivation (Saldana, 2016; Valsa, 2005). The documents collected included teaching modules, learning materials, learning media, evaluation instruments, and learning motivation instruments. Meanwhile, the interview results were analyzed to evaluate learning models applied in schools.

The population in this study was two junior high schools in Bogor Regency that implemented the independent curriculum, namely SMPN 1 Klapanunggal and SMP Nusantara. The sampling method applied in this study was simple random sampling. Terrel (2016) stated that the simple random sampling technique is the most effective strategy to reduce bias in sample selection and ensure that the sample truly represents the population. In this study, three classes from each school were selected as samples to test the implementation of the ACEP cycle.

2. Data collection

The data collection process in this study was carried out through several systematic stages. In the early stages of the cycle, students were asked to complete tasks individually or in groups, aiming to encourage the formation of mental constructions. These tasks were more directed at stimulating reflective abstraction than producing perfect writing. In the class discussion stage in the APOS learning model modified through the ACEP cycle, the teacher acted as a facilitator in guiding discussions about the material and problems that emerged from the initial activities (activities). The discussion was carried out after students were divided into heterogeneous groups consisting of four people. Each group was given an authentic assessment task in the form of a project designed to develop writing skills, especially in the context of exposition writing material. This task aims to help students build mental structures through the stages of action, internalize them into processes, and then encapsulate them into objects—which is the core of the APOS theory-based learning approach.

The exercise stage is carried out in two meeting sessions. The teacher gives students an exposition writing skill assignment using an authentic assessment approach in the form of self-assessment, which is done independently at home. This assignment strengthens students' conceptual understanding of the studied material. The exercise stage supports the continued development of students' mental construction (Weller et al., 2009). Each student completes the assignment individually at home. Furthermore, in the second meeting, the teacher discusses the results of the students' work in detail. The teacher evaluates writing skills based on a previously determined assessment rubric.

The performance stage is the closing phase in the ACEP cycle, which functions as a form of evaluation of the success of the implementation of the cycle in improving students' writing skills. At this stage, the writing results obtained from the previous exercises are assessed by two assessors using the assessment rubric that has been determined. Students' writings are then displayed on the school wall magazine as a form of appreciation and publication.

3. Instrument Validation

Motivation Questionnaire Instrument

The indicators of student learning motivation are student actions such as discipline, perseverance, tenacity, responsibility, hard work, and achievement. The learning motivation questionnaire consists of 30 questions and positive and negative statements derived from the indicators can be seen in Table 1.

Table 1. Learning motivation variable grid

No	Indicator	Positive Statements	Negative Statements	Amount
1	Discipline	1, 2, 3	26	4
2	Strong	6, 16, 18, 24	19	5
3	Persistent	11, 27	22, 23	4
4	Responsibility	17, 28, 29, 30	13, 14, 15, 20, 21	9
5	Diligent	10	9, 12, 25	4
6	Achiever	4, 5	7, 8	4
	Amount	**16**	**14**	**30**

A validity test determines how accurately the measuring instrument can measure the object to be studied. The validity test is carried out through a product-moment correlation test. In this case, the statement item is called valid if the r_{count} value> r_{table} for dk = n-1 with a significance level of 5%. Preferably if $r_{count} < r_{table}$ for dk = n-1, the item is considered invalid. The results of the validity test can be seen in Table 2.

Table 2. Validity test results

No.	r_{count}	r_{table}	Description	No.	r_{count}	r_{table}	Description
Positive Statements				**Negative Statements**			
1	0.64	0.361	Valid	7	0.58	0.361	Valid
2	0.51	0.361	Valid	8	0.66	0.361	Valid
3	0.55	0.361	Valid	9	0.59	0.361	Valid
4	0.56	0.361	Valid	12	0.68	0.361	Valid
5	0.65	0.361	Valid	13	0.63	0.361	Valid
6	0.52	0.361	Valid	14	0.56	0.361	Valid
10	0.60	0.361	Valid	15	0.59	0.361	Valid
11	0.60	0.361	Valid	19	0.59	0.361	Valid
16	0.73	0.361	Valid	20	0.57	0.361	Valid
17	0.61	0.361	Valid	21	0.56	0.361	Valid
18	0.52	0.361	Valid	22	0.57	0.361	Valid
24	0.55	0.361	Valid	23	0.51	0.361	Valid
27	0.48	0.361	Valid	25	0.50	0.361	Valid
28	0.53	0.361	Valid	26	0.55	0.361	Valid
29	0.58	0.361	Valid				
30	0.54	0.361	Valid				

Table 2 above shows that the results for all questionnaire items are valid, meaning they meet the validity test.

Exposition Writing Skills Instrument

The validity of exposition writing skills is tested through content and construct validity. Before collecting research data, this instrument was adjusted to the material taught in the Indonesian language subject at the junior high school level. Meanwhile, construct validity is based on relevant theories and concepts. The rating reliability statistical formula is used to determine the level of reliability of the exposition writing skills test items can be seen in Table 3.

Table 3. Summary of anova for calculation of reliability of ratings exposition writing skills

Variasi	Jk	db	Mk
Total	627,4	14	-
Raters	13,4	2	-
Subject	587,4	4	146,8
Residue	23,6	8	2,9

Calculating the reliability coefficient of a rater

$$r_{ii} = \frac{146{,}8 - 2{,}9}{146{,}8 + (3-1)(2{,}9)} = \frac{143{,}9}{152{,}6} = 0{,}94$$

Calculating the average reliability coefficient of ratings from k raters

$$r_{kk}2 = \frac{St^2 - Sr^2}{Ss^2} = \frac{146{,}8 - 2{,}9}{146{,}8} = 0{,}98$$

The results of the reliability test of the exposition writing skills test were declared reliable because, after calculations, a reliability coefficient of 0.98 was obtained.

Results and Discussion

Results

This research was conducted in class IX of junior high schools in Bogor in the 2024/2025 academic year. The schools used as research subjects were SMPN 1 Klapanunggal and SMP Nusantara. One class was taken from each of the two junior high schools to be used as research subjects, where one class was treated with the modified APOS learning model of the ACEP cycle as an experimental class and the other class with the lecture learning model as a control class. The modified APOS learning model of the ACEP cycle was applied to class IX-C at SMPN 1 Klapanunggal and the conventional learning model to class IX-A at SMP Nusantara.

After implementing the learning model on writing exposition, the next process is to conduct an evaluation test on the material taught to determine the skills of writing exposition. In addition, to determine the level of learning motivation possessed by students, the students are asked to fill out a questionnaire containing statements that can be used to measure the level of student learning motivation according to the indicators set can be seen in Table 4.

Table 4. Exposition writing skills test results and learning motivation scores

Variable	Class	N	Minimal	Maximum	Mean	Std deviasi
Exposition writing skills	ACEP Cycle	30	72	98	90	8.42
	Conventional Learning Model	30	60	88	76.8	8.22
Motivation to learn	ACEP Cycle	30	70	134	106.30	19.81
	Conventional Learning Model	30	65	117	94.22	19.84

Table 4 shows that the exposition writing skills of the ACEP cycle classes ranged from a minimum of 72 to a maximum of 98, with a mean score of 90 and a standard deviation of 8,42. Meanwhile, the exposition writing skills of typical classes ranged from 60 to 88, with a mean score of 76,8 and a standard deviation of 8,22. In classes using the ACEP cycle, learning motivation scores ranged from 70 to 134, with a mean of 106,3 and a standard deviation of 19,81. In classes using the conventional learning paradigm, learning motivation scores ranged from 65 to 117, with a mean of 94 to 22 and a standard deviation of 19,84.
A normality test is conducted to determine whether the research data is normally distributed. If the data is normal, parametric statistical analysis is used; if it is not normal, non-parametric statistical analysis is used can be seen in Table 5.

Table 5. Normality test

One-Sample Kolmogorov-Smirnov Test			
		ACEP Cycle	Konvensional
N		30	30
Normal Parameters[a,b]	Mean	83.7528	74.3694
	Std. Deviation	7.91963	8.39159
Most Extreme Differences	Absolute	.059	.078
	Positive	.047	.053
	Negative	-.059	-.078
Test Statistic		.059	.078
Asymp. Sig. (2-tailed)		.200[c,d]	.073[c]

a. Test distribution is Normal.

b. Calculated from data.
c. Lilliefors Significance Correction.
d. This is a lower bound of the true significance.

Based on the results above, the ACEP cycle value has a normal distribution, and the findings are proven by Sig.= 0.200 > 0.05. Conventional values also have a normal distribution, and the findings are proven by Sig.= 073 > 0.05. The results can be seen from the significance value (Sig.) of Kolmogorov-Smirnov > 0.05, which indicates that the data is normally distributed. Because the data is normally distributed, parametric statistical analysis is used.

This study was analyzed using a two-way ANOVA test. Table 6 shows the descriptive statistics results for this test can be seen in Table 6.

Table 6. Descriptive statistics

Motivation	Descriptive statistics	ACEP Cycle	Conventional	Total
Tall	N	24	20	44
	χ	92.39	80	86.16
	Std. Deviasi	6.48	9.15	10.28
Low	N	5	11	16
	χ	76.25	72.74	73.67
	Std. Deviasi	2.5	2.61	2.97
Total	N	28	31	60
	χ	90	76.77	82.93
	Std. Deviasi	8.32	8.12	10.51

According to the following data, students who are taught using the ACEP Cycle yet have strong learning motivation have exposition writing skills of 24, with an average score of 92,39 and a standard deviation of 6,48. Students with strong learning motivation who receive instruction using the conventional learning have exposition writing skills of 20, with an average score of 80 and a standard deviation of 9,15.

In addition, the hypothesis was tested using a two-way ANOVA test, the results of which can be summarized in Table 7.

Table 7. Test the research hypothesis

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	3692.314[a]	3	1230.448	25.454	**.000**
Intercept	236378.656	1	236378.656	4887.835	**.000**
Motivation	1157.547	1	1157.547	23.926	**.000**
Model	659.594	1	659.594	13.625	**.001**
Motivation *model	225.198	1	225.198	4.639	**.036**
Error					
Total	2611.411	55	48.342		
Corrected Total	405300.000	60			
	6302.725	59			

Based on Table 7, the results of ANOVA with a value of Sig = 0.000 <0.05 and Fh = 13,625, then H_0 is rejected and H_1 is accepted. This means that there is an influence of the learning model on students' exposition writing skills. In other words, there is a difference in exposition writing skills using the ACEP cycle with those using the conventional learning model.

Based on Table 7, the results of ANOVA with a sig value = 0.000 <0.05 and Fh = 23,926, then H_0 is rejected, and H_1 is accepted. This means that there is a significant influence of learning motivation on students' exposition writing skills. In other words, there is a difference in exposition writing skills between those who have high learning motivation and those who have low learning motivation.

Based on Table 7, the results of ANOVA with sig value = 0.036 and Fh = 4.639, then H_0 is rejected and H_1 is accepted. This means that there is a significant interaction effect of learning models and learning motivation on students' exposition writing skills.

Discussion

Writing is an important productive skill for students, but many have difficulty mastering it. The results of this study indicate that some students do not yet deeply understand the basic concepts of writing skills. Therefore, a learning model is needed to stimulate students' critical thinking skills.

The ACEP cycle was developed based on the APOS theoretical framework, which is then widely used as a learning model, especially in mathematics. The APOS learning model itself is an approach that emphasizes mental formation to understand mathematical concepts (Arnon et al., 2014). This mental formation refers to knowledge from individual construction because everyone has initial knowledge that will be strengthened through the learning process.

ACEP cycle learning involves students, both individually and in groups, in learning activities to support students in creating mental constructions. The ACEP cycle approach emphasizes holistic education with the aim of stimulating students' interest in understanding the relevance of learning materials by linking them to everyday life. The experience of learning the context of life brought into the classroom is actual learning. Hattie (Hattie, 2011) stated that actual learning has a great influence on students.

This study refers to the principles discussed in the preliminary study, namely the results of initial research related to the meta-analysis of the APOS learning model in developing language skills (Hidayat et al., 2021). This study's findings align with previous studies' results regarding the application of the APOS learning model, modification of M-APOS (Nurlaelah & Sumarno, 2009), the concept of vector space (Parraguez & Oktaç, 2010), the concept of probability (Ortiz & González, 2014), eigenvectors (Salgado & Trigueros, 2015), construction principles (García-Martínez & Parraguez, 2017), problem-solving (Kurniati et al., 2018), frameworks (Nagle et al., 2019), linear functions (Yuniati et al., 2020), GeoGebra (Baye et al., 2021), and meta-analysis of language skills (Hidayat et al., 2021), modification of the ACEP cycle to improve writing skills (Hidayat et al., 2024).

ACEP cycle learning has several weaknesses, namely, the implementation of the ACEP cycle requires a long time for each stage, so it can be less effective and efficient if teaching time is limited. ACEP cycle learning requires a high level of independence and initiative from students, which can be a challenge for students who are less motivated or need more intensive guidance. One of the advantages of the ACEP cycle is its structural approach, which offers a systematic and organized learning framework, allowing students to understand the material gradually. The ACEP cycle also supports the formation of a deeper understanding of concepts in students by integrating elements of action, process, object, and scheme.

Conclusion

This study evaluates the effect of implementing the ACEP cycle and learning motivation on exposition writing skills. The ACEP cycle was implemented through an experimental method using a two-way analysis of variance (two-way ANOVA). The two-way ANOVA test was used to assess the extent to which the ACEP cycle and the level of learning motivation affect exposition writing skills. The results of the analysis showed that the implementation of the ACEP cycle had a significant impact on improving these skills. This approach is designed to encourage active student involvement in the learning process, and its effectiveness will be more optimal if all stages in the ACEP cycle are applied consistently. In this study, learning with the ACEP cycle proved more effective than conventional learning methods. Students who took this learning showed development in critical thinking and aesthetic and ethical sensitivity to phenomena in the surrounding environment.

Declarations

Author contribution	:	Ryan Hidayat was responsible for the overall research project. He also led the writing of the manuscript and collaboration with other authors. Merry Lapasau participated in data collection and translation. Andayani and Atikah Anindyarini revised the manuscript. All four authors approved the final manuscript.
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