The Effectiveness of the Process Oriented Guided Inquiry Learning (POGIL) Model in Educational Psychology Learning

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ABSTRACT

Theoretically, this research contributes to: (1) the development of educational psychology theory, and (2) the development of research-based learning theory; the research results are especially relevant to methods such as authentic learning, problem-based learning, cooperative learning, inquiry learning, process oriented guided inquiry learning (POGIL) and contextual teaching and learning, which are currently increasingly popular. Practically, this research can be used as a teaching material for lecturers and students in lectures, and may be particularly beneficial as a comparative or supplemental book to enrich the educational psychology materials used in a new course of Faculty of Education and Teachers' Training at Tidar University. The objectives of this study were: (1) to propose appropriate learning materials for the subject of educational psychology using research-based learning models, and (2) to test the effectiveness of research-based learning models, especially POGIL. The research was conducted among the second semester students in English Education Study Program. The research method used was Research and Development, which consisted of three steps, namely preparation, development, and reporting of results. The data analysis technique used was one group pre-test post-test design. This research succeeded in developing teaching materials for educational psychology using a research-based learning model and indicates that POGIL can improve students' learning outcomes. The research results show that: (1) there is a significant difference between learning outcomes before and after learning using the POGIL model, as proven by the increase in the mean score from 58 to 91, and (2) there is no significant difference between the three sample groups using POGIL model in their learning, as proven by t-count being smaller than t-table, and the average post-test score of both groups 1 and 2 being 90, and the average post-test score of group 3 being 93.

Keywords: process oriented guided inquiry learning (POGIL); educational psychology; teaching materials

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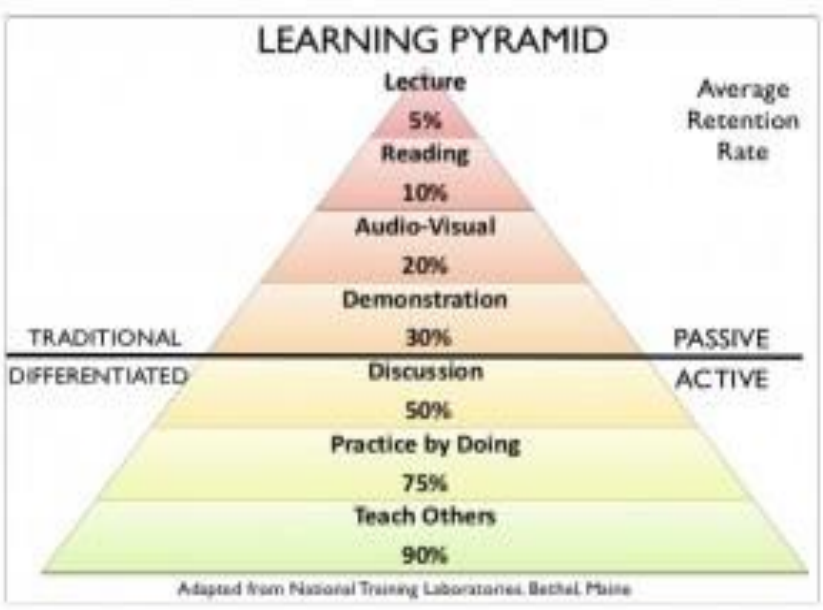
INTRODUCTION

There have been many teaching innovations undertaken by lecturers and the results are encouraging; however, some lecturers still place emphasis on the low-level cognitive domain. Moreover, the learning model that is typically used does not facilitate students to learn actively. Most lecturers dominate their lessons so that the level of student activity is not optimal. These dominant lecturers implement a conventional learning model, namely the lecturing method; such lecturers still feel that they are the only learning source and the most knowledgable person in the class. In fact, the teacher-centered approach is incompatible with the current educational paradigm, which emphasizes student-centered learning (SCL) and research-based learning. SCL is one of the most popular learning approaches among education practitioners around the world. SCL is believed to be very effective in improving the learning process in order to enable student learning outcomes to be achieved optimally. This is consistent with the philosophy of learning, which proposes that learning is an activity of acquiring new knowledge, as the more knowledge students acquire, the greater their chances of improving the quality of their attitudes and behaviors. This argument is in line with the learning approach that is developed in the cognitive psychology view, especially the theory of constructivist learning. Through the implementation of SCL, students can attain a great deal of knowledge, and are able to explore new sources of learning, both by themselves and in peer groups. At the same time, lecturers are also facilitating their students to learn. Some of these facilitating activities include: assigning students to conduct research, giving them the opportunity to present the results of their studies, asking them to take part in a peer group discussion, and asking them to summarize the results of the discussion. Angele Attard compares the learning outcome achievement of various learning models, as shown in the following diagram.



In the above diagram it is seen that learning by using passive learning model through lectures, reading, audio-visuals, and demonstrations are only able to

produce the highest learning achievement of 30%. Even if you only rely on audio-visual, reading, and lectures, the subject matter achievement that can be attached and remembered by each student only reaches 20%, 10% and even 5%. The achievement percentage is so different from the active learning model through discussion, practice, or teaching others. The lowest achievement recorded 50% for discussion method. While the practice and teaching record the higher percentage of learning outcomes, i.e. 75% and 90%. The last teaching method is done by explaining the information learned on peer group by asking each other, dialogue, discuss or even argue. Thus, SCL is currently highly recommended for students to achieve maximum learning outcomes. So what exactly is SCL? SCL is a learning process centered on students. This approach facilitates the students become active actors in learning process. This is different from Teacher-Centered Learning where the learning process is more centered on lecturers. A more detailed definition of SCL was delivered by Ang (2001) from Loyola School Ateneo de Manila University. According to him, SCL is a learning model that facilitates the students to participate actively in the learning process. This activity is done by reading text books, reading digital books in the computer, looking for material from online sources, and facilitate them to actively seek materials, including discussing the information obtained. In addition to learning with multiple sources, this process allows students to study happily and enjoy each process, both inside and outside the classroom. Ang (2001) added that the SCL process will occur when lecturers and students are actively learning. In this case, the students are facilitated to explore teaching materials and discuss various information obtained, while the lecturers actively assist them during the process, including encouraging them to search, discuss, and summarize the results of their discussions. The demands of lecturers to keep an active role in the learning process of students to be an affirmation that the SCL is not automatically lecturers become more relaxed and not much activity. In contrast, in the SCL approach lecturers should be more active in reading and learning with their students. In SCL, the relationship between lecturer and student is the relationship between senior learner and junior learner.

The use of SCL students are expected to (1) have the right to carry out the inquiry, search, assessment, and understanding process undertaken by the students themselves. Through SCL they have the opportunity to do research and present it before doing it for peer groups and their lecturers. Furthermore, the lecturer should give feedback to the presentation of the students; (2) improve students' learning motivation, it is because the SCL treats students as the academic community who have to master the theory, applying it, and continue to conduct a study and evaluation of the theory. In addition, students are also required to present the results of his studies on peer group and lecturer. Thus, students will be motivated to expand the learning activities outside the classroom so that they becomes a learning community; (3) make students become more independent and responsible to continue learning. SCL keeps students bound to learn, as they have to present the learning outcomes in front of the peer groups and their lecturers. Thus, the students will have responsibilities and must move independently, as they are required to continue completing the various scientific information they

need to be presented in front of the class weekly; (4) give students the opportunity to study independently.

SCL is developed by: (1) the lecturer providing learning materials in various forms, such as problematic questions to be discussed among students, scenarios to be simulated and demonstrated by the students, hypothetical questions to be solved through problem solving, and concepts and principles to be applied by students; (2) the lecturer formulating the objectives of cognitive domain learning in terms of higher-level thinking skills, such as analysis, synthesis, evaluation, and creativity; (3) the lecturer using varied teaching methods to encourage learning activities, such as the assignment method, discussion method, demonstration method, experimental method, and problem-solving method; (4) students using various learning resources in presenting learning materials such as human, props, books, and current scientific journals; and (5) students presenting the results of discussions in various forms, such as power point, gallery walk, mind-mapping and other methods.

Research-based learning or *Pembelajaran Berbasis Riset* is a learning method that involves authentic learning, problem solving, cooperative learning, contextual teaching and learning, and an inquiry discovery approach, and is based on the constructive learning philosophy (Haryati, 2018). Constructivist learning theory states that knowledge will be composed or built in students' minds in the process of trying to organize new experiences based on the available cognitive framework in their minds. This is in line with the opinion of Prince and Felder (2006), as follows:

> "An alternative model of constructivism holds that whether or not there is an objective reality, individuals actively construct and reconstruct their own reality in an effort to make sense of their experience. New information is filtered through mental structures (schemata) that incorporate the student's prior knowledge, beliefs, preconceptions and misconception, prejudices, and fears."

In line with the above opinion, Liu and Chen (2010) argue that:

> "Constructivism is a theory of how to learn and think about the process, rather than about how the student can memorize and recite a quantity of information ... Therefore, constructivism means that learning involves constructing, creating, inventing, and developing one's own knowledge and meaning."

Therefore, students must be able to construct or build their own knowledge in their own schemata, because knowledge cannot be simply transferred from the lecturer's schema to the student's schema. There are two points of view in the constructivist learning theory, namely cognitive constructivism and social constructivism. Piaget, as cited in Powell and Kalina (2009), explains that cognitive constructivism is a knowledge which is learned by the students themselves to build their own knowledge from their experience. An example of cognitive constructivism is the discovery learning model. Meanwhile, according to Vygotsky, as cited in Powell and Kalina (2009), social constructivism is a learning situation where knowledge is built and derived from the social interaction

process. An example of social constructivism is the cooperative learning model (Purnomo, 2011).

Choosing an effective learning model can help to improve and students' cognitive ability and process ability. An effective learning model, according to some experts, is a learning model that emphasizes the process of acquiring knowledge (learning based on constructivism) and linking knowledge with real-life experiences (Hanson, 2006). Learning and understanding require active restructuring of the students' minds. The knowledge which is built in the students' minds is known as constructivism. Process oriented guided inquiry learning (POGIL) is one of the learning models which is based on constructivist theory (Zamista, 2015).

POGIL emphasizes cooperative learning: during the learning process, students work in teams, design activities to build cognitive skills, and develop skills, such as science processes, thinking skills, problem solving, communication skills, management, positive social attitude building, and self-assessment skills, which can develop metacognitive knowledge (Hanson, 2006).

This article emphasizes the effectiveness of the POGIL model in educational psychology learning. In fact, several models have been developed in the implementation of research-based learning for the subject of educational psychology; these are: problem-based learning, guided-inquiry learning, quantum learning, POGIL, and cooperative learning. Simonson and Shadle (2013) explain that POGIL uses specially designed activities and cooperative learning to teach content and to actively engage students in inquiry, analytical thinking and teamwork. Walker and Warfa (2017) found that POGIL reduced the risk of failing a course by 38%. These findings suggest that providing opportunities to improve process skills during class instruction does not inhibit content learning but enhances conventional success measures. Furthermore, Soltis, Verlinden, Kruger, Carroll, and Trumbo (2015) found that the use of the POGIL strategy increased overall student performance in examinations, improved higher-level thinking skills, and provided an interactive class setting. Moreover, Daubenmire et al. (2015) argue that, when implemented effectively, POGIL environments place students' ideas and thought processes at the center of the classroom experience.

POGIL MODEL

Hanib (2017) states that POGIL is a learning model that combines the guided-inquiry and cooperative approaches. The success of POGIL is supported by some of the results of previous studies. Eberlein et al. (2008), comparing problem-based learning, peer-led team learning, and POGIL, proved that POGIL can improve performance value, and stated that students and teachers found the classroom environment more pleasant. Rohmah (2013) also expresses that the POGIL model can be used to enhance students' critical thinking skills (Haryati, 2018). POGIL is an active form of learning that is student-centered and based on the learning cycle. Stages in the learning cycle include: exploration, concept discovery, and concept application (Atkin & Karplus, as cited in Barthlow, 2011). Straumanis (2010) points out that POGIL involves stages that require students to think, meaning they

must have the confidence to follow the learning well. Examples of such stages are: exploration, concept invention/formation, and application.

In the POGIL model, at the beginning of a lecture, the lecturer presents an issue to build cognitive conflicts in students in order to motivate them to solve problems and design activities under the lecturer's guidance. These activities will enable the students to acquire the concept knowledge and to develop various skills. The objectives of the implementation of POGIL, according to Hanson (2004), are: (1) developing learning process, thinking, and problem solving skills, (2) encouraging students to actively participate in learning process, (3) increasing interaction among students and interaction between lecturers and students, (4) developing positive attitudes toward the subject matter, (5) linking learning with information technology, and (6) developing communication skills and performance in groups.

The lecturer plays four main roles in the POGIL model; these are leader, monitor/assessor, facilitator, and evaluator.

Table 1. Roles of the Lecturer in the POGIL Model (Hanson, 2006)

No	Role of Lecturer	Activity Details
1	Leader	The lecturer creates learning tools, develop and explain learning scenarios, define basic learning/competence goals, define behaviors that are expected to appear after students follow learning, and determine success criteria.
2	Assessor	The lecturer organizes the learning course in the classroom, assess the performance and achievement of students both individually and in groups, and obtain information about students' achievement, misconceptions and difficulties that students encounter during the lesson.
3	Facilitator	Information gained from assessing is used to design strategies to correct the existing weaknesses and to improve student achievement, whether it has been found to be lacking or satisfactory. As a facilitator, the lecturer has a responsibility to ask students questions, provide analogies, and present videos or activities, in order to facilitate students' activeness, motivate them, and ensure they acquire the necessary knowledge.
4	Evaluator	This role is carried out by the lecturer at the end of the lesson. Evaluation results are given to each student and group, relating to learning achievement, achievement of learning objectives, effectiveness of activities undertaken by students, and general points about activities that have been completed.

Table 2. Roles of Each Group Member in the POGIL Model (Hanson, 2006)

No	The Role of Group Member	Activity Details
1	Manager	Participate actively, ensure the teams stays focused during the learning process, distribute the division of tasks, resolve in case of internal group conflict, and ensure that every member of the group contributes.
2	Spokes-person	Participate actively, convey point of view and conclusion, and present the results of group discussions.

3	Recorder	Participate actively, record what the team has done, prepare presentation/final report material, documentation, and communicate with other group members.
4	Strategy Analyst	Participate actively, identify and record the methods and strategies needed to solve problems, identify and record what the group has done well (whether in accordance with the draft strategy or needs to be improved), and record what has been discovered about the achievement of the content and the achievements of the team.

Table 3. Learning Activity Stages in the POGIL Model (Hanson, 2004, as cited in Zasmita, 2015: 3-4)

No	Stages	Details of Activities
1	Orientation	This stage prepares students to study physically and psychologically. In this stage the lecturer's activities are: • providing motivation to students to follow the learning activities, • determining learning objectives, • determining the criteria of student learning outcomes, which indicate whether a student has achieved the learning objectives or not, • creating student interest in science, • raising students' curiosity and making connections with the knowledge that students already have through both their experience and the observations they have made, • presenting narration, illustration, demonstration or video for students to observed and begin to learn new things, which then must be analyzed by the students. At this stage, after observing, the students are expected to communicate the results of their observation, classify, make inferences (deductions or conclusions based on the observation) or make measurements.
2	Exploration	In this stage, the lecturer gives the student a plan or set of assignments or activities to complete, as a guide for students on what needs to be done to achieve the learning objectives. At this stage students have the opportunity to: • determine the required variables to analyze based on the results of observations in the previous stage, • propose hypotheses (express relationships between variables), • design experiments to test hypotheses, • collect data based on experimental designs that have been created, • check/analyze data or information, • describe the relationship between variables based on data that has been collected through experiments.

3	Concept Formation	As a result of the exploration step, students are expected to discover, introduce or shape the concept. This stage involves lecturers providing questions that can guide students to think critically and analytically about what they have done in the exploration section. These questions serve to help students define the exercises, guide the students to information, assist students to identify appropriate relationships and conclusions, and help students to construct cognitive abilities through learning.
4	Application	When the concept has been identified through the previous steps, it is necessary to strengthen and expand the understanding of the concept. At this stage, students apply new concepts in exercises, problems, and even research situations. • Exercises give students the opportunity to build trust using simple problems or familiar contexts. • Solving problems involves transferring new knowledge to an unfamiliar context, populating with other knowledge, and using that knowledge in different ways to solve problems related to real-world contexts. • Research questions develop learning by raising new issues, questions or hypotheses.
5	Closure	Learning activities end with students validating the results they have achieved, reflecting on what they have learned, and assessing their performance in learning. Validation is achieved by students reporting the results they obtained to their classmates and lecturers, and finding out their perspectives on the content and quality of content. In this stage students are also required to conduct self-assessment, by completing the self-assessment sheet. Self-assessment is the key to improving student performance. When students know what they are doing well, then they will strive to maintain and even develop that positive area.

RESEARCH METHOD

The research method employed in this study is Research and Development, which consists of three stages: preparation, development, and reporting. The preparation stage involves producing teaching materials for educational psychology courses using research-based learning models and the implementation phase of the model in the classroom. The development stage involves testing the effectiveness of various research-based learning models, including POGIL. The research population are the second semester students of the English Education Department of the Faculty of Education and Teachers' Training, Tidar University. Data collection techniques used are tests, questionnaires, and observations. Instruments used include the semester learning plan (RPS), textbook draft, and the pre-test and post-test questions. The data analysis technique used is one group pre-test post-test design.

RESULTS AND DISCUSSION

The research results on the effectiveness of the POGIL model in the learning of educational psychology are as follows:

The Implementation of POGIL Model

In the orientation stage, the lecturer prepares the students physically and psychologically, using the educational psychology textbook draft. Each chapter of the textbook draft has determined: basic competencies, indicators, learning scenarios, learning materials, and exercises. To test the indicators and basic competencies, the lecturer provides a pre-test.

In the exploration stage, the lecturer provides motivation and guidance to the students in conducting observation activities in groups so that students can form and master the concept. Students determine problems, hypothesize, analyze problems and organize concepts on *plano* paper.

At the concept formation stage, students present in front of the class and communicate observations or group discussions in the form of reports written on plano paper. The group leader gives the students an opportunity to express their opinions and ask questions regarding the subject matter. The group leader answers questions and summarizes the results of discussions and presentations.

At the application stage, the lecturer advises the students to (1) complete various exercises in each chapter of the textbook draft, and (2) apply the theory of learning psychology in real life.

At the closure stage, the lecturer provides reinforcement of the concept, reviews the lesson, together with the students concludes the learning outcomes, conducts a post-test, reflects, and previews the upcoming material.

The performance scores of the implementation of the POGIL model in learning are as follows:

Table 4. Average Performance of POGIL Model

No	POGIL Syntax	Group 1	Group 2	Group 3	Average
1	Orientation	97	100	86	94
2	Exploration	70	100	63	78
3	Concept Formation	89	100	91	93
4	Application	65	89	86	80
5	Closure	100	100	100	100
	Average	84.2	97.8	85.2	89

Table 4 shows that the average score of the level of implementation of POGIL model is 89%. This means that the overall implementation of POGIL model is in accordance with the RPS and the textbook drafts that have been prepared may be categorized as good. The results indicate that learning with the POGIL model has a positive influence and improves students' higher-level thinking abilities, especially analysis, evaluation, conclusions, and self-regulation.

Hanib (2017: 29) states that, through POGIL activities at the exploration, concept formation and application stages, students are trained to develop their ability to analyze, evaluate and draw conclusions. This is reinforced by Simonson and Shadle (2013: 4) who explain that POGIL can improve retention of knowledge, and higher-order thinking. Zawadzki (2010) suggests that by carrying out POGIL activities in groups, students learn to think and solve problems together.

The average score for the implementation of the POGIL model for the orientation, concept formation, and closure stages is very good (above 90%), because, in the orientation stage, the lecturer has prepared instructional guidance in the form of the textbook draft; at the concept formation stage, students are always active in group discussions, presenting, communicating, answering questions, and summarizing the results of the discussion in front of the class; and at the closure stage, the lecturer always concludes, and provides a review and follow-up to the learning. Meanwhile, at the exploration stage, the POGIL method only achieves an average score of 78% because not all presentations are carried out using power point but by writing on *plano* paper, which limits the extent to which students understand and master the necessary concepts and principles, and reduces their ability to determine the problem and formulate hypotheses. The application stage is scores only 80%, which means that only 80% of students complete the exercises in each chapter, and 80% of students apply the theory of learning psychology in real life.

Students' Learning Outcomes

To evaluate the effectiveness of the POGIL model in learning educational psychology in the three study groups, the post-test value was compared with the pre-test value and analyzed using the quasi-experiment technique one group pre-test post-test design. Students' learning outcomes were analyzed using the range of cognitive competency values in accordance with indicators that were formulated in the textbook draft. The results are shown in Table 5, below.

Table 5. Summary of One Group Pre-test Post-test Design Analysis

No	Study Group and Materials	Mean Pre-test	Mean Post-test	db	t-count	t-table	Decision Test	Mean Difference
1	Group 1 - Cognitive Learning Theory	41	83	34	18.6133	2,704	H_0 rejected	Significant
	- Humanistic Learning Theory	56	98	36	11.6968	2,704	H_0 rejected	Significant
	- Cybernetic Learning Theory	65	89	35	7.9234	2,704	H_0 rejected	Significant
2	Group 2 - Cognitive Learning Theory	39	83	32	16.3308	2,750	H_0 rejected	Significant
	- Humanistic Learning Theory	58	98	33	12.3704	2,750	H_0 rejected	Significant
	- Cybernetic Learning Theory	59	90	28	8.1849	2,763	H_0 rejected	Significant

3	Group 3 - Cognitive Learning Theory	47	89	35	17.2126	2,704	H_0 rejected	Significant
	- Humanistic Learning Theory	63	95	36	9,6438	2,704	H_0 rejected	Significant
	- Cybernetic Learning Theory	93	94	32	0.1212	2,750	H_0 accepted	Not significant
	Average	58	91					

With regard to the effectiveness of the POGIL model in the learning of educational psychology, it is found that the use of the POGIL model can effectively improve learning outcomes. This is proved by the significant difference between the mean learning outcome scores before and after learning with the POGIL model in the class. The result of the research analysis shows that the average score before learning is 58, and the mean score after learning is 91; there is an increase of 33.

The results of the study are in accordance with the opinion of Bilgin (2009: 1041) that the POGIL model has a positive influence on the improvement and development of student performance. The POGIL model has also been shown to improve student performance, activity, and value (Eberlein, 2008), improve students' critical thinking skills (Anam, 2012: 67), and develop students' critical thinking and problem-solving skills (Hanson, 2006). There was no significant difference between the three study groups using the POGIL model in their learning which is proved by the score of t-count being smaller than that of t-table. The mean post-test score of both study groups 1 and 2 is 90, while the mean post-test score of study group 3 is 93.

Based on the results of the one group pre-test post-test design analysis, it is found that there is a significant difference between student learning results before and after the POGIL model is applied in learning. Indeed, the pre-test mean score (58) was considerably lower than the post-test mean score (91). However, there was not a significant difference between the pre-test score (93) and post-test score (94) of Group 3 in Cybernetic Learning Theory. This indicates that these students had learned material that had not yet been explained because all students already had a draft textbook containing the competencies that they must master, and learning scenarios, learning materials, and training questions that they must complete. This proves that the POGIL application, especially in the orientation stage (reading the learning syntax in the textbook draft) and the application stage (completing the exercises that have been prepared in the textbook draft), is carried out well by the students.

CONCLUSION

Based on the research data and analysis above, it can be concluded that the use of the POGIL model in the learning of educational psychology is effective. This is proved by the result of the application of the POGIL model in the class which falls into the very good category. The mean score of all the three groups is 89. The increase in the learning achievement obtained is 33, from a mean score of 58

to 91. The use of the POGIL model provides the same learning outcomes in each study group. The orientation, concept formation, and closure stages contribute to excellent learning outcomes. The exploration and application stages are only categorized as good, while the orientation, concept formation, and closure stages are excellent. Therefore, it can be concluded that the POGIL model can improve students' ability to think critically, communicate, and cooperate with others. POGIL is a learning model that emphasizes the process of constructivism and thereby facilitates students to explore their process skills, builds students' own cognitive abilities, and fosters a positive attitude among students. Each stage of the POGIL model strongly supports the improvement of student learning outcomes. The implementation of learning with the POGIL model contributed to the improvement of process skill and learning results by 89%.

It is suggested (1) to conduct research which compares the effectiveness of the POGIL model implementation and other research-based learning models in improving student learning outcomes; (2) that good time management needs to be considered in every implementation of teacher-based learning models, including POGIL; (3) that the commitment of the leaders, lecturers, and students is required to apply research-based learning models; and (4) that the management needs to provide the necessary facilities for lecturers and students in the implementation of this research-based learning model.

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