

The Influence of The Andragogy Approach on The Problem Solving Skills of High School Students in Biology Learning

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Abstract: The andragogy approach is learning that directs students to independently solve problems. Students' low solving skills can be seen from the lack of student activity in the learning process resulting in low learning outcomes. The aim of the research is to determine the effect of the andragogy approach on students' problem solving skills in biology learning. The method used is quasi experimental. The research design is a pretest-posttest nonequivalent control group design. The research population was biology teachers in class XI and class XI high school students, totaling 239 people. The sample used a purposive sampling technique with a total of 144 students. Data on problem solving skills using case study questions and teacher interviews. Data analysis used the normalized gain test and independent sample t-test. The results of data analysis show that there is a significant difference between the average N-gain with a result of $P = 0.001$. The teacher's perspective shows that the andragogy approach improves students' problem solving skills. The research conclusion is that there is an influence of the andragogy approach on students' problem solving skills in biology learning.

Keywords: Andragogy; Problem solving skills; Teacher perspective.

Introduction

In the world of education, to gain understanding and knowledge related to a science, different methods and treatments are needed according to the character and level of understanding of learning according to the age of the students. Adult people will be ready to learn if the learning material is appropriate to what they need (Kamil, 2007). In formal education, andragogy is often used in the learning process at the secondary and upper level of education (Hiryanto, 2017).

Based on observations made at SMA Negeri 3 Banda Aceh, teachers still use a pedagogical approach and the learning process still focuses on the teacher, students only pay attention to what is conveyed. Continuous use of the Teacher Centered Learning model will make learning boring, because learning is one-way so students become passive (Puryanti & Maryamah, 2015 in Widyanto & Viententia, 2022). The problem solving skills of students at SMA Negeri 3 Banda Aceh

are still low. Therefore, students' problem solving skills need to be trained in the learning process. Teachers in the field of biology study stated that students still lack focus during the learning process, so that when the teacher asks questions or problems, students have difficulty finding solutions to problems in the learning material.

Programme for International Student Assessment (PISA) reported that the problem-solving abilities of Indonesian students are still relatively low compared to other member countries (Ilmi, 2019). To overcome this problem, learning is carried out by improving problem solving skills through an andragogy approach by providing test instruments in the form of case study questions. Problem-based learning can involve individuals in logical and critical thinking, the use of analogies and divergent thinking. Therefore, problem-based learning is a learning model that supports learning activities in an effort improve problem-solving abilities in biology learning (Jayanti et al., 2018).

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Learning is directed at target conditions that emphasize improving life, providing skills and abilities to solve problems (Hiryanto, 2017 in Nudiati et al., 2023).

Problem solving skills are one of the important skills that students must have in the 21st century (Hidayatulloh et al., 2020). This is because through problem solving skills, new experiences can be promoted in students by finding solutions and problem solving processes (Lismayani & Mahanal, 2017). Developing problem solving skills in students can have a positive impact on other skills such as science process skills (Yulianti & Khanafiyah, 2012); critical thinking skills (Zunanda & Sinulingga, 2015); communication skills (Yavuz & Guzel, 2020); scientific literacy (Thummathong & Thathong, 2016); and entrepreneurship skills (Kim et al., 2018), so that developing students problem solving skills is an important thing for teachers to do, especially in the learning process. According to the problem solving stages, students are expected to be able to identify what is known and what they want to look for in the problem, then make a plan by choosing the equation that will be used, then enter the known value and calculate it mathematically until they find the answer to the problem. The final step is checking again. (Polya, 2004 dalam Arsyad et al., 2022). The problem solving process is suitable to be applied in science learning because it can improve students ability to think logically, critically, creatively and innovatively (Sukmasari & Rosana, 2017).

Andragogy is learning based on experience (Morrison & McCutheon 2019). Andragogy is not only how adult education is, but also how the learning process is received by adults. Andragogy is also a continuation of the pedagogical approach where andragogy contributes more to adult self-education (Loeng, 2018). Andragogy brings adults to be involved in the learning process and have experience as a learning resource, so that they can be oriented towards problem focused learning (Carpenter & Linton, 2016). Andragogy focuses on the characteristics of adults which include self-concept, orientation, and readiness to learn from experience, where andragogy learning focuses on adult learning needs but the teacher is still a facilitator (Lynch et al., 2021). The andragogy approach can develop students' self-confidence in the world of education without any coercion, so this approach emphasizes self-awareness and independence in the learning process (Ulum & Hadawiah, 2022). Education in Ukraine discusses how to scientifically reflect on the problems of adult learning and education. In fact, Ukraine is a country that was preceded by the activities of

educational institutions for adults or directly implemented the andragogical approach in education in the 19th century (Thymchuk et al., 2022).

Students are expected to be guided to know what they need and be responsible for their own learning. With the andragogy approach, teachers also play a role in supporting students' ability to mature in thinking and be independent (Johnson et al., 2022). Professors who apply the andragogy concept say that teaching carried out using an andragogy approach influences how educators understand learning motivation problems experienced by students, both intrinsically and extrinsically (Putri & Elihami, 2021).

Method

The method used in this research is the Quasi Experimental method. The research design used was Nonequivalent Control Group Design, with pre-test post-test type. In the experimental group, learning used an andragogy approach through the discussion method by providing case study questions to see students' problem solving skills (Problem Based Learning). In the control group, learning used a conventional approach (pedagogy/lecture). The research design can be seen in Table 1.

Table 1. Research Design

Class	Pretest	Treatment	Posttest
A	O _{a1}	X ₁	O _{a2}
B	O _{b1}	X ₂	O _{b2}

- Description:
- A : experiment
 - B : control
 - O_{a1} : pretest experiment
 - O_{b1} : pretest control
 - X₁ : treatment experiment (andragogy)
 - X₂ : treatment control (pedagogy)
 - O_{a2} : posttest experiment
 - O_{b2} : posttest control

The research was conducted at SMA Negeri 3 Banda Aceh. This research was conducted in May 2023 in the 2023/2024 academic year. The population in this study was class XI students consisting of 7 classes totaling 239 students (Table 2).

Sampling was carried out using purposive sampling technique. Of the 7 classes, 4 classes were selected with a total of 144 students who were determined based on obtaining an average score that was close to (Table 3).

Table 2. Research population

Class	Mipa 1	Mipa 2	Mipa 3	Mipa 4	Mipa 5	Mipa 6	Mipa 7
Biology average score	93.20	93.2	92.25	93.24	92.51	88.51	88.83

Table 3. Research Sample

	Class	Number of students	Average score
Control	Mipa 1	34	93.20
	Mipa 5	37	92.51
Experiment	Mipa 3	37	92.25
	Mipa 4	36	93.24

The instrument used in this research is a problem solving test instrument in the form of case study questions totaling 10 questions at level C5 (evaluating). The material used is cell division. The aim is to measure students' initial abilities (Pretest). These questions are also given during Postests.

The hypothesis test used in this research is the Normalized gain test which aims to determine the significant difference between the experimental class posttest scores and the control class posttest scores. Then an Independent Sample t-test was carried out which aims to find out whether there is a difference in the average andragogical approach to students' problem solving skills. if the sig value <0.05, Ho is rejected and Ha is accepted, which means there is a difference in the average treatment of the dependent variable.

Result and Discussion

Based on the results of research at SMA Negeri 3 Banda Aceh, data on problem solving skills was obtained which is presented in Figure 1.

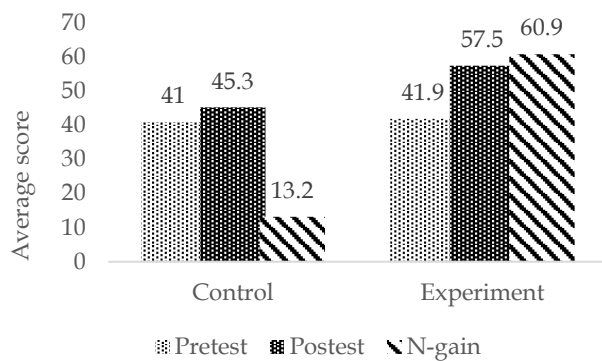


Figure 1. Average Score of Students Problem Solving Skills

Based on Figure 1, the average posttest score in the experimental class which applies the andragogy approach is higher than the average posttest score in the control class. The average pretest score for the experimental class and control class shows that students have the same initial abilities. The pretest scores in the experimental and control classes were included in the

quite good category. Average posttest score in the experimental class is included in the good category, while the posttest score in the control class is included in the quite good category. Problem solving abilities can be seen as one of the learning processes and outcomes (Davita & Pujiastuti, 2020).

The problem based learning model is a learning model that focuses on students, by directing students to become independent learners and actively involved in group learning, so that it can help students to develop thinking skills in finding solutions to problems until a solution is obtained for a problem, rational and authentic (Pitriah et al., 2018). The learning system for adult students can be directed into various forms of learning activities according to their needs and the need for the learning resources and materials, such as discussion groups (Hiryanto, 2017). Students who are invited to discuss, interact and dialogue will be able to consturct the concepts and rules of knowledge they learn. Students are accustomed to having different opinions so that they become intelligent and critical figures. The learning process for adults places more emphasis on techniques that tap into their experiences, such as discussion groups and the case method (Nainggolan et al., 2017). The average score of students' problem solving skills according to the problem solving skills indicators is presented in Figure 2.

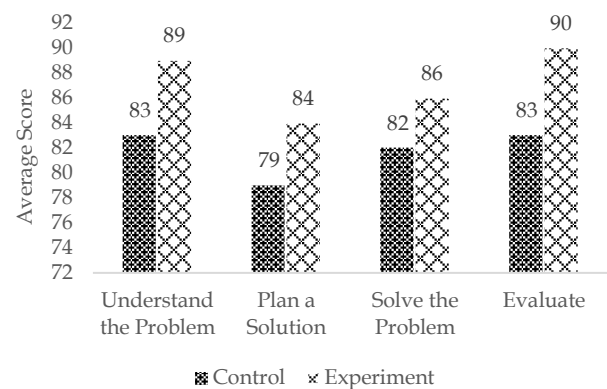


Figure 2. Average Score of Students Problem Solving Skills According to Indicators

Based on Figure 2, the average score of students' problem solving skills on the indicator of understanding

problems in the control class and experimental class is in the very capable category. Indicators of planning completion, the control class is in the capable category and the experimental class is in the very capable category. In the problem solving indicator, the control class and the experimental class are in the very capable category, while in the evaluating indicator, the control class and the experimental class included in the very capable category. This shows that there was a higher increase in scores in the experimental class compared to the control class based on scores on problem solving indicators.

The Indicators of the problems that are easily mastered by students (Hidayatulloh et al., 2020). Evaluating indicators make students more careful in responding and concluding on solving problems (Yanti et al., 2016). The main factor that causes students problem solving skills to be in the good category is

because students have been accustomed to solving problems during the learning process. So that students get used to actively discovering their own knowledge and experiences while still being guided by the teacher (Palennari et al., 2021). Students are expected to be guided to know what they need and be responsible for their own learning. Adults have a clear understanding of their abilities and desires to achieve (Bright, 2020).

Based on statistical tests and increasing scores on indicators of problem-solving skills in the experimental class, it shows that the andragogy approach has a good and quite effective impact on students learning experiences in improving problem solving skills. The influence of the andragogy learning theory approach on the ability to solve problems (Rosania et al., 2019). Statistical tests were carried out, namely the N-gain test, normality test, homogeneity test and hypothesis test with the results presented in Table 4.

Table 4. Research average different test

Class	N-gain		Normality test		Homogeneity test		t test***	
	posttest	Pretest	Posttest	Posttest	t	Sig	Sig	
Experiment	60.9	.200	.200	.200	.978	7.310	.001	.001
Control	13.2	.179	.179	.179				

Based on the N-gain test data in Table 4, the experimental class is included in the medium category. Meanwhile, the control class is included in the low category. Based on the posttest scores between the experimental class and the control class, there is a significant difference in scores, this shows that there has been an increase in problem solving skills in the experimental class. Based on normality tests in the experimental and control classes, it was found that the data were normal. The homogeneity test in the experimental and control classes stated that the data was homogeneous. The independent sample t-test hypothesis test showed that there was a difference in the average treatment of the dependent variable, which means that the hypothesis was accepted. Based on the results of statistical analysis, the impact of the andragogical approach has an influence on students' problem-solving skills.

Conclusion

Based on the results of the research and discussions the andragogical approach to the problem-solving skills of high school students in biology learning shows good results, so that the andragogical approach can be implemented in biology learning.

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Author Contributions

Conceptualization, F. S, H. R, W. A; methodology, F. S; software, F. S; validation, H. R, W. A, I. H, S; formal analysis, F. S, H. R, W. A; investigation, F. S; resources, F. S; data curation, F. S, H. R, W. A; writing – original draft preparation, F. S; writing – review and editing, F. S, H. R, W. A; visualization, F. S; supervision, I. H, S; project administration, F. S; funding acquisition, F. S. All authors have read and agreed to the published version of the manuscript.

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Conflicts of Interest

The authors declare no conflict of interest.

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