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The Effectiveness of The Novick Learning Model on The Representative Ability Of Students

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Abstract

This study aims to examine the suitability of learning with the Novick learning model through observation sheets of students' active activities and teachers' teaching abilities, to determine the ideal learning time using an ideal time observation sheet, and to assess the quality of learning based on the improvement of students' representational abilities, all of which are indicators of the effectiveness of the learning model. The research results obtained show that the learning outcome suitability for student active participation is 4.27778 and the teaching ability of lecturers is 4.58333, both in the excellent category. The ideal time obtained for delivering learning objectives using the Novick model is 4.85714, which is in the excellent category. Data analysis for learning quality indicates an improvement in students' representative abilities. The conclusion of the study is that the Novick learning model is effective for the representational abilities of students in the Mathematics Education Study Program at the Faculty of Teacher Training and Education at UHN.

Keywords: Effectiveness, Novick Learning, Representative Ability, Mathematics Education

INTRODUTION

According to Law No. 20 of 2003, the goal of national education is to educate the nation, develop the potential of students, and shape the character and civilization of a dignified nation (Abdullah, 2022; Pelawi et al., 2021) . This requires all educators, both teachers and lecturers, to develop their teaching skills and continually update all their abilities according to developments in the era, technology, and stakeholder demands (Parwati Ni Putu Yuniarika & Pramartha I Nyoman Bayu, 2021; Ubabuddin, 2019). Numerous studies showing an increase in students' cognitive abilities (including university students) prove that teachers (both teachers and lecturers) are increasingly improving their teaching skills (Karyati, 2024; Situmorang, Sauduran, et al., 2024). This cognitive

improvement was successfully achieved by conducting learning using learning models, where one of these learning models is the Novick learning model (Situmorang, Tambunan, et al., 2022; Situmorang, Sauduran, et al., 2024). We know that, students' mathematical representation ability is an ability possessed by a student in conveying or presenting mathematical ideas on a mathematical problem in various ways (Sauduran et al., 2024). A student is said to have representative ability if the student has been able to: 1) represent the solution to a mathematical problem in the form of a picture, chart, or table. 2) represent mathematical statements or notations and algebraic forms of the problem solution. 3) verbally represent all solutions to mathematical problems (Sari et al., 2020).

The Novick learning model emphasizes the process of building students' conceptual mastery in a meaningful way, enabling them to master the concepts in depth (Situmorang, Siauduran, et al., 2024). This learning model helps students understand concepts and creates relationships between one topic and another. With this model, the teacher facilitates, guides, and directs students in developing concepts (Haniyah, 2022; Nopiyadi, 2022). So, we can say that Novick's learning model can improve students' representational abilities because it prioritizes students' mastery of mathematical concepts. A strong grasp of these concepts will make it easier for students to represent solutions to mathematical problems, whether in the form of pictures, charts, tables, or mathematical symbols.

However, the improvement in student learning outcomes during learning (especially learning using the Novick model) is not sufficient to prove that students' representative abilities have improved permanently. This is because the sample studied was humans as dynamic beings (Kristiyanto, 2014, where humans can change and develop along with their interactions with the environment, both physically, mentally, and socially (Hyun et al., 2020).

Therefore, to further ensure whether this Novick model is very good for use in improving representative abilities, it is necessary to see the effectiveness of the Novick learning model on students' representative abilities because learning effectiveness will see the quality of learning, the suitability of learning, and the efficiency of learning time (Situmorang, Siahaan, et al., 2022). This is in accordance with the suggestions from previous research entitled "Improving the Representative Ability of Mathematics Education Students of FKIP UHN with the Novick model" (Situmorang, Sauduran, et al., 2024) as well as the roadmap of this research

RESEARCH METHODS

This type of research is quantitative research and uses descriptive method. The researcher conducted the research by giving a pretest/post t -test as a supporting technique, to obtain an overview of the suitability of the learning outcomes of representative abilities with the Novick learning model on the first indicator of effectiveness (Putri, Anwar, & Nasution, 2022). This study has a control group but cannot function fully to control external variables that affect the implementation of the experiment. This study will also conduct observations on the active activities of students and lecturers to see the achievement of the

second indicator of effectiveness (Rezeki & Mutia, 2020). The observation sheet for achieving the ideal time (PWI) to see the achievement of the third indicator of effectiveness (Situmorang, 2023) . This study will select two classes directly, where one class is planned to be used as an experimental class (treatment) and the other class as a comparison class or control class. The experimental class is given treatment, namely the provision of the Novick learning model, while the control class carries out the learning process with a conventional model (Arafa, Dwiastuti, Fatmawati, & Mahanani, 2021).

The research was planned by taking the population of all students of the Mathematics Education Study Program, FKIP UHN Medan. Sampling was carried out by determining the sample, namely all students who took the Mathematics learning program development course which consisted of two classes. Using random sampling techniques, one class was selected as the experimental group and one class as the control group. The research data taken from the selected samples will be analyzed using SPSS to find improvements in the representative abilities of students (Dachi et al., 2023).

The instruments used in this study were: 1) Test. Test of ability to solve pretest and posttest questions. Before the test is used on a sample, it is first tested to see its validity and reliability. After the trial, the valid questions are then re-validated by a validator who is a lecturer in the field of mathematics, to determine whether the questions used are in accordance with the objectives to be achieved. There are four stages in developing a test, namely: 1) Compiling Question Grids, aiming to produce a test with the same instrument. 2) Compiling Questions, designed to be used as an evaluation tool to measure the achievement of objectives. 3) Content Validity, is an assessment of the elements in the measuring instrument using rational analysis that cannot be expressed in numerical form. 4) Instrument Test, aims to obtain a good test related to the accuracy and precision of the designed instrument. 2) Observation Sheet (Aras, Akina, Lestari, & Rahmat, 2022). The observation sheet for active student and lecturer activities is used to see the suitability of learning with the Novick model, whether it is in accordance with the RPS that has been prepared or not. An observation sheet for achieving the ideal time will also be used to see the ideal time needed to deliver material using the Novick model (Rezeki, 2017).

The data collection techniques used in this study were pretest and posttest which were used in descriptive form, to obtain data on students' representative abilities with the Novick learning model. Before the test questions are given to students, the test questions are first validated by the validator to determine the validity of the questions. After that, the questions can be tested in the experimental class and the control class (Sihombing, 2022).

For data analysis, two tests were carried out, namely a two-way ANOVA test, a secretion test, and a research hypothesis test. If the resulting data is normally distributed and homogeneous, the researcher uses a Two-Way ANOVA test followed by a Scheffe test. A two-way ANOVA test is performed to compare several means from several categories or groups for a single treatment variable to determine whether there is an increase in various criteria tested towards the desired outcome. The Scheffe test is performed to make unplanned comparisons between group means in an analysis of variance experiment, so

that this test will determine whether the increase that occurs is entirely influenced by the treatment or is influenced by other factors (Ni'matuzzahroh, 2020a).

RESULTS AND DISCUSSION

In accordance with the objectives of this study, namely to see: 1. The suitability of the learning level from the results of observations of active student activities and the suitability of teaching and learning by lecturers with the steps of the Novick learning model (Nopiyadi, 2022). 2. Seeing the ideal time obtained from the results of observations of ideal time with tolerance time limits. 3. Seeing the quality of learning with the Novick learning model, the following will present the results obtained from the field (Ni'matuzzahroh, 2020b).

1. Learning Suitability.

The suitability of learning using the Novick learning model in this study will be seen from observations of active student activities and observations of the suitability of lecturers' teaching with the steps of the Novick learning model (Mangunsong, Syahbana, & Nopriyanti, 2019). The rubric for the observation sheet used is as follows.

Table 1. Rubric for Student Active Activity Observation Sheet

Student Active Activity Observation Indicators According to the Novick Model	**Observation Result Assessment Categories**				
	1	**2**	**3**	**4**	**5**
Listening to the teacher's directions when conveying learning objectives and apperception					
Providing responses to learning motivation and material presentation given by the teacher					
Student activity in representing discussion results					
The role of students in providing alternative initial frameworks					
The role of students in building initial concepts from the problems studied					
Student responses during the process of providing conclusions on learning outcomes					

Table 2. Rubric for Observation Sheet on the Suitability of Lecturers' Teaching Using the Novick Learning Model

Observation Indicators of Lecturer Teaching Suitability Using the Novick Model	Observation Result Assessment Categories				
	1	2	3	4	5
Greeting and checking student attendance					
Conveying learning objectives and apperception					
Motivate students to learn by providing concrete problems					
Presenting concrete problems in accordance with the PPPM course					
Ask students to examine alternative new frameworks according to the problems presented.					
Invite students to present new problems according to the example problems that have been given.					
Inviting students to build new concepts from the learning process that has been implemented					
Invite students to conclude the learning outcomes					

The observation sheets were given to three observers. Each observer observed the students' active activities and the suitability of the lecturer's teaching with the Novick learning model. The results of the observations obtained are as follows.

Table 3. Results of Observations of Student Active Activities

Student Active Activity Observation Indicators	Observer			Average
	1	2	3	
Indicator 1	5	4	5	4.66667
Indicator 2	4	5	4	4.33333
Indicator 3	5	4	4	4.33333

Indicator 4	4	5	4	4.33333
Indicator 5	4	4	4	4
Indicator 6	4	4	4	4
Total Average				4.27778

By consulting the observation results on the assessment criteria:

1.00 – 1.49	is not good
1.50 – 2.49	is not good
2.50 – 3.00 is	quite good
3.0 0 – 4.00	good
4.0 0 – 5.00	very good

Therefore, the average observation results for each indicator, from indicator 1 to indicator 7, presented in Table 3, show that the average is in the interval of 4.00-5.00, in the "very good" category. Furthermore, the total average observation results also indicate that student activeness during learning using the Novick model is in the "very good" category. Next, the results of observations on the suitability of lecturers' teaching using the established learning model will be presented.

Table 4. Observation Results of the Suitability of Lecturers' Teaching with the Novick Learning Model

Lecturer Teaching Suitability Observation Indicators	**Observer**			**Average**
	1	**2**	**3**	
Indicator 1	5	5	5	5
Indicator 2	4	5	5	4.66667
Indicator 3	5	4	4	4.33333
Indicator 4	5	5	4	4.66667
Indicator 5	4	5	5	4.66667
Indicator 6	4	4	5	4.33333
Indicator 7	5	4	5	4.66667

Indicator 8	4	5	4	4.33333
Total Average				4.58333

After consulting the average observation results of the lecturer's teaching suitability on the established assessment criteria, we obtain the results that each observation indicator starting from indicator 1 to indicator 8 in table 4 shows that the average observation is in the interval of 4.00-5.00, the "very good" category. Even the total average observation results also show that the lecturer's teaching ability is in accordance with the steps of the Novick learning model because the average observation results are in the "very good" category.

2. Ideal Time

The ideal time in this study aims to see whether the delivery of teaching materials using the Novick learning model in the Mathematics Learning Program Development course by lecturers until students understand the learning objectives is in what category. The rubric for the ideal time observation sheet is presented in Table 5 below.

Table 5. Rubric for the Ideal Time Observation Sheet Using the Novick Model

The th meeting	Time Normal	Time of achievement	Category 1 2 3 4 5	Total
1				
2				
.				
.				
.				
.				
etc.				

Information:

1 = Time longer achievement is above 40 % of the time in RPS.

2 = The achievement time is longer, approximately 15 %- 39 % of RPS time

3 = Achievement time same as RPS or older 1 4% of RPS time

4 = Achievement time is faster up to 1.5 % of RPS time

5 = Fast achievement time reaches above 1.6 % of RPS time

The ideal time observation sheets were given to four observers. Each observer recorded the time required by the lecturer to deliver the material at each PPPM lecture meeting by consulting the normal time set in the course RPS. The results of the ideal time achieved in this study are presented in Table 6 below.

Table 6. Results of Ideal Time Observations Using the Novick Model

The th meeting	Observer				Average
	1	2	3	4	
1	5	5	5	5	5
2	5	5	5	5	5
3	4	5	4	5	4.5
4	5	5	5	5	5
5	5	4	5	4	4.5
6	5	5	5	5	5
7	5	5	5	5	5
8	5	5	5	5	5
9	5	5	5	5	5
10	4	4	5	5	4.5
11	5	4	4	5	4.5
12	5	5	5	5	5
13	5	5	5	5	5
14	5	5	5	5	5
Total average					4.85714

From the table above, it can be seen that the ideal time achievement interval at each meeting is in the interval 4.5 -5 and the total average ideal time achievement is 4.85714. By consulting the ideal time observation results listed in table 6 above on the assessment criteria interval, it can be concluded that the ideal time achievement category is in the "Very Good" category.

3. Improving Students' Representative Ability

To see the quality of learning in this study, data analysis was carried out on representative student ability data, to see whether there was a significant increase after learning using the Novick learning model. Data were obtained from learning outcome tests that measure representative student abilities. The data obtained will be subjected to inferential data analysis to determine improvements using SPSS.

Before conducting inferential data analysis to see the increase in students' representative abilities that occurred, normality and homogeneity tests were first carried out. The results of the normality and homogeneity tests are presented as follows.

Table 7. Tests of Normality

	Kolmogorov-Smirnov [a]			Shapiro-Wilk		
	Statistics	df	Sig.	Statistics	df	Sig.
Experimental_Representative_Ability	.120	40	.147	.968	40	.322
Representative_Control_Ability	.105	40	.200*	.967	40	.289

*. This is a lower bound of the true significance.
a. Lilliefors Significance Correction

From the Kolmogorov-Smimov normality test table, it can be seen that the sig. value for the experimental class is 0.147 > 0.05 and for the control class is 0.200 > 0.05. The Shapiro-Wilk table also shows a sig. value for the experimental class of 0.322 > 0.05 and for the experimental class of 0.289 > 0.05. This indicates that both data are normally distributed. The homogeneity test will be presented in the following section.

Table 8. Test of Homogeneity of Variances

Representative Ability			
Levene Statistics	df1	df2	Sig.
.195	1	78	.660

Table 7 shows that the significant value of homogeneity for each data variant is 0.66 > 0.05. This indicates that both data come from homogeneous groups.

Next, we will present the ANOVA results for both sets of data. This analysis was conducted to determine whether there was a difference in the average variance of the two data sets . The following is a presentation of the results of the analysis using SPSS.

Table 9. ANOVA Calculation Results

Representative Ability					
	Sum of Squares	df	Mean Square	F	Sig.

Between Groups	3,042	1	3,042	40,910	.000
Within Groups	5,800	78	.074		
Total	8,842	79			

From the ANOVA calculation table above, it can be seen that the sig. value = 0.00 < 0.05, which means there is a difference in the average variance of the two data groups, indicating that there is an increase in the representative ability of students who take the P3M course due to the treatment.

Further testing will be conducted using the Scheffe test. The results obtained are as follows.

Table 10. Tests of Between-Subjects Effects

Dependent Variable: Representative_Ability

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	8.018 [a]	5	1,604	144,060	.000
Intercept	6159.596	1	6159.596	553332.373	.000
Novick Learning Model	2,682	1	2,682	240,926	.000
Conventional Learning Model	4,950	2	2,475	222,335	.000
Learning_Model Class_Level	*.012	2	.006	.544	.583
Error	.824	74	.011		
Total	6182.940	80			
Corrected Total	8,842	79			

a. R Squared =.907 (Adjusted R Squared =.901)

From Table 10, it can be seen that the F value for the Novick learning model is 240.926 with a significant value of 0.00 < 0.05, which means there was an increase in representative ability in the experimental group and the F value for the conventional model is 222.335 with a significant value of 0.00 < 0.05, which means that there was also an increase in representative ability in the control class. So it can be concluded that

Table 11. Multiple Comparisons

Dependent Variable: Representative_Ability

		Std. Error	Sig.	95% Confidence Interval

	(I) Class_Level	(J) Class_Level	Mean Difference (IJ)			Lower Bound	Upper Bound
Scheffe	Low	Currently	-.3000 *	.02872	.000	-.3717	-.2283
		Tall	-.6338 *	.02899	.000	-.7062	-.5613
	Currently	Low	.3000 *	.02872	.000	.2283	.3717
		Tall	-.3338 *	.02899	.000	-.4062	-.2613
	Tall	Low	.6338 *	.02899	.000	.5613	.7062
		Currently	.3338 *	.02899	.000	.2613	.4062

Based on observed means.

The error term is Mean Square(Error) =.011.

*. The mean difference is significant at the 0.05 level.

From Table 11 for the Scheffe test, it can be seen that in the low, medium, and high groups, there was a significant increase as indicated by the sig. results for each class level of 0.00 < 0.05. So it can be concluded that there was an increase in students' representative abilities caused by the treatment using the Novick learning model (Sulistiawati, Rahman, & Alatubir, 2019).

CONCLUSION

From the research results, it can be seen that the results of learning suitability are in the "very good" category, the results of the ideal time observation also show that it is in the "very good" category, and the results of data analysis to see the quality of teaching also show that there is an increase in the representative abilities of mathematics education study program students by using the Novick learning model

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