



**THE APPLICATION OF GENERATIVE LEARNING MODEL
BASED ON REMEDIAL INTEGRATION IN REDUCING STUDENT
MISCONCEPTIONS**

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Abstract

This study was aimed to examine the effect of a remedial-integrated activity on dynamic fluids materials using generative learning to reduce student misconception in Senior High Schools (SMA). Pre-experimental method with the design of pretest-posttest control group was used in this study. This study was held in SMAN 7 Pontianak, West Kalimantan, involving the total number of 36 students from which were selected randomly at XI MIPA Class (Eleventh grade of Natural Science Class) using the random sampling with intact group technique. The instrument of this study used was the total question of a diagnostic test with 18 multiple-choice questionnaires. Then, the collected data was analysed using a descriptive statistic and t-test. The result of this study revealed that the remedial integration on Physics misconceptions positively decreased the levels of student misconceptions in Senior High Schools against dynamic fluids materials.

Keywords: *Generative Model, Remedial Integration, Misconception, Dynamic Fluids*

The alteration of Competency-Based Curriculum becoming to the Education Unit Level Curriculum (KTSP) and finally adapting to the 2013 Curriculum is a government effort to improve the quality of education in Indonesia. The curriculum refinement process is the attempt thrived by the government to respond to the changes of need and community development in the field of education (Mulyasa, 2019).

The 2013 curriculum is fundamentally constructed on the competencies that should be owned by students after finishing their learnings. One of the main principles in implementing this curriculum is a completed-learning concept (mastery learning), in which each student is allocated times according to their needs in order to achieve the established learning objectives (Miller, et al., 2009). The implementation of completed



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learning in the learning process is formed in the determination of minimal complete criteria (KKM) as a successful indicator of the achievement of learning outcomes.

The principle of complete learning suggested that each student is expected to reach to the KKM before continuing to the next materials. This suggestion concerns the capability of the students in facing difficulties and needing assistance to overcome possible problems appeared during the learning process. Based on the discussion on the learning outcomes of Physics in the eleventh-grade students (XI) SMAN 7 Pontianak, it was shown that plenty of students were still having difficulties, including in the dynamic fluid materials, due to massive memorising of concepts and formulas to answer questions during the learning activity. This is enforced with the result of documentation analysis against the learning results of fluid materials in eleventh-grade (XI class) students with Natural Science major in the academic year of 2016-2017, showing that 66,67% of students were averagely under the KKM. The struggles on the fluid materials were also encountered by Sabariasih (2015), in which 100% of eleventh-grade (XI class MIA) students in one of the Senior High Schools in Surakarta was also below the KKM.

The forms of difficulty experienced by students in learning physics are the incapability of understanding a concept and solving physics questions (Wenno, 2016; Sutarja, et al., 2016; Purnamasari, et al., 2017). These struggles are identified by the misconceptions produced by students in learning Physics, in which the student conceptions are against the scientist's (Suparno, 2013; Kirbulut & Geban, 2014). The incorrect pre-conceptions in

learning Physics leads to the unsatisfied learning outcomes resulting in the low marks in students. Moreover, Oluwasegun (2018) discovered that misconception is also the cause of poor learning outcomes in Physics for prospective teachers in Nigeria compared to other subjects. Due to Physics linked to concept-to-concept, a misconception is usually triggered to appear on the student's thoughts in which leading to another misconception on other materials. Therefore, it is crucially required to be fixed in order to prevent a continuous mis-conceptual process.

Generally, students consider that solving Physics problems is difficult. This reflects the learning outcomes that are still under the learning expectations (Duit & Schecker, 2010). Even, the investigation resulted from Uwizeyimana, et al. (2018) revealed that only 8.2% of research samples confessing of having no trouble during the completion of question tests.

The finding of Gunada & Roswiani (2019) disclosed that lack of practices and absence of habit in doing question tests are the factors contributing to the incapability of student in resolving Physics problems. Meanwhile, according to Eikici (2016), struggles in learning physics are caused by a paradigm created by students who think that the scope of materials and concepts to be learnt at schools are too massive compared to the actual needs in real life. Besides that, mathematics equations that are challenging to understand can bring students to wrong interpretations of a concept in Physics problems (Sutarja, et al., 2016). This results in students who are still experiencing difficulties in resolving Physics question tests. Hence, a learning activity that can improve and

increase the skills of problem-solved learning in students is fundamentally crucial to be implemented in a classroom in order to help them overcome their learning problems.

To anticipate misconception, Suparno (2013) suggested an alternative way to tackle this issue in students. The misconception-anticipating method begins with analysing the error forms generated by students and investigating the causes. By conducting a precise diagnosis, a refinement effort can be held with an accurate method. The most often activity done to reduce misconception is remediation (reteaching). Remediation is a process to help students overcome their difficulties at learning, particularly in misconceptions they have (Sutrisno, Kresnadi, & Kartono, 2007).

Remedial teaching is a learning assistance program provided for students, who experience problems and difficulties in learning and who failed to achieve completeness minimum standard (KKM), in order to be able to continue to the next modules. The regulation of the Ministry of Education and Culture of the Republic of Indonesia Number 104 in 2014 regarding the Guidelines of Determination in Learning Outcomes, stating that a student who has not achieved the minimum standard criteria, namely KKM, is giving another chance to join in a remedial teaching after obtaining the results of learning individually, in a group or class. Most of the remedial teachings have been implemented; Taufik (2012) remedied misconceptions on prospective teachers in Newton concept through the application of the 5E learning cycle. Sabariasih (2015) also found that remedial teaching can improve learning outcomes in cognitive aspects of students in dynamic fluids materials

through the application of Snowball Throwing model on high school students in Surakarta. Moreover, Haeroni, et al. (2019) implemented a model of learning cycle in the optics material discovering that remediation is effectively decreasing student misconceptions.

Generally, remediation is conducted after the learning process and the evaluation of learning outcomes, in which there will be required additional time to perform it. However, based on the interview with teachers from SMAN 7 Pontianak, the most often remedial activity done in the school is by providing an additional test (resit exam) to students who failed in achieving the KKM. Whereas, the remedial activity in the form of a resit exam preceded with a diagnosis in difficulty in students is rare. In addition, there is limited time at school for this, according to the teacher's opinions. Therefore, the alternative solution offered to overcome the problem of additional time for the implementation of student misconception remediation is, by giving the misconception remediation during the ongoing learning process, known as remedial integration. Learning that integrates with a remedial activity constitutes a refinement action against misconceptions presenting in a more interactive learning process and emphasising more on a concept, in expecting to have the conceptual changing in students. A previous study that applied this remedial integration on momentum and impulse materials showed that this learning method is effective in decreasing the levels of misconception in students and is efficient in the learning process because it fits with the semester plan designed by teachers (Silitonga, et al., 2019). Hence, this study design is concomitantly

carried out with the learning process using the generative learning model.

The generative model constitutes a learning model as a result of studies from the theoretical application of generative studying, which is a cognitive model on how a person constructs their own insight. This theory examines a person's attitudes in processing information and actively constructing its meaning (Osborne & Wittrock, 1985; Wittrock, 1992). There are five syntaxes of generative learning: (1) orientation phase, (2) idea-expression phase, (3) challenge and reconstruction phase, (4) implementation phase, (5) backward phase (Katu, 1995). These five learning syntaxes can accommodate students in constructing their understandings according to the constructivism culture at learning. Maknun (2015) demonstrated that the implementation of generative learning is successful in elevating the Physics learning outcomes in students at SMK. In line with this, Irwandani & Rofiah (2015) also unveiled that the application of generative learning in students at MTS in sound materials is more efficient to improve the understanding of a concept in students compared to the conventional learning model, mainly in "comparison" and "explanation" aspect. Therefore, generative learning to improve learning outcomes and to reduce student misconception is applicable as a remedial integration in dynamic fluids material.

METHOD

The method used in this study was an experimental model in the form of Pre-experimental Design with a model of Pretest-posttest Control Design (Sugiyono, 2016). The research population was a group of eleventh-

grade students (XI MIPA class) from SMAN 7 Pontianak in the academic year of 2018/2019, who had not studied the dynamic fluid material, with the total number of 153 pupils. Meanwhile, the research samples were those eleventh-grade students (XI MIPA) from two different classes, with the total number of 36 pupils.

The data collection method used in this study was a measuring technique in the form of a written test (pretest-posttest) with a total of 18 multiple choices questions. Whereas the research instrument was Learning Planning Design (RPP), Student Worksheet (LKS), learning text with refutation format, and questionnaire tests that had been validated by two lecturers of Physics Education (FKIP) at University of Tanjungpura Pontianak (UNTAN) and one Science teacher from SMAN 7 Pontianak. All these instruments were confirmedly validated with proven by the results of a 3.89 average validity value on multiple-choice questions. Based on the try-out conducted by SMAN 7 Pontianak was obtained that the reliability value of multiple-choice questions was moderate (0.45).

The results of pretest-posttest were analysed by searching for student scores before and after the implementation of remedial integration. In this study, data analysis was executed by using independent samples over t-test to investigate the differences between experimental and control class after implementing the misconception-remedial integration in the learning of dynamic fluids material using this generative learning model. The procedure at this learning is consists of three stages: (1) preparation stage, (2) research implementation stage and (3) final stage.

RESULTS AND DISCUSSION

This study was conducted at SMAN 7 Pontianak on the eleventh-grade students from XI MIPA 1 as the experimental class that implemented the integrated remediation and XI MIPA 5 as the control class for the application of conventional learning at the first semester in the academic years of 2018/2019 in the dynamic fluid material. The giving of the pre-test was firstly carried out on the initial meeting using the multiple-choice tests with some short essays of providing reasons with the total of 18 questionnaires. This pre-test aimed to determine and examine the initial conception in students and was analysed to investigate the difficulties at learning in students, including pre-conceptions that were not linked to scientist's concepts. The analysis of student misconception profile is highly imperative as constructive advice in planning the learnings.

Meanwhile, post-test was ultimately executed after completing all three meetings of dynamic fluid materials (3 x 45 minutes). After that, the student's answers of both pre-test and post-test for both classes were recapitulated to generate a percentage of student scores. The increasing percentage can be seen in Table 1.

Table 1. Scores of the Learning Results in Dynamic Fluid Material

	Eksperimental Class	Control Class
N	18	18
Mean Pre-test	5.56	5.44
Mean Post-test	14.50	9.28

The analysis result of the final marks of pre-test and post-test revealed that the average score of pre-test outcomes in the experimental class was 5.56, and the average score for the control class was 5.44. Normality test using SPSS software with Shapiro-Wilk test showed that the significant values for both classes, due to small sample size which was less than 50 Sarjono (2011), were 0.070 and 0.206 which meant greater than 0.05, then it was assumed that the data was normally distributed for both classes.

To examine the differences of pre-test in both classes, Homogeneity test, as the next prerequisite test, was performed using SPSS software, in which unveiled that the significance of Levene test was 0.778, is greater than 0.05. This implied that the variance of pre-test result data for both classes was homogenous. Consequently, the t-test could be then carried out. The t-test using SPSS software exhibited that the most significant value obtained was 0.931, meaning there was no significant difference between the two classes before the study.

Based on Table 1, it showed that the learning outcome of students from the experimental class was higher (14.50) than the control class (9.28). To determine the significant differences of this, the results of post-test were examined with Normality test before using a t-test to further assess for more details.

Normality test with Shapiro-Wilk showed that the significant values for both classes were 0.075 and 0.81, due to sample size of less than 50. These values reflected that the distribution of post-test results in both classes was normal. The analysis of this using SPSS software was presented in Table 2.

Table 2. Normality of Post-Test

	Kolmogorov-Smirnov ^a			Shapiro-Wilk		
	statistic	df	Sig.	Statistic	df	Sig.
RECAP FDM1	,170	18	,178	,907	18	,075
RECAP FDM5	,167	18	.200*	,908	18	,081

Homogeneity in both classes was also analysed according to the SPSS results presenting in Table 3. The significant value demonstrated 0.625 greater than 0.05. Therefore, it confirmedly stated that the variance of post-test results for both classes was homogenous. Due to normally

distributed and homogenous, t-test was then executed with independent samples.

The results of t-test, using hypothesis on the difference of both post-test results, was obtained from analysis in SPSS software, and was displayed in Table 3.

Table 3. The Result of T-test in Experimental and Control Class

		t-test for Equality of Means						
							Interval of the Difference	
		t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Post-Test	Equal variances assumed	-1,571	34	,125	-3,61111	2,29825	-8,28172	1,05950
	Equal variances not assumed	-1,571	33,907	,125	-3,61111	2,29825	-8,28219	1,05997

Based on Table 3, generative learning with remedial integration was applicable effective at learning, primarily in dynamic fluid materials. Besides it can increase learning outcomes in students, it also leads to better results compared to conventional learning applied in the control class. This is in line with the study conducted by Silitonga, et al. (2019), yet in another chapter, impulse and momentum materials.

Overall, students understood more in the dynamic fluid concept after participating in the learning activities with a generative learning model that

integrated to remedial teaching of misconception in learning. There are five (5) stages of the generative learning model that are entirely contributed to the improvement of student's understanding of concepts learnt.

At the orientation stage, as the introductory activity, was aimed to facilitate in phenomena triggering relating to daily life. This was predictable that students were able to link the physics concepts that have been learnt at schools to everyday life. Based on the presented phenomena, teachers were expected to trigger one question addressed to students to nurture an initial

conception in students. In the implementation of remedial integration, the portraits of student misconception were recorded through the analysis results of pre-test done before the learning activities.

Stages of challenge and reconstruction in syntaxes of generative learning were redirected to the occurrence of conceptual changes from incorrect pre-conceptions (misconceptions) to the factual concepts according to scientists. These stages also engage in the cognitive conflicts occurred that are the vital part in the implementation of constructivism learning. As a result, students can fully and actively participate in constructing their own insights (Bada & Olusegun, 2015; Bhattacharjee, 2015).

The implementation stage is the most crucial phase in giving chances to

students to practise applying concepts and principles that have been studied. The application of dynamic fluid material in daily life was expected to help students to see the correlations between concepts and materials learnt with everyday life things. This is reasonably fundamental as students, in general, are not able to see the correlation between sciences learnt at school and things surrounding them in factual life so that they imperatively require to practise in order to obtain insights and skills that are useful in daily life.

The learning of dynamic fluid concept comprises six (6) indicators as the learning targets. The diagram in Figure 1 presented the comparisons of student conception between pre-test and post-test in each student indicator at XI MIPA 1.

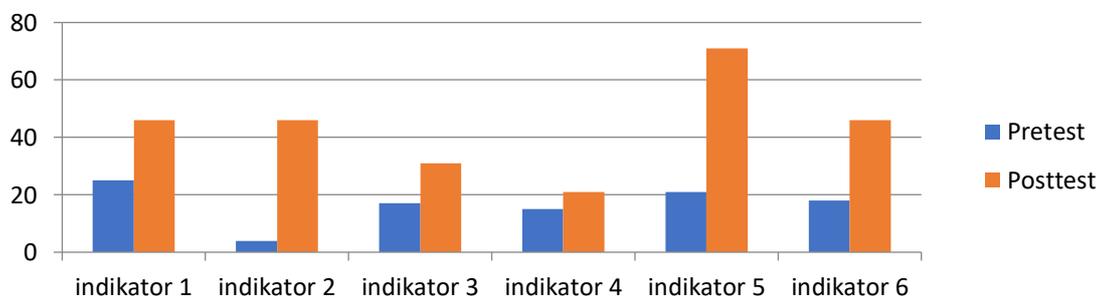


Figure 1. Diagram of Average Score Comparison for Pre-test and Post-test

Findings from the analysis of score changes in student conception at each indicator showed that student conception increased overall indicators of competency achievements. The intensifications of mastery aspects at indicator 2 and 5 were higher than other indicators.

In the pre-test, the most often occurred misconception at indicator 2 was to identify a fluid flow in pipes with different surface areas. Whereas, in the

post-test, there was an increase in student mastery shown from the average post-test scores achieved by students.

Averagely, the highest score of post-tests gained by students was at indicator 5, regarding the determination of a material position on fluid velocity between two enlarged things. Previously, there were still lots of students to experience misconceptions while answering questions at this indicator. For instance, students

considered that two things would have been staying away due to immense pressures between them. Experimental activities implementing at learning after the prior insight trigger by students can facilitate to create a cognitive impulse, and discussions about the experiment results can help students reconstructing their own conception towards the right conceptual insights by scientists. This is agreed by the findings of Riyanti (2018) stating that generative learning was effective to promote critical thinking in students. The escalation of student understanding reflected that the implementation of generative learning with the integrated remedial model was significantly effective to correct misconceptions in students. This is caused due to the existing misconception identified before and during learning can be directly remedied on the process of learning. Silitonga, et al. (2019) also confirmed this results in momentum and impulse materials, who implemented remedial-integrated learnings using interactive conceptual models. The effectivity of generative learning model was also found in the findings of Yuliarti (2016) that concluded that the application of generative learning with scientist's card assistance could promote the cognitive learning outcomes in students and could achieve the minimum standard of 72.88%.

CONCLUSION AND SUGGESTION

Based on these current findings, it was concluded that remedial-integrated programs in Physics learning activities in dynamic fluid material using generative learning can effectively and significantly change misconception in students and can improve the learning outcomes. Therefore, it was suggested that physics learning process integrating with

remediation can be an alternative solution for teachers in anticipating learning difficulties in students in Physics.

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