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Imitative and Creative Reasoning Abilities Viewed from Locus of Control on Guided Inquiry Model React Strategy

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Abstract

The aims of this study were (1) to know the quality of guided inquiry learning with REACT strategy on imitative and creative reasoning abilities, (2) to describe imitative and creative reasoning abilities viewed by internal locus of control on guided inquiry models REACT strategy, and (3) to describe imitative and creative reasoning abilities viewed by external locus of control on guided inquiry model REACT strategy. This study was a mixed method research with using convergent design. The population was 7th grade students of SMP N 3 Ungaran academic year 2017/2018. The subjects was selected based on internal locus of control and eksternal locus of control. The result showed that (1) guided inquiry learning with REACT strategy towards imitative and creative reasoning abilities was on good quality, (2) imitative and creative reasoning abilities of internal locus of control students can be achieved well, (3) imitative reasoning abilities of external locus of control students can be achieved well on indicators bearing in mind the facts, definitions and formulas used, while other indicators have not been achieved, student's creative reasoning ability of external locus of control can be achieved well on indicators explaining the reasons for selection procedures . By knowing the locus of control of students, the teacher can design a learning model that is appropriate to the circumstances of the students. The existence of a guided inquiry learning model REACT strategy can train student's imitative and creative reasoning abilities.

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INTRODUCTION

Curriculum (K13) emphasizes learning with a scientific approach. According to the Regulation of the Minister of Education and Culture of the Republic of Indonesia Number 81A of 2013 concerning Curriculum Implementation, it is explained that in direct learning students carry out learning activities in the form of observing, asking questions, gathering information, associating/ reasoning, and communicating.

The five learning activities are usually called the scientific approach. Based on the Regulation of the Minister of Education and Culture of the Republic of Indonesia Number 22 of 2016, to strengthen the scientific approach it is strongly recommended to implement discovery/ inquiry learning.

Inquiry learning is a learning model that emphasizes discovery. Inquiry is defined by the National Science Foundation (2000) as a process of exploring nature that leads to activities of asking questions, making discoveries, and then testing discoveries in the search for new understanding. Several levels of inquiry according to (Banchi & Bell, 2008) include confirmation inquiry, structured inquiry, guided inquiry, open inquiry.

Guided inquiry (guided inquiry) is the third level of inquiry learning. The teacher gives research questions then students design procedures to test their questions and the explanations produced. The role of the teacher during learning is to provide guidance or direction to students so that the procedures used by students can be accepted (Banchi & Bell, 2008).

Guided inquiry according to (Derbitz & Horne, 2013) was identified as an effort to promote high-level thinking. One type of high-level thinking is reasoning. Research by Fielding-wells, Dole, & Makar (2014) found that teacher guidance was conducted to encourage students to reason. Based on this, it was found that guided inquiry can optimize reasoning abilities.

The goal of teaching mathematics is to help students develop problem solving skills, conceptual understanding, and reasoning skills (Norqvist, Lithner, Jonsson, & Liljekvist, 2016). There are several types of reasoning, they are imitative reasoning and creative reasoning. Imitative reasoning is used by students when solving problems that require memory and creative reasoning is used when dealing with problems that have never been given a solution (Boesen, Lithner, & Palm, 2010).

Research conducted by Derwinger, Neely, & Bäckman (2005) found that someone who was encouraged to create his own memory strategy, eight months later experienced an increase when given a memory test. Based on these studies creative reasoning has been used and obtained longer memory results. In addition to creative reasoning, there is also imitative reasoning, according to Lithner (2007), the use of imitative reasoning saves more time and minimizes errors. This is because parts that are conceptually difficult will be maintained by existing algorithms and simple parts that are left to students. Imitataive and creative reasoning are important for students to get maximum achievement in learning.

Based on the results of the preliminary study on class VII students of Ungaran 3 Junior High School, imitative creative reasoning ability were obtained. Imitative reasoning abilities possessed by students are quite good, but the results of student work are not perfect. The creative reasoning ability of Ungaran 3 Junior High School students is still lacking. This can be explained through the work of students, most of whom have not been able to solve problems in creative reasoning questions.

Increasing the ability of imitative reasoning and creative reasoning needs to be pursued. The selection of learning strategies that can support imitative and creative reasoning skills and guided inquiry models are REACT strategies. In the REACT strategy requires students to be able to associate the previous knowledge they have with the new knowledge that will be accepted. This makes REACT's strategy able to optimize student's imitative and creative reasoning abilities.

The success of a person in learning mathematics is influenced by several factors including internal motivation (Garon-Carrier et al., 2016), self-concept (Suarez-Alvarez, Fernandez-Alonso, & Muniz, 2014), which is an internal factor determining individual success. Internal factors are classified as internal locus of control. In addition to internal factors, success is also determined by other factors, that are the influence of teachers, parents and friends, all of which belong to an external locus of control. Research conducted by Khaleghinezhad (2016) shows the results that locus of

control has a significant relationship with one's academic performance. Not only that, Zahodne (2015) obtained the results of research that one's reasoning was influenced by locus of control in him.

Based on the background, a study was conducted. The research was focused on (1) the quality of guided inquiry learning with REACT strategies on imitative and creative reasoning abilities viewed from student's locus of control, (2) imitative and creative reasoning abilities viewed from internal locus of control in the guided inquiry strategy REACT strategy and (3) imitative and creative reasoning ability viewed from external locus of control in the guided inquiry model REACT strategy.

METHODS

This research is a mix method research in convergent (or parallel or concurrent). According to (Creswell, 2012) convergent designs combine qualitative and quantitative data then use the results to discuss research problems. The population is VII grade students of SMP 3 Ungaran in the even semester of the academic year 2017/2018. Sampling uses purposive sampling where one class will be taken as the experimental class and one class as the control class. This study consists of four stages, namely the preliminary stage, the preparation stage, the implementation stage and the evaluation stage.

Introduction is a step to describe the initial condition. Quantitative research is conducted to determine the imitative and creative reasoning abilities of students in the initial conclusions. Quantitative data obtained using tests, questions taken from Jonsson's research, B (2014). Qualitative research is conducted by interview. Interviews with teachers are conducted to determine the initial conditions of students' abilities. Interviews with students were also conducted to determine the initial conditions of learning.

At the preparation stage of learning, the activities carried out are preparing learning devices that will be used for research. Devices prepared include syllabus, lesson plans, worksheets, learning observation sheets, interview guidelines, test questions imitative and creative reasoning abilities, scale of locus of control students. Learning devices are then validated. Plans for implementing learning, learning observation sheets, interview guidelines were validated by experts, while tests of imitative reasoning abilities and creative reasoning after expert validation were carried out trials.

The implementation stage of learning begins with giving a scale of locus of control to students. This stage uses experimental research with the design of Posttest Only Control Design. There are two research groups namely the experimental group and the control group. To find out the class in the same initial conditions, several prerequisite tests need to be carried out, including the normality test, homogeneity test. The data used as a prerequisite test in the selection of samples is the result of the test data on the initial abilities of imitative reasoning and students' creative reasoning.

In the experimental group, the treatment was given in the form of learning with guided inquiry model REACT strategy. In the control group were not given special treatment. The evaluation stage is at the next meeting after the learning is complete. At this stage a test is given to obtain quantitative data on imitative and creative reasoning abilities. Qualitative data is needed to support quantitative data. Qualitative data is obtained from the results of interviews with selected students.

RESULT AND DISCUSSION

The Quality of Guided Inquiry Learning with REACT Strategy

The average syllabus, lesson plans, student worksheets and test questions imitative and creative reasoning ability are included in the good category. Mathematics learning preparation with guided inquiry model REACT strategy is good quality.

The percentage of implementation of learning at the first meeting reached 82.5% the criteria is high. The second meeting reached 85.6% the criteria achieved were very high. At the third meeting 88.7% of criteria were very high. In this case, observations of researchers can describe learning during the three meetings well.

The results of the student response questionnaire analysis showed that the average percentage of student's response scores reached 83%. In this case, the response of students to the

implementation of guided inquiry learning REACT strategy can be said to be good.

The average imitative reasoning ability and creative reasoning of students subject to the guided inquiry learning model REACT strategy more than 70 is indicated by the results of the acquisition $t_{value} = 4{,}91 > 1{,}69 = t_{table}$. The proportion of students has reached more than 75% completeness indicated by $z_{value} = 1{,}97 > 1{,}64 = z_{table}$.

The average imitative reasoning and creative reasoning ability of students who get guided inquiry learning REACT strategy is more than the average imitative reasoning creative reasoning ability of students with conventional learning models this is obtained based on calculations where $t_{value} = 4{,}12 > 1{,}67 = t_{table}$.

The proportion of imitative reasoning abilities and creative reasoning of students with the guided inquiry model REACT strategy is more than students taught with conventional learning models obtained from the calculation of $z_{value} = 4{,}91 > 1{,}64 = z_{table}$. Based on the three stages that have been carried out during the study it can be concluded that guided inquiry learning REACT strategies are said to be of high quality.

Imitative and Creative Reasoning Viewed from Internal Locus of Control

Based on the results of the study, student's imitative and creative reasoning ability with internal locus of control can be achieved well. The achievement of imitative reasoning abilities and creative reasoning of the internal locus of control students is shown in Table 1.

Table 1. Achievements in Each Students Indicator Internal Locus of Control

Types of Reasoning	Indicator	Subjects of Internal Locus of Control		
		IN-20	IN-27	IN-30
Imitative Reasoning	Given the facts, definitions, formulas used	Can remember facts and formulas well.	Facts can be remembered well. The formula is not fully remembered.	Can remember facts and formulas well.
	Choose strategies that have been used in writing answers	Can choose the right strategy.	The chosen strategy is still not suitable.	Can choose the right strategy.
	Can determine the final result by using a previously chosen strategy	Can determine the final result correctly but the unit used is not perfect.	The final results can be determined precisely if the chosen strategy is right.	Can determine the final result as it should.
Creative Reasoning	Determine new problem solving procedures	Can determine the procedures in detail.	Can determine the procedures in detail.	The procedure written is simple and correct
	Explain the reasons for choosing a procedure	Can explain the reasons for choosing a procedure	Can explain the reasons for choosing a procedure	Can explain the reasons for choosing a procedure
	The reasons are based on mathematical properties	The reasons given are based on the step of completion chosen	The reasons given are based on known mathematical problems	The reasons are based on the step of completion chosen.

Students with internal locus of control have similarity achievements on the first indicator, namely "remembering facts, definitions, formulas used". The three research subjects were IN-20, IN-27 and IN-30 were able to remember the facts well.

The second indicator of imitative reasoning is "choosing a strategy that was used in writing answers" has quite good results. IN-20 and IN-30 subjects were able to choose the strategy correctly. IN-27 subjects have errors when choosing a settlement strategy on the right trapezoidal area. IN-27 explained during the interview that he confused between the trapezoidal area formula and the parallelogram area formula.

On the third indicator, the results obtained varied from the three research subjects who had internal locus of control, but the third indicator could be achieved well. IN-20 subjects were able to answer mathematical calculations correctly. The IN-27 subject was right when determining the results of the circumference calculation, but for extensive calculations it was not right because the choice of strategy was wrong. The final results made by the IN-30 subject are perfect, the calculations and units used are correct.

The three indicators can be achived well even though the answers given vary. The research conducted by Saragih (2011) found that student's reasoning abilities with internal locus of control were better than those with external locus of control. Internal locus of control significantly influences learning outcomes (Achadiyah, 2013). This is because someone with an internal locus of control tries to overcome a related problem (Widyastuti, 2015).

Imitative and Creative Reasoning Viewed from Internal Locus of Control

Imitative and creative reasoning ability of students with external locus of control are shown in Table 2.

Table 2. Achievements In Each Students Indicator Eksternal Locus Of Control

Types of Reasoning	Indicator	Subject Eksternal Locus of Control		
		EK-18	EK-22	EK-28
Imitative Reasoning	Given the facts, definitions, formulas used	Cannot remember well the facts and formulas used	Can remember facts well enough. But it's not good enough when considering the formula	Can remember facts. Can remember the formula but the writing is not right
	Choose strategies that have been used in writing answers	Hard to choose the strategies used in writing answers	The strategy used is not fully appropriate. Only one correct answer	The strategy chosen is not in accordance with the rules that should be.
	Can determine the final result by using a previously chosen strategy	Cannot determine the final result because the chosen strategy is wrong	The final results obtained are only one that is in accordance with the expected answers	The final result is appropriate even though the strategy is not right
Creative Reasoning	Determine new problem solving procedures	Cannot determine the procedure for solving new problems	Not yet able to determine the settlement procedure independently	Belum tepat ketika menentukan prosedur penyelesaian
	Explain the reasons for choosing a procedure	Cannot explain the reason for choosing the procedure	Can give reasons for the chosen procedure	Can give reasons for the chosen procedure
	The reasons are based on mathematical properties	The reasons have not been based on mathematical characteristics	The reason has not been based on the characteristics of mathematics	The reason has not been based on the characteristics of mathematics

Based on the three indicators varied results were obtained on the subject of external locus of control. The first indicator is "remembering facts, definitions, formulas used" to get different results for each subject. At EK-18 information is obtained that he cannot remember facts and formulas properly. The EK-22 subject can remember the facts well but it is not good enough when considering the formula. The EK-28 subject can remember facts and formulas but there is no exact formula.

The second indicator has the same results on students external locus of control. The EK-18, EK-22 and EK-28 subjects have not complied the second indicator. EK-18 has difficulty choosing the strategies. EK-22 subjects cannot yet choose the appropriate strategy. While the EK-28 subject was not precise in writing down the strategy

On the third indicator the results obtained vary. The subject of EK-18 and EK-22 is not right when determining the final result. EK-18 and EK-22 subjects chose the wrong strategy so that the results obtained were also incorrect. While the EK-28 subject can determine the final result correctly even though the strategy used is wrong. EK-28 is confused when remembering the formula used, but he understands the strategy used.

The results obtained on the imitative reasoning abilities of the external locus of control students is vary. The first indicator does not have same results. The second indicator gives the same results where all three subjects have difficulty choosing a settlement strategy. The third indicator gives diffecent results on each students.

Creative reasoning ability in external locus of control students viewed from each indicator is as follows. In the first indicators EK-18, EK-22 and EK-28 have not been able to achieve it independently. The subject needs the help of the teacher when determining the procedure for solving new problems.

The second indicator has varying results where the EK-18 subject cannot reach but the EK-22 and EK-28 subjects can. The EK-18 subject could not give a reason even though he had been asked a question by teacher.

On the third indicator the results obtained are the same, where the three subjects have not met the indicator. The subjects EK-18, EK-22 and EK-28 when giving reasons are not based on mathematical properties. Students only answer improbably without arguments based on known questions.

Student's creative reasoning abilities with external locus of control have different achievements on each indicator. The first and third indicators give the same results where the subject has not been able to achieve it. The second indicator gives different results, some subjects are able to reach but some others cannot reach it.

CONCLUSION

Based on the results of the research and discussion obtained the following conclusions. (1) Guided inquiry learning REACT strategy towards imitative reasoning abilities and creative reasoning abilities are of good quality. Shown by the following things. (a) Preparation of mathematics learning with a guided inquiry model with REACT strategy has good quality. (b) The implementation of learning that has been carried out has good quality. (c) Most students give a good assessment of guided inquiry learning REACT strategy. The average imitative reasoning ability and creative reasoning of students who are subject to the guided inquiry learning model REACT strategy is more than 70. The proportion of students has reached more than 75% completeness. The average imitative reasoning ability and creative reasoning of students who get guided inquiry learning REACT strategy is more than the average imitative reasoning ability and creative reasoning of students with the STAD learning model. The proportion of imitative reasoning abilities and creative reasoning of students with guided inquiry models REACT strategies are more than students taught with the STAD learning model. (2) Imitative and creative reasoning ability are viewed from internal locus of control. Imitative and creative reasoning reasoning ability of students who have internal locus of control are students able to achieve all three indicators well. (3) Imitative reasoning abilities and creative reasoning are viewed from external locus of control. (a) The imitative reasoning ability of students with external locus of control is that of the three research indicators, only indicators remember the facts, definitions and formulas used that can be achieved properly. (b) The ability of students' creative reasoning of external locus

of control is that of the three indicators, only one indicator is fulfilled, namely explaining the reasons for the selection of procedure.

By knowing the locus of control of students, teachers can design the appropriate learning. Guided inquiry learning with REACT strategies can optimize imitative reasoning abilities and students' creative reasoning. The achievement of students' imitative reasoning and creative reasoning abilities based on external locus of control varies. This needs to be carried out further research to find out the reasons for the differences in achievement.

REFERENCE

Achadiyah, B. N., Laily, N. 2013. "Pengaruh Locus of Control Terhadap Hasil Belajar Mahasiswa Akuntansi". *Jurnal Pendidikan Akuntansi Indonesia*, 11(2): 11-18.

Banchi, H., Bell, R. 2008. "The Many Levels of Inquiry". *Science and Children,* 26–29.

Boesen, J., Lithner, J., Palm, T. 2010. "The relation between types of assessment tasks and the mathematical reasoning students use". *Educational Studies in Mathematics*, 75(1): 89–105.

Creswell, J. W. 2012. *Educational research: Planning, conducting, and evaluating quantitative and qualitative research, Fourth Edition*. Boston: Pearson.

Derwinger, A., Neely, A. S., Bäckman, L. 2005. "Design your own memory strategies! Self-generated strategy training versus mnemonic training in old age: An 8-month follow-up". *Neuropsychological Rehabilitation*, 15(1): 37–54.

Derwinger, A., Neely, A. S., Bäckman, L. 2005. "Design your own memory strategies! Self-generated strategy training versus mnemonic training in old age: An 8-month follow-up". *Neuropsychological Rehabilitation*, 15(1): 37–54.

Fielding-wells, J., Dole, S., Makar, K. 2014. "Inquiry pedagogy to promote emerging proportional reasoning in primary students". *Mathematics Education Research Journal.*

Garon-Carrier, G., Boivin, M., Guay, F., Kovas, Y., Dionne, G., Lemelin, J. P., Tremblay, R. E. 2016. "Intrinsic Motivation and Achievement in Mathematics in Elementary School: A Longitudinal Investigation of Their Association". *Child Development*, 87(1): 165–175.

Jonsson, B., *et al*. 2014. "Learning Mathematics through Algotithmic and Creaive Reasoning". *Journal of Methematical Behavior*, 36 (2014): 20-32.

Khaleghinezhad, S. A., *et al*. 2016. "Prediction of High School Student's Life Satisfaction and Academic Performance Based on Locus of Control and Self-Esteem". *Int J School Health,* 3(3): 1-7.

Lithner, J. 2007. "A Research Framework for Creative and Imitative Reasoning". *Educ Stud Math*, 67: 255-276

Norqvist, M., Lithner, J., Jonsson, B., & Liljekvist, Y. 2016. "Creative reasoning more beneficial for cognitively weaker students". *Proceedings*. Ninth Congress of the European Society for Research in Mathematics Education. Prague, Februari 2016.

Saragih, S. 2011. "Pengaruh Pendekatan Pembeleajaran dan Locus of Control terhadap Kemampuan Penalaran Matematik Siswa". *Jurnal Kependidikan,* 41(2): 108-119.

Suarez-Alvarez, J., Fernandez-Alonso, R., & Muniz, J. 2014. "Self-concept, motivation, expectations, and socioeconomic level as predictors of academic performance in mathematics". *Learning and Individual Differences*, 30: 118–123.

Widyastuti, N., Widyowati, A. 2015. "Hubungan Antara Locus of Control Internal dengan Kematangan Karir Pada Siswa SMKN 1 Bantul". *Humanitas,* 12(2): 82-89.

Zahodne, L. B., *et al*,. 2015. "External Locus of Control Contributes to Racial Disparities in Memory and Reasoning Training Gains in ACTIVE". *Psycchology and Aging,* 30 (3): 561-572.