

The Effect of PQ4R Strategy and Intellectual Intelligence on Higher Thinking Ability in Mathematics in Elementary Schools

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ABSTRACT

This study aims to determine (1) the influence of PQ4R strategy on higher order thinking skills, (2) the influence of Intellectual Intelligence on HigherOrder Thinking Ability, (3) to see the interaction between learning strategies and intellectual intelligence, this type of research is experimental research with design Experimental research design. The sample in this study is the Vc class as the experimental class and Vd class as the control class in At-Taubah Islamic Elementary School, Jakarta. Data collection method is done by test, the initial test is done to classify the level of intelligence, in this case, is done using the CFIT test, then the results are divided into two levels, namely intellectual intelligence high and intellectual intelligence on average, always given action with the PQ4R strategy and strategy expository. posttests are given to measure high-level thinking skills, with Mathematics questions designed by researchers following Olympic and TIMSS questions, which are then expertly Expected. The results of the high-level thinking skills test are then analyzed by prerequisite tests which include, normality test, homogeneity test, and Anava test. Based on the results of data analysis obtained a significant influence on the application of the PQ4R strategy to higher-order thinking skills than the expository strategy of fifth grade students of At-Taubah Islamic Elementary School, there is a significant influence on high intellectual intelligence on higher-order thinking skills than average intellectual intelligence average fifth grade students of At-Taubah Islamic Elementary School, then there is no interaction between learning strategies and intellectual intelligence on high-level thinking skills of class V students of At-Taubah Islamic Elementary School.

Keywords: High-Level Thinking Ability, Intellectual Intelligence Strategy PQ4R, Expository Strategy

1. INTRODUCTION

1.1 Higher Level Thinking Ability

High order thinking skills are defined as the broad use of the mind to find new challenges. Introducing high-level thinking skills that have five levels of thinking such as remembering, understanding, applying, analyzing and evaluating even though this taxonomy was revised by Anderson and Krathwohl with the addition of one more level with the ability to create (Anderson, et al: 2001). High-level thinking ability is a thinking process that involves mental activities in an effort to explore complex, reflective and creative experiences that are carried out consciously to achieve goals, namely acquiring knowledge that includes the level of thinking analyzing, evaluating and creating. (Heong, Y.M: 2011).

Marzano's research in Yee, M. H., Widad et al about the ability to think is very important for students and educators in universities especially. Marzano identified 13 high-level thinking abilities, namely comparing, classifying, inducing, inferring, error analysis, making support, prospective analysis, abstract, decision making, investigation, problem-solving, experimental inquiry, and discovery (Yee, M. H. et. al: 2013). Kruger K in Shukla This high-level thinking ability involves "concept formation, critical thinking, creativity/brainstorming, problem-solving, mental representation, the use of rules, reasoning and logical thinking (Shukla, D : 2016)

Meanwhile, according to King in Wajeeh Daher, higher-order thinking skills include thinking, logic, being able to reflect, relating to metacognition and the ability to think creatively (Wajeeh Daheer, et.al: 2017). Based on the opinions of the experts above, the ability to think creatively is part of high-level thinking skills. Creative thinking is one way to be a creative person. Creative thinking, as the name implies is thinking in order to find original ideas or new things (Dharma Kusuma, et.al : 2010).

Torrance argues in Dharma Kusuma that creative thinking is: "A process of being sensitive to or aware of problems, shortcomings, and gaps in knowledge for which no solution is learned; bring along available information from a memory warehouse or external sources; defining difficulties or identifying missing elements; look for solutions-solutions; suspect, create alternatives to solve problems, test and retest these alternatives; perfect it and finally communicate the results (Dennis K.Filsaime:2008).

From some of the opinions above the researcher limits the ability to think high based on Bloom's taxonomy that has been revised by Anderson, namely the ability to think analytically, evaluate and think creatively.

1.2 Intellectual Intelligence

The aspects of the mind that underlie our ability to think, to solve problems, by providing real reason and knowledge (M. Anderson: 2006). Intelligence is the power to quickly find an adequate solution in solving problems that arise and become a very broad solution search space(D. Lenat and E. Feigenbaum: 1991) The MASEM results confirm that the classroom, psychological and intellectual characteristics of students have a direct effect on HOTS (Prayoonsri Budsankom: 2015). Studies show that performance on intelligence tests correlates with school performance (Ritu Chandra & Sheikh Azimmudin : 2013).

1.3 PQ4R Learning Strategy

The PQ4R strategy was developed by Thomas and Robinson The PQ4R steps consist of reading sultans, asking, reading, reflecting, reading, and reviewing, this strategy is student-centered which helps increase student involvement in learning ((Thomas, E. L., & Robinson, H. A. : 2014). PQ4R is one popular strategy to enable students to understand and maintain what they read. This is a strategy that makes it easy for students to emphasize organizing knowledge and making it effective (Slavin,R.E : 2008). PQ4R Strategy is an efficient strategy that facilitates and engages students during the learning process (Pehofer, et. al: 2003). PQ4R asks readers to give answers and reflect on questions during their journey of reading this way students are attentive throughout learning activities (Dunn, S. Dana: 2006).

1.4 Expository Learning Strategy

The term expository is a form of teacher-oriented approach (Prayekti: 2016). According to Roy Killen in Sumantri expository learning is direct learning (direct instruction). In this system, the teacher presents the material in a form that has been prepared in a neat, systematic and complete manner so that students just listen and digest it regularly and orderly. Students are also required to master the material that has been conveyed. The steps in implementing a learning strategy are preparation, presentation, linking, concluding and applying (Syarif Sumantri : 2016).

The same opinion also expressed by Akinbobola and Afolabi defines that expository learning is direct learning which is a practice of constructivism where student achievement is preferred (Afolabi F., Akinbobola A.O: 2009). While Iheonu identified that in the expository learning process the teacher talked about knowledge and students read about that knowledge (Ibe, H: 2013).

2. RESEARCH METHODOLOGY

This type of research is experimental research with design This experimental research design uses a 2x2 treatment by level design. In the design the independent variable is formed into two sides, namely the first side of the variable treatment with the preview question strategy read reflect recite review (PQ4R) and expository learning strategy (A), the second side is attributed independent variable that is intellectual intelligence classified into two, namely high and low (B). the sample in this study is the V^C class as the experimental class and the class and V^d class as the control class. Data collection method is done by test, the initial test is done to classify the level of intelligence, in this case, is done using the CFIT test, then the results are divided into two levels, namely high intellectual intelligence and intellectual intelligence on average, always given action with the PQ4R strategy and strategy expository. posttests are given to measure high-level thinking skills, with Mathematics questions designed by researchers following Olympic and TIMSS questions, which are then expertly Expected. The results of the high-level thinking skills test are then analyzed by prerequisite tests which include, normality test, homogeneity test, and Anova test.

3. RESULT AND DISCUSSION

Table 1. DESCRIPTIVE STATISTICS

Dependent Variable:HOTS

IQ	Startegi P	Mean	Std. Deviation	N
1 High	1. PQ4R	81.92	10.218	13
	2. Expository	78.43	6.294	7
	Total	166.00	16.512	20
2 Avarage	1.PQ4R	74.18	10.255	11
	2.Expository	71.00	9.871	15
	Total	145.18	20.126	26
Total	1.PQ4R	151.1	20.473	24
	2.Expository	149.43	16.165	22
	Total	300.53	36.638	46

Table 2. Summary of ANOVA

Dependent Variable:HOTS

Source	Type III Sum of Squares	df	Mean Square	F	Significance
Corrected Model	3240.218 ^a	3	1080.073	29.746	.000
Intercept	235414.327	1	235414.327	6483.452	.000
IQ	2958.848	1	2958.848	81.488	.000
Learning Strategy	754.282	1	754.282	20.773	.000
IQ * Learning Strategy	.302	1	.302	.008	.928
Error	1525.021	42	36.310		
Total	269095.000	46			
Corrected Total	4765.239	45			

a. R Squared = ,680 (Adjusted R Squared = ,657)

Based on the results of the analysis of variance (ANOVA) of the two pathways above, the hypothesis testing can be explained as follows:

3.1 First Hypothesis

The difference in higher-order thinking skills in students taught with the PQ4R learning strategy is higher than that of students taught with expository learning strategies.

Based on the ANOVA calculation above, it can be seen that the significant value of data is $0.000 < \text{significant value of } 0.05$, thus H_0 is rejected and the alternative hypothesis H_1 is accepted, meaning that the hypothesis states that there is a difference in higher-order thinking skills between the two groups of students taught with the PQ4R learning strategy and taught with the expository learning strategy as a whole proved to be significant.

This PQ4R learning strategy has been examined by Asrean Hendi from the results of their research which states that there is an effect of PQ4R strategy on mathematical problem-solving abilities, and in this study, he uses expository learning strategies as a control class (Asrean Hendi: 2017). The PQ4R strategy has also been used by B.A. Omoteso and F. A. Sadiku, from the results of their research, concluded that the PQ4R strategy is effective in improving student performance in Chemistry (B.A. Omoteso and F. A. Sadiku: 2013). Subsequent research conducted by Ruqia Bibi showed that scholastic achievements of groups of students taught through the PQ4R learning strategy and groups taught through traditional methods were the same before action. But the scholastic achievement (ability related to logic) of the groups taught through the PQ4R study strategy and from the groups taught through traditional methods differed significantly after the PQ4R action was taken (Ruqia Bibi & Manzoor H. Arif: 2018).

3.2 Second hypothesis

Differences in higher-order thinking skills in students who have an high and average level of intellectual intelligence.

Based on the ANOVA calculation above, it can be seen that the significant value of data is $0.000 < \text{significant value } 0.05$, thus H_0 is rejected and the alternative hypothesis H_1 is accepted, meaning that the hypothesis states that there is a difference in high-level thinking ability between the two groups of students who have intellectual intelligence high and students who have average intellectual intelligence have proven to have a significant influence.

This is in line with research conducted by Ritu Chandra and Sheikh Azimmudin stating that the results showed that intelligence affects students' academic achievement, Children with High IQ have better academic achievement than children with an Average IQ. (Ritu Chandra & Sheikh Azimmudin: 2013). The same research was also carried out by Stephen A. Erath et al, saying that intelligence affects student achievement (Stephen A. Erath, et.al: 2015).

3.3 Third hypothesis

The interaction between learning strategies and intellectual intelligence on higher-order thinking skills (INTAXB).

ANOVA calculation results can be seen that the results of testing the third hypothesis presented in ANAVA table obtained F value of $IQ * SP = 0.008$ with a significance value of $0.928 > 0.05$ or H_0 is received based on value, thus it can be stated that there is no significant interaction effect between learning strategies and intellectual intelligence of students towards higher-order thinking skills. Summary of the results of data calculation through 2×2 ANAVA can be seen in Figure as follows:

Based on the picture above, it can be seen that the average score of high-level thinking ability in each learning strategy treatment with intellectual intelligence does not intersect. This shows that there is no interaction between the two variables, namely learning strategies with intellectual intelligence on higher-order thinking skills, meaning that these two factors only affect the ability to think high-level individually.

This finding is supported by research conducted by (Prayoonsri Budsankom et al: 2015) The results of his study confirm that the classroom environment which includes learning strategies, the way teachers teach and spatial planning and intellectual characteristics of students have a direct effect on HOTS (96.8% explained variance).

4. CONCLUSION

Higher-order thinking skills of students taught with PQ4R learning strategies are higher than high-level thinking skills taught by expository learning strategies. Intellectual intelligence above average has a significant effect on higher-order thinking skills than students who have average intelligence. There is no significant interaction between learning strategies and intellectual intelligence on higher-order thinking skills.

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REFERENCES

1. Afolabi F., Akinbobola A.O. "Constructivist problem based learning technique and the academic achievement of physics student with low ability level in Nigerian secondary schools". *Eur. J. of Phys. Chem. Educ.*, 1(1), 2009, h. 45-51.
2. Anderson, Lorin W.; Krathwohl, David R., eds. *A taxonomy for learning, teaching, and assessing: A revision of Bloom's taxonomy of educational objectives*. Allyn and Bacon. ISBN 978-0-8013-1903-7, 2001.
3. Asrean Hendi, "Pengaruh Strategi Preview, Question, Read, Reflect, Recite, And Review (PQ4R) Untuk Meningkatkan Kemampuan Pemecahan Masalah Matematika Siswa", *Prosiding Seminar Nasional Matematika dan Pendidikan Matematika 2017 UIN Raden Intan Lampung 6 Mei 2017*.
4. B.A. Omoteso and F. A. Sadiku, "Effectiveness Of PQ4R Study Technique On Performance Of Students In Chemistry", *IFE PsikologiA*, Vol 21 No 3 (2013).
5. D. Lenat and E. Feigenbaum. On the thresholds of knowledge. *Artificial Intelligence*, 47:185–250, 1991.
6. Dennis K. Filsaime. 2008. *Menguak Rahasia Berpikir Kritis dan Kreatif*. Jakarta : Prestasi Pustaka Publisher. P. 8.
7. Dharma Kesuma. dkk. 2010. *Contextual Teaching and Learning Sebuah Panduan Awal Dalam Pengembangan PBM*. Jakarta: Rahayasa Research and Training. P.30
8. Dunn, S. Dana. *Best practices for teaching introduction to psychology*, Francis: Lawrence Erlbaum Associates, 2006.
9. Heong, Y.M., "The Level of Marzano Higher Order Thinking Skills Among Technical Education Students". *International Journal of Social and Humanity*, Vol. 1, No. 2, July 2011, p 121-125
10. Ibe, H. "Effects of Guided-Inquir and Expository Teaching Methods on Senior Secondary School Students' Performances in Biology in Imo State". *Journal of Education Research and Behavioral Sciences*, 2(4), 2013., h 051-057.
11. M. Anderson. Intelligence. MS Encarta online encyclopedia, 2006.
12. Pehofer, Johan and Roy William. "New media and teacher education", (ITE Conference New York, 2003).
13. Prayekti, "Pengaruh Strategi Pembelajaran Inkuiri Dan Ekspositori Terhadap Hasil Belajar IPA Siswa Kelas 5 Sekolah Dasar", *Prosiding Seminar Nasional Fisika*, Volume 4, Oktober 2015, Universitas Terbuka, p. 177
14. Prayoonsri Budsankom., dkk, "Factors affecting higher order thinking skills of students: A meta-analytic structural equation modeling study", *Journal of Educational Research*, vol 10(19), 2015, p.2639-2652.
15. Program Pascasarjana UNJ, *Pedoman Penulisan Tesis dan Disertasi* (Jakarta: 2012), p.27
16. Ritu Chandra & Sheikh Azimmudin. "Influence of Intelligence and Gender on Academic Achievement of Secondary School Students of Lucknow City". *IOSR Journal Of Humanities And Social Science (IOSR-JHSS)* Volume 17, Issue 5 (Nov. - Dec. 2013), PP 09-14 e-ISSN: 2279-0837, p-ISSN: 2279-0845. www.iosrjournals.org.
17. Ruqia Bibi & Manzoor H. Arif, "Effect of PQ4R Study Strategy in Scholastic Achievement of Secondary School Students in Punjab (Pakistan)"
18. (<http://www.languageinindia.com/dec2011/ruquiabibischolasticfinal.pdf>) di akses Maret 2018
19. Shukla, D, "Student's Perceived Level and Teachers' Teaching Strategies of Higher Order Thinking Skills, A Study on Higher Educational Institutions in Thailand. Department of Business Administration", St. Theresa International College, Thailand. (2016).p.213
20. Slavin, R.E). *Educational psychology: theory and practice*, Fifth Edition. Massachusetts: Allyn and Bacon Publisher, (2008)
21. Stephen A. Erath dkk. "Association between Children's Intelligence and Academic Achievement: The Role Of Sleep". *J Sleep Res.* 2015 Oct; 24(5): 510–513. Published online 2015 Feb 14. doi: [10.1111/jsr.12281](https://doi.org/10.1111/jsr.12281)
22. Syarif Sumantri, *Strategi Pembelajaran: Teori dan Praktik di Tingkat Pendidikan Dasar*. (Jakarta: PT Raja Grafindo Persada, 2016), p. 62
23. Thomas, E. L., & Robinson, H. A. *Improving reading in every class: A sourcebook for teachers*", Boston, Allyn & Bacon, 2014
24. Wajeeh Daher, Amal Tabaja-Kidan, Faaiz Gierdien. Educating Grade 6 students for higher-order thinking and its influence on creativity. *Pythagoras - Journal of the Association for Mathematics Education of South Africa* ISSN: (Online) 2223-7895, (Print) 1012-2346. 2017.
25. Yee, M. H., dkk, "The Level of Marzano Higher Order Thinking Skills Among Technical Education Student". *International Journal Of Social Science and Humanity*, (2013), h. 121.