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THE TREND OF MIDDLE SCHOOL STUDENTS' SCIENTIFIC REASONING ABILITIES IN THAILAND

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THE TREND OF MIDDLE SCHOOL STUDENTS' SCIENTIFIC REASONING ABILITIES IN THAILAND

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ABSTRACT

Scientific reasoning is one of the goals in science teaching and learning. Previous researches in Thailand have studied scientific reasoning abilities of grade 7, grade 8, and grade 9 students separately. However, there is a lack of research studying scientific reasoning abilities development in middle school. Therefore, this research aimed to study the trend of students' scientific reasoning abilities in middle school. A cross-sectional study was used in this study. Scientific reasoning abilities test was developed by a researcher. The test was five situations selecting multiple choices in the first section and reasoning in the second section (full scores = 20). Cronbach's alpha coefficient was .87 and inter-rater reliability was 87%. The test was administered to grade 7 (n=130), grade 8 (n=130), and grade 9 (n=130) students at the end of the first semester of the 2020 academic year, totaling 390 students, from a school in Saraburi province by cluster random sampling. Data was analyzed using means, standard deviation, one-way ANOVA. It was found that scientific reasoning abilities of grade 7 students were at a fair level, grade 8 and grade 9 students were at a good level. There was a statistically significant difference at .05 level between grades as a whole. However there were no differences between grade 7 and grade 8 students. The trend showed that there is linear development from grade 7 to grade 9. The explanation of the results were discussed based on the curriculum and intellectual development theory.

Keywords: *Cross-sectional study, Lower secondary school students, Scientific reasoning*

INTRODUCTION

Scientific reasoning is the ability to express ideas in searching evidence, finding relationships between evidence and conclusions to reasonably support or reject a hypothesis (Lawson, 1985). Scientific reasoning abilities are one of the important goals of science education. (OECD, 2018). Previous research study in Thailand was conducted to explore the scientific reasoning of grade 7 (Surachai, 2015), grade 8 (Jindawong, 2012), and grade 9 students (Nangsrikun, 2014). However, there is a lack of research studying the trend of scientific reasoning abilities from grade 7 to grade 9 students. Students in this ages (13-15 years old) have developed intellectually and are able to think for reasons, as well as able to think like a scientist (Goot, 1986). The developmental study of students' scientific reasoning abilities will be useful. If there is a problem or defect in any part, teachers or educators can help to promote them immediately and effectively.

OBJECTIVES

1. To study the scientific reasoning abilities of grade 7, grade 8, and grade 9 students
2. To compare the mean score difference between three grades
3. To study developmental trends in scientific reasoning abilities at different ages.

METHODOLOGY

A cross sectional study was used in the study. The samples were 390 students from grade 7, grade 8 and grade 9 students selected by cluster sampling method from a population of 15,301 middle school students in Saraburi province. Scientific reasoning abilities test (Cronbach's alpha coefficient of the test = .87, inter-rater reliability = 87%) was administered to the samples at the end of the first semester of 2020 academic year. Data were analyzed by means and standard deviation. The mean scores were classified into the four levels of abilities (0–5 = need improvement, 6-10 = fair, 11-15 = good, and 16-20 = very good).

One-way ANOVA was used to test the difference between grade levels. Graph was constructed to see the developmental trend of the abilities across three grades.

RESULTS

The students' scientific reasoning abilities of grade 7 were at a fair level (M= 10.65, S.D= 3.65). Grade 8 (M = 11.54, S.D = 4.09) and grade 9 (M= 13.62, S.D = 4.08) students were at a good level. There was a statistically significant difference between grades ($F(2,387) = 25.80$, $p = .000$. Grade 9 was statistically significantly higher than grade 8 (19.43, $p = .000$) and grade 7 (19.43, $p = .000$). There were no statistically significant differences between grade 7 and grade 8 students. The developmental trend of middle school students' scientific reasoning abilities were shown in Figure 1.

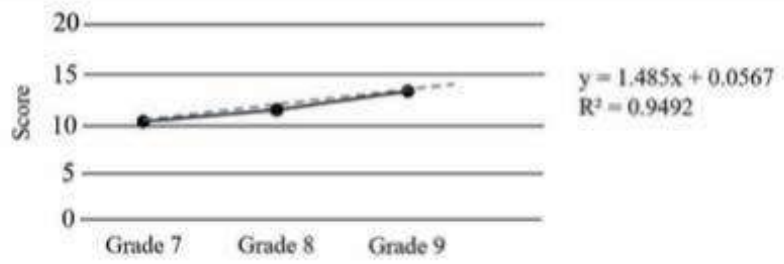

Figure 1. Trend of middle school students scientific reasoning abilities

DISCUSSION AND CONCLUSIONS

Grade 7 and grade 8 students have learned using the new science curriculum (B.E. 2560), but grade 9 students have studied using the old one (B.E. 2551). The new science curriculum focuses on promoting the ability of scientific reasoning. However, the scientific reasoning abilities of grade 7 students were at a fair level and the abilities of grade 7 and grade 8 were no different. There was a statistically significant difference between grades as a whole, as well as the graph revealed that the trend is linear development according to Piaget's cognitive development theory. The students' scientific reasoning abilities are result of their development by age. Therefore, teachers should help them to improve their level by adjusting ways of teaching and learning appropriately. The first grade of middle school is especially a good beginning.

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