

Logical thinking abilities among Form 4 students in the interior division of Sabah, Malaysia

Abstract

The science curriculum in Malaysia emphasizes the acquisition of scientific skills, thinking skills, and the inculcation of scientific attitudes and noble values. Besides that, the acquisition of scientific and technological knowledge and its application to the natural phenomena and students' daily experiences are also equally emphasized. The purpose of this study was to gauge the logical thinking abilities namely conservational reasoning, proportional reasoning, controlling variables, combinatorial reasoning, probabilistic reasoning, and correlational reasoning among Form 4 students in the Interior Division of Sabah, Malaysia. This study was also aimed to ascertain if there is any significant difference in students' logical thinking abilities based on their gender and science achievement at lower secondary level. This was a non-experimental quantitative research and sample survey method was used to collect data. Samples were selected by using a two-stage cluster random sampling technique. Independent samples t-test and one-way ANOVA were used to test the stated null hypotheses at a specified significance level, $\alpha = .05$. Research findings showed that the overall mean of students' logical thinking abilities were low. The mean score in percentages for all the subscales (except conservational reasoning) were lower than the overall mean. This research also revealed that up to 98% of the respondents were categorized at the concrete operational stage whereas only 2% were categorized at the transitional stage. Research findings also found that there was no significant difference in the mean of logical thinking abilities (except for conservational reasoning) based on students' gender. Nonetheless, a significant difference based on their science achievement at lower secondary level was found. This research finding brings some meaningful implications to those who are involved directly or indirectly in the curriculum development and implementation of science curriculum especially at the rural secondary schools of Sabah, Malaysia.

Background of the Study The development of thinking abilities is well-discussed in the world of education. Cohen (1980) stated that the higher the ability of a

person to think in an abstract way, the higher the ability of the person will function effectively in the society. Hence, the improvement of formal reasoning and thinking abilities among students is one of the aims of science education at all level of schooling. Cognitive Development Theory, a well-known theory proposed by Jean Piaget has conceptualised four different stages in the cognitive development of a person i.e. sensorimotor (0-2 years), preoperational (2-7 years), concrete operational (7-11 years) and formal operational (11-16 years). The main difference among these stages of cognitive development is the mode of thinking. Children at formal operational stage can think logically about abstract propositions and test hypotheses systematically. At the same time, they become concerned with the hypothetical, the future and ideological problems. Researchers (e.g. Inhelder & Piaget, 1958; Lawson, 1982b, 1985; Linn, 1982) have identified five different modes of formal operational reasoning i.e. proportional reasoning, controlling variables, probabilistic reasoning, correlational reasoning and combinatorial reasoning which are determinants of students' success in science and mathematics advanced courses at secondary level (Wilson & Wilson, 1984).