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# Self-confidence and Intuitive Thinking Skills in the Topic of Fractions among Level 2 Primary School Students

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**Abstract**
Self-confidence plays an important role in cognitive development in students' mathematics learning. Cognitive thinking skills such as intuitive thinking help students master mathematical topics that are often considered difficult. Therefore, this study was conducted to determine self-confidence and intuitive thinking skills in the topic of fractions based on gender and age. In addition, this study also aimed to identify the relationship between self-confidence in mathematics and intuitive thinking skills in the topic of fractions. A survey study was conducted on 80 Level 2 students in a primary school in the Central Melaka District. All respondents were selected using stratified random sampling method. The results of two-way ANOVA test showed that there were significant differences in self-confidence in mathematics based on gender and age. However, the two factors did not show significant differences on intuitive thinking skills in the topic of fractions. In addition, the Pearson correlation test showed that there was a positive relationship between self-confidence and intuitive thinking skills in fractional topics. Thus, teachers need to provide a mathematics learning environment that can increase self-confidence and intuitive thinking skills in the topic of fractions. This is to help students to master mathematics better, especially for the topic of fractions.
**Keywords:** Self-confidence, Mathematics, Intuitive Thinking, Fractions, Primary School

## Introduction

Mathematics is one of the main subjects taught in schools. Indirectly, mathematics plays a very important role in improving the quality of knowledge for each student. Therefore, teachers need to pay attention to the factors that influence students to learn mathematics. Among them is the self-confidence factor in mathematics subjects. According to Kadijevich (2018), self-confidence is an important aspect of psychology and often discussed in studies on student mathematical achievement.

However, the aspect of self-confidence is often confused with the aspect of self-efficacy introduced by the famous psychologist Albert Bandura. Self-efficacy is an individual's self-belief about their ability to generate behaviours towards events that will affect their lives

(Bandura, 1986). On the other hand, self-confidence can be defined as individuals' confidence towards themselves (Kunhertanti & Santosa, 2018). Thus, self-efficacy is a belief specific to a particular situation, while self-confidence is a general personality trait. For example, a student's belief in his or her ability to meet the behaviours required to complete a math task indicates self-efficacy, while students' belief in the overall ability in learning mathematics shows self-confidence.

Self-confidence is important in determining an individual's feelings, thoughts, behaviours, and motivation to perform a task. Individuals with low self-confidence always avoid difficult tasks and regard them as threats as well as are quick to give up. Individuals with high self-confidence typically work harder while completing tasks and are better prepared for challenges (Hosein & Harle, 2018). This also explains that self-confidence can influence an individual's achievement and is an important predictor of mathematical achievement. Studies have found that students' self-confidence is worrisome when more than half of students have low self-confidence in mathematics (Diniyah et al., 2018). A similar situation was also discussed by Kosim et al (2020), who found that students' self-confidence in mathematics varied due to the diversity of backgrounds and environments.

Studies of self-confidence have been widely conducted, but researchers tend to look at the relationship between self-confidence and students' mathematical achievement (Bernard & Senjayawati, 2019; Çiftçi & Yildiz, 2019; Yaniawati et al., 2020; Yıldırım, 2019). There are also researchers who focus studies on self-confidence over motivation and anxiety in mathematics (Irhamna et al., 2020). Meanwhile, the aspect of self-confidence can be extended to students' intuitive thinking skills in the teaching and learning of mathematics. Intuitive thinking can be defined as an ability or skill to know an idea spontaneously without going through the thought process (Hasanah et al., 2018). According to Jianhua (2020) students are found to be weak in intuitive thinking due to the teaching approach used by teachers. Pupils are often exposed to drills and memorisation without understanding mathematical concepts more accurately. In the context of education in Malaysia, studies on the intuitive thinking skills of mathematics of primary school students found them to be poorly implemented, although they are one of the important mathematical skills for the early stages of student learning.

Mathematical intuitive thinking skills become a necessity to be studied because mathematics is often considered difficult by students, especially for the topic of fractions (Dash, 2020) which plays a very important role in the subject of mathematics. This is because it is widely used in other mathematical topics such as decimals, percentages, ratios and proportions, and it is also applied in algebra (Aliustaoğlu et al., 2018). The failure of students to master the topic of fractions will make it more difficult for them to understand various mathematical skills in the next field. Students who frequently make mistakes in the topic of fractions contribute indirectly to low mathematical achievement (Deringöl, 2019).

In addition, differences in gender and age of students are also factors that influence a variable of a study. A study conducted in an Indonesian school found that the level of intuitive thinking of female students was better than the male students (Yuni et al., 2019). Nevertheless, the level of self-confidence of female students in Germany was found to be lower than that of male students in mathematics subjects (Zander et al., 2020). While the level of students' self-confidence in mathematics is different according to age, not all students

at the upper level have higher self-confidence in mathematics than students at the lower level (Çiftçi & Yildiz, 2019). All the findings of the study indicate that students' gender and age affect their self-confidence and intuitive thinking skills. However, the studies conducted mostly focus on mathematics generally, while studies involving intuitive thinking in certain topics, such as fractions, are still poorly implemented.

Therefore, this study was conducted on Level 2 primary school students in Central Melaka District. The aim of this study is to determine self-confidence and intuitive thinking skills in the topic of fractions based on gender and age. There are three objectives to be obtained:

- To determine the differences in students' self -confidence based on gender and age.
- To determine differences in intuitive thinking skills in fractional topics based on gender and age.
- To identify the relationship between self-confidence and intuitive thinking skills in the topic of fractions.

**Methodology**

The design of this study was a survey study using a questionnaire. Therefore, the population of this study consists of students in years 4, 5 and 6 in a primary school in the Central Melaka District. The unit of analysis for the study is the gender and age of the students. Stratified random sampling was used to select respondents in the study because the technique facilitates researchers to obtain information from the sample based on demographic factors set in the study, namely gender and age (Zaman, 2021). Therefore, the findings of the study are limited to the specified population and do not reflect the population of Level 2 students in other primary schools in the Central Melaka District.

The sample size was determined based on Krejcie and Morgan (1970) who suggested that a total of 76 students was sufficient to represent a population of 97 people. Thus, 80 of the 97 survey questionnaires distributed to Level 2 students were retained as involved respondents despite having exceeded the proposed number of respondents. This is because the feedback provided has complete data for the use of the study by representing 82% of the response rate. Table 1 shows the demographic information for the respondents involved in the study. Overall, the number of male and female respondents is almost equal to the values of 49% and 51%. The number of students aged 12 years old is the most followed by students aged 10 years old and 11 years old at 32, 25 and 23 students, respectively.

Table 1: Demographic information of respondents

| Category | | Frequency | Percentage |
|---|---|---|---|
| **Gender** | Boy | 39 | 49% |
| | Girl | 41 | 51% |
| | Total | 80 | 100% |
| **Age** | 10 years old | 25 | 31% |
| | 11 years old | 23 | 29% |
| | 12 years old | 32 | 40% |
| | Total | 80 | 100% |

The selection number of respondents for the pilot study is based on Treece and Treece (1982) who suggested that the minimum number of respondents is 10% of the actual study respondents. The statement was augmented by Johnson and Christensen (2019) who stated that the minimum number of pilot test respondents was five to ten people. Therefore, the questionnaire instrument was first tested on 10 Level 2 students using simple sampling. This is to ensure that data collection during the actual study can be carried out smoothly.

The data collection of the study was done using a questionnaire adapted from Saintine (2017); Gómez and Dartnell (2018), and Van Hoof et al. (2020). The back-to-back translation method was used to translate research instruments through experts proficient in Malay and English languages. Next, the study instruments were evaluated by two mathematicians for validity. The actual study data were collected in October 2021 for two weeks using the Quizizz platform which aimed to attract students to be involved as study respondents. This is supported by Abidin et al (2019) who stated that student engagement in mathematics activities increases when teachers use a technology game-based approach. Therefore, the sharing of questionnaire links was disseminated by the mathematics teachers through WhatsApp groups of each class. In addition, follow-up reminders were sent to students who did not answer the questionnaire within the stipulated period. Appreciation in the form of souvenirs was also given to students who successfully completed all the questionnaires.

The research questionnaire is divided into three parts A, B and C. Part A is the demographic information of the students while part B is the test item for intuitive thinking skills in the topic of fractions. Items for the intuitive thinking skills test were in the form of correct and incorrect answer choices. Pupils must answer each of these items within 10 seconds. This item test collects the total marks for all the items answered correctly within the specified period. Next, part C is the item of measuring self-confidence in mathematics. The measurement of this section uses a four-point Likert scale. This is appropriately used to avoid bias to determine the score of each item (Ramdani et al., 2020). The four levels of agreement are 1 = Strongly Disagree, 2 = Disagree, 3 = Agree, 4 = Strongly Agree.

All data were successfully collected and analysed using SPSS software version 26. There are two types of analysis involved in this study, which are descriptive analysis of respondent demographics and inferential analysis to test the null hypothesis. Two-way ANOVA tests were used to determine differences in self-confidence in mathematics based on gender and age and to determine differences in intuitive thinking skills in the topic of fractions based on gender and age. In addition, correlation analysis was used to identify the relationship between self-confidence in mathematics and intuitive thinking skills in the topic of fractions.

**Results**

The findings of this study are based on the objectives of the study using descriptive statistics and inferential statistics. Two-way ANOVA test was conducted for objectives 1 and 2 while Pearson correlation test was used for objective 3. Before data analysis was conducted, the testing assumptions for ANOVA and correlation were met. The assumptions are normally distributed data, the respondents are from independent groups, the dependent variables are in the form of intervals or ratios, the variances are homogeneous and the relationships that exist are linear.

**Objective 1: Determine the mean difference of self-confidence in mathematics based on gender and age**

The results of the two-way ANOVA test (Table 2) showed that there was no significant interaction effect between gender and age factors on self-confidence in mathematics with a value of F(2,74)=1.413, p=0.302. This means that gender and age do not depend on each other in influencing self-confidence in mathematics.

Table 2: Two-way ANOVA test for self-confidence in mathematics

| Main effect | df | F | Sig. | Partial eta square ($\eta^2$) |
|---|---|---|---|---|
| Gender | 1 | 11.413 | .003 | .084 |
| Age | 2 | 8.511 | .004 | .059 |
| Gender * Age | 2 | 1.413 | .302 | .017 |

Analysis of the main effect of the gender factor found that there was a significant difference with the value of F(1,74)=11.413, p=0.003, $\eta^2$=0.084. Male students have higher self-confidence in mathematics (M = 2.96, SD = 0.414) than female students (M = 2.36, SD = 0.424), as seen in Table 3. The difference proves that gender factors affect students' self-confidence in mathematics with a medium size effect.

Table 3: Descriptive statistics of self-confidence in mathematics

| Gender | Age | Mean (*M*) | Standard Deviation (*SD*) |
|---|---|---|---|
| Boy | 10 years old | 2.94 | 0.339 |
| | 11 years old | 2.87 | 0.411 |
| | 12 years old | 3.08 | 0.337 |
| | Total | 2.96 | 0.414 |
| Girl | 10 years old | 2.00 | 0.392 |
| | 11 years old | 2.36 | 0.363 |
| | 12 years old | 2.69 | 0.422 |
| | Total | 2.37 | 0.424 |
| Total | 10 years old | 2.51 | 0.401 |
| | 11 years old | 2.62 | 0.393 |
| | 12 years old | 2.89 | 0.381 |
| | Total | 2.85 | 0.438 |

In addition, the main effect of the age factor of students also showed that there was a significant difference in self-confidence in mathematics, that is F(2,74)=8.511, p=0.004, with the effect of medium size $\eta^2$=0.059. Twelve-year-old students (M=2.89, SD=0.381) had the highest self-confidence in mathematics followed by 11 year olds (M=2.62, SD=0.393) and 10 year olds (M=2.51, SD=0.401). Furthermore, the Scheffe post hoc test (Table 4) showed that there was a significant difference in self-confidence between the ages of 10 years old and 12 years old (p=0.003). However, there was no significant difference in self-confidence between the ages of 10 years old and 11 years old (p=0.181) and self-confidence between the ages of 11 years old and 12 years old (p=0.308).

Table 4: Scheffe post hoc test for age

**Multiple Comparison**

Dependent Variable: Self-confidence

Scheffe

| (I) Age | (J) Age | Mean Difference (I-J) | Std. Error | Sig. | 95% Confidence Interval Lower Bound | Upper Bound |
|---|---|---|---|---|---|---|
| 10 years old | 11 years old | -.0882 | .0476 | 0.181 | -.2050 | .0286 |
| | 12 years old | -.1593 | .0459 | 0.003* | -.2719 | .0467 |
| 11 years old | 10 years old | .0882 | .0476 | 0.181 | -.0286 | .2050 |
| | 12 years old | -.0711 | .0463 | 0.308 | -.1846 | .0424 |
| 12 years old | 10 years old | .1593 | .0459 | 0.003* | -.0467 | .2719 |
| | 11 years old | -.0711 | .0463 | 0.308 | -.0424 | .1846 |

Note: * Significant difference in self-confidence < 0.05

**Objective 2: Determine the mean difference of intuitive thinking skills in the topic of fractions based on gender and age**

Based on the results of the two-way ANOVA test, Table 4 shows no significant interaction between gender and age factors on intuitive thinking skills in the topic of fractions with F value (2.74 )=0.140, p=0.665. This explains that gender and age do not depend on each other on intuitive thinking skills in the topic of fractions.

Table 5: Two-way ANOVA test for intuitive thinking skills in the topic of fractions

| Main effect | df | F | Sig. | Partial eta square ($\eta^2$) |
|---|---|---|---|---|
| Gender | 1 | .811 | .371 | .011 |
| Age | 2 | 1.055 | .354 | .028 |
| Gender * Age | 2 | .411 | .665 | .011 |

The main effect for the gender factor found that there was no significant difference with the value of F(1.74)=0.811, p=0.371. Similarly, the effect of student age factor showed that there was no significant difference on intuitive thinking skills in the topic of fractions, that is F(2,74)=1.055, p=0.354. The results of this test clarified that these two factors of gender and age did not affect the students' intuitive thinking skills in the topic of fractions.

**Objective 3: To identify the relationship between self-confidence in mathematics and intuitive thinking skills in the topic of fractions**

To achieve objective 3 in this study, Pearson correlation analysis was conducted. Based on Table 6, there was a significant relationship between self-confidence in mathematics and intuitive thinking skills in fractional topics with a value of r(78)=0.372, p=0.028. These results indicate a positive relationship with medium strength. The interpretation of the strength is based on Cohen (1988) who suggested that the correlation value of 0.30 to 0.49 is at a moderate level. Thus, high self-confidence in mathematics will also have high intuitive thinking skills in the topic of fractions, and vice versa.

Table 6: Pearson correlation test between self-confidence in mathematics and intuitive thinking skills in fractional topics

| | | Intuitive |
|---|---|---|
| Self-confidence | Pearson correlation | .372 |
| | Sig. (2-tailed) | .028* |
| | *N* | 80 |

Note: *Significant at the level of $p < 0.05$

**Discussion**

This study was conducted to determine the self-confidence in mathematics and intuitive thinking skills of Level 2 students in primary schools in the Central Melaka District. These findings are important for contributing to the literature in the field of mathematical studies. In addition, this study helps teachers in planning and implementing lessons that can increase students' self-confidence as well as intuitive thinking skills in mathematics.

Based on the results of two-way ANOVA analysis for self-confidence it showed that male students have a higher level of self-confidence in mathematics than female students. These findings are in line with the results of studies by Jouini et al. (2018) and Zander et al. (2020). This is because male students are more daring to try and ask questions in mathematics learning sessions (Opstad, 2021). Accordingly, they are more exposed to more meaningful learning experiences. There are also studies that found that more male students choose to venture into mathematics at a higher level than female students (Jouini et al., 2018). As a result, the skilled workforce in the future will be gender unbalanced. Therefore, a more in-depth study on the involvement of female students in mathematics learning should be considered. This is because active involvement in the classroom has a relationship to self-confidence in mathematics (Christensen & Knezek, 2020).

Furthermore, the level of students' self-confidence in mathematics based on age also showed significant differences. Ten-year-old students had the lowest level of self-confidence in mathematics followed by 11 year olds and 12 year olds. However, this finding is not in line with the findings by Çiftçi and Yildiz (2019) who stated that support factors from the sector of human progress and development can increase the level of self-confidence in mathematics among students regardless of age.

However, the findings of this study are in line with several other study findings such as Mulcahy-Dunn et al (2018); Amiyani and Widjajanti (2019) and explains that the level of self-confidence in mathematics was increased as age increased. This is because the period of experience in the process of learning mathematics can reduce students' anxiety about mathematics. Vice versa, there were also studies that have found that students' levels of self-confidence in mathematics decrease as age increases (Zander et al., 2020). This situation can occur due to factors of unpleasant learning environment (Christensen & Knezek, 2020). Therefore, studies on the learning environment of older students should be considered. This is to ensure that the self-confidence in mathematics for older students can be increased.

The next two-way ANOVA analysis was to determine the differences of intuitive thinking skills in the topic of fractions based on gender and age. The results of the analysis showed that there was no difference in the level of intuitive thinking skills in the topic of

fractions based on gender. These findings do not support the study of Yuni et al (2019) who found that female students' mathematical intuitive thinking skills were higher than male students. These differences in findings are due to female students often using less precise intuitive thinking in mathematics (Juanchich et al., 2020), whereas male students were found not to use intuitive thinking in mathematics which resulted in the skills not being honed (Arwanto et al., 2018). Both findings explain the cause of intuitive thinking skills for female and male students being at the same level.

Findings by age factor also did not show significant differences on intuitive thinking skills in the topic of fractions. The results of this analysis do not support the findings of Abín et al. (2020) who stated that older students have higher cognitive levels. These findings were found to be different because the respondents of the study were different, and less when compared to the previous study. In addition, it is also likely due to student involvement in the learning process. Recently, Malaysia has implemented *Pengajaran dan Pembelajaran di Rumah* (PdPR) or known as online learning due to school closures. PdPR, which lasted for an extended period, has raised the issue of student absenteeism. According to Fung et al. (2018), the presence of students in the teaching and learning process can increase their level of mathematical thinking. Unfortunately, the involvement of students in PdPR was found to be less encouraging, especially for older students (Nasir & Mansor, 2021). As a result, students' intuitive thinking skills do not develop well at the appropriate age. Therefore, the involvement of older students in mathematics learning needs to be studied further to ensure that intuitive thinking skills in the topic of fractions can be constructed more effectively.

In addition, Pearson correlation analysis to identify the relationship between self-confidence and intuitive thinking skills in the topic of fractions showed a positive relationship. This explains that self-confidence in mathematics is important in determining the level of intuitive thinking skills for the topic of fractions. These results support Kosim et al (2020) who stated that the self-confidence factor towards mathematics becomes a predictor of students' skills in learning the topic of mathematics. High self-confidence in mathematics makes intuitive thinking skills in the topic of fractions increase. Thus, students need to build self-confidence in mathematics to improve intuitive thinking skills in the specific topic of mathematics (Siddiqui, 2021).

This study has provided broader exposure to the importance of self-confidence and intuitive thinking skills in the topic of fractions. In addition, the results of this study also provide additional information on the relationship between self-confidence and intuitive thinking skills in the topic of fractions. Thus, this study has a positive impact on mathematics teachers, especially in providing a better mathematics learning environment. Teachers need to be sensitive in providing learning that can increase the self-confidence of students, especially female students. Learning activities need to be planned in accordance with the level of cognitive development of students to produce optimal intuitive thinking skills. School administrators and superiors also play a role in providing programmes that can increase students' self-confidence and intuitive thinking skills.

**Future Study**

The findings of this study are limited to the population of Level 2 students in a primary school in the Central Melaka District only. Therefore, future studies related to self-confidence and

intuitive thinking skills in the topic of fractions need to be implemented in a larger population. Furthermore, the study found that intuitive thinking in the topic of fractions did not show differences based on gender and age of students. Therefore, this study also suggests that further studies be implemented on the population of students consisting of same gender school, which refers to a school that consists of either only female or male students. This aims to obtain more information related to students' gender factors on intuitive thinking skills in the topic of fractions. In terms of research methodology, this study only focuses on survey design through questionnaires. Thus, a study using a mixed quantitative and qualitative approach can be implemented in future studies to obtain more in-depth findings. Mixed approach can enrich information related to self-confidence and intuitive thinking skills in fractions as well as to be a guide to educators.

## Conclusion

In conclusion, gender and age factors affect self-confidence in mathematics. However, these two factors did not affect intuitive thinking skills in the topic of fractions. Even so, both factors need to be given attention as they have to do with mathematical achievement. Self-confidence in mathematics and intuitive thinking skills can be enhanced through classroom learning experiences. Teachers play the main role in providing a learning environment that increases students' self-confidence and intuitive thinking skills. At the same time, the school administrators and superiors need to support and involve in planning school programmes that can impact on students' success in mathematics.

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