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SCIENCE PROCESSING SKILLS AND SCIENCE INTEREST AMONG SECONDARY SCHOOL STUDENTS IN SELANGOR

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Abstract: *Secondary schools face a big pedagogical challenge in balancing students' enthusiasm for science and their process abilities. Addressing this issue is crucial for developing a generation capable of understanding and engaging with science. A detailed investigation of this relationship identifies critical issues and suggests opportunities for change. This study explores the relationship between basic science process skills and students' interest in science at one of the secondary schools in Shah Alam, focusing on the core of scientific learning. This study examined two primary questions using quantitative methods: how science process skills vary by gender and age group and how they influence students' interest in science. The target population for this study were all lower secondary students, which includes 50 students from Form 1 and 50 students from Form 2. This study uses a stratified random sampling, and the instrument used for data collection was the Science Process Skills Exam. The results showed no noticeable gender disparities in ability, indicating the broad applicability of these skills for success in science and casting doubt on any potential biases. Age was also not a significant factor, indicating that Form 1 and Form 2 students had similar backgrounds in science. A robust relationship was found between high-interest levels in scientific research and proficient task execution, problem-solving, and critical thinking abilities. The study empowers multiple stakeholders by shedding light on the complex relationships among science process skills, interests, and demographic factors. Teachers can utilize these findings to develop lesson plans, materials, and teaching methods that serve the needs of various students and their scientific curiosity.*

Keywords: *Science Process Skills, Scientific Research, Quantitative Methods, Science Laboratory*

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Introduction

As the twenty-first century began, science and technology became the most important aspects of human existence. In the past, technological advancement required a healthy ecosystem. The current necessary competency level highly values the younger generation's development of solid scientific process abilities (Özgelen, 2012, Darmaji et al., 2019). Applying scientific knowledge to identify questions and situations that can be resolved using a scientific method and drawing conclusions based on knowledge gained improves understanding of the world and the changes brought about by human activity, which in turn aids in making well-informed decisions (Abd Rauf et al, 2013, Ibrahim, 2011). This is known as science process skills. Hence, the scientific method has been utilized as early as elementary school to stimulate the apprentices of science and make them lay down their base in a scientific approach. However, as much science and technological advancement as the world can ever achieve, there is still a need for an increased showcase of enthusiasm in science to learners. A student's level of interest plays a significant role in determining their academic success (Shahali and Halim, 2010). When a subject fascinates them, students actively participate in studying and exhibit greater learning. Stated differently, students must possess the necessary knowledge, skills, and attitudes to understand scientific concepts completely. Zeidan and Jayosi (2014) assert that mastery of the scientific method is necessary for generating and applying scientific knowledge, conducting scientific research, and problem-solving. Nonetheless, professors routinely disregard students' interests in learning science in favor of explaining scientific concepts and helping students absorb knowledge. Studies show that science is losing students' interest, so educators are urged to emphasize the value of teaching scientific facts, concepts, and ideas and why they are essential to them daily. This will likely encourage students to carry out more scientific research. This research lays the essential foundation for students to advance in their education, addressing the growing expectations for their science process skills and enthusiasm for science. The findings of this study can be effectively utilized by science teachers in the classroom to assess whether their students have met the required standards and, if not, to take appropriate corrective actions. Consequently, educators should be better equipped to create and execute strategies that are more effective at helping students acquire science process skills and more likely to spark their interest in the subject (Chabalengula, 2012). This study seeks to investigate the relationship between students' science process skills and their interest in science. It will primarily assess and evaluate the level of science process skills among students, with a focus on gender differences. Additionally, the study aims to examine the connection between the level of science process skills and the degree of interest in science.

Literature Review

Scientists employ the scientific method skills when conducting their investigations and studies. The search for scientific knowledge involves a wide range of cognitive skills, including the capacity for observation, classification, communication, measurement, inference, and prediction on the part of researchers and students to whom they are explaining findings. According to the National Education Philosophy, Malaysian education fosters a culture of science and technology by turning forth students who are morally upright, competent, integrated, and capable of realizing their country's goals. Additionally, students are given access to activities that focus on helping them acquire procedural skills and practical knowledge connected to scientific inquiry and experimentation. Since students learn best by doing, effective laboratory students must arrange how to use their learning skills. However, mastering science process skills can be challenging for some students due to their psychological

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demands and high cognitive ability. Inquiry-based learning centers on the development of student's capacity to engage in the scientific process. So, learning the scientific method entails becoming proficient in all the research process steps. A strong passion for science, however, is crucial. Students with a more optimistic outlook on science tend to perform better academically (Maranan, 2017).

Zeidan dan Jayosi (2014) researched Palestinian students' science process abilities and showed considerable differences, which may be affected by discrimination based on gender. However, no notable variations transpired between their perspectives on science. The researchers relate this discrepancy to Palestinian women placing a higher priority on the sciences than men and women having easier access to higher education. Furthermore, Al-Rabaani (2014) discovered no statistically significant variation in the development of science process skills across the sexes among pre-service teachers. It might also be related to the fact that science processing abilities need to be given more of a curriculum emphasis in pre-service social studies teacher training programs. In a comparable study, the Basic Science Process Skills (BSPS) of upper primary Indian elementary pupils did not differ based on gender, according to the findings of Tek and Manikam (2014). As a result, there is no discernible difference in the levels of proficiency gained in the fundamental science process abilities between male and female students, supporting the claim that all students in Malaysia have equal access to a balanced education (Tek and Hassan, 2013).

In education, science processing skills are developed through constructivist, inquiry-based approaches, which also foster science interest by making learning engaging and meaningful.
The tendency to apply basic process skills in the tasks under consideration varies greatly depending on several factors, including the students' classes, test scores, high school admission order, and type of school attended, according to the study conducted by Gürses et al. (2015). Children's access to financial resources is influenced by the jobs held by their parents. Additionally, it suggested that kids from households where both parents work full-time were likely to support their children's education and take an active interest in their studies; in fact, the researchers thought that these individuals had the highest levels of education. Therefore, it is evident from the findings that gender differences affect students' basic science process skills and their interest in learning about more serious science-related issues. Additionally, differences can be influenced by factors such as family income, parental occupation, and grade level (Conel, 2021).

Methodology

A quantitative method, along with stratified random sampling, was used in this study. Using this sampling technique ensured that no significant portion of the population was disregarded in favor of a smaller sample. Since stratified random sampling involved selecting a larger sample size compared to other techniques, it produced results with less variance. The target population for this study comprised all lower secondary students, and four classes participated in the study, including 50 students from Form 1 and 50 students from Form 2. All participants in this study were provided with a consent form to complete, ensuring their personal details were kept confidential by the researcher. The Science Process Skills Test (SPST) was used to gather data, adapted from Zeidan and Jayosi's (2014) earlier research. This questionnaire had three sections: A, B, and C. Section A gathered demographic data. The 18 items in Section B included 10 questions on basic science process skills and 8 questions on integrated science

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process skills. Conversely, the Interest Toward Science Questionnaire (ITSQ) in Section C was similarly adapted from Mustapha and Jamamludin (2021). The Statistical Package for Social Sciences (SPSS) was used for data analysis. Specifically, the significance of the differences in students' science process skill levels according to gender and age was examined using an independent sample t-test. Additionally, the second research question was analyzed using the Pearson correlation test, which aimed to ascertain the connection between students' enthusiasm for science and their science process skills. Basic and integrated science process skills are often emphasized in early science education and focus on fundamental cognitive abilities, such as observing, measuring, designing experiments, and controlling variables (Mohamad and Ong, 2013, Tek and Mohamad, 2014)

Table 1 displays the gender distribution of the respondents who took part in this study. Of the students who participated in this research, 51 (51%) are male, and 49 (49%) are female. The students consist of those from Form 1 and Form 2.

Table 1: Gender of Respondents

Gender	Frequency	Percentage (%)
Male	51	51
Female	49	49

Results and Discussion
The primary research questions in this study are as follows:
Research Question 1: Is there any difference in the level of science process skills among students due to gender?
Research Question 2: Is there any correlation between science process skills and interest in science among secondary students?
Research Question 1: Does the level of science process skills differ among students based on age?

The data were analyzed using SPSS, and the results included an examination of demographic characteristics, the total number of participants, frequencies, means, and the standard deviation as a measure of variability. To address the research questions, an Independent sample t-test was used to analyze group differences, while Simple Linear Regression was applied to explore relationships between variables.

The Level of Science Process Skills Among Secondary Students Is Based on Their Gender.

Research Question 1: Is there any difference in the level of science process skills among students due to gender?

Table 2: Mean, standard deviation, and std error mean of science process skills

Science Process Skills	Gender	No	Mean	Std. deviation	Std. Error Mean
Observing	Male	51	2.33	0.622	0.087
	Female	49	2.47	0.616	0.088
Measuring	Male	51	2.25	0.483	0.068

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	Female	49	2.45	0.614	0.088
Classifying	Male	51	2.41	0.606	0.085
	Female	49	2.53	0.581	0.083
Predicting	Male	51	2.18	0.434	0.061
	Female	49	2.18	0.391	0.056
Communicating	Male	51	2.75	0.627	0.088
	Female	49	2.76	0.662	0.095

As can be seen in Table 2 above, female students had a somewhat higher mean score on science process skills markers such as observing (M = 2.47), measuring (M = 2.45), classifying (M = 2.53), and communicating (M = 2.76) than male students.

Table 3: Group Statistics for Science Process Skills

	Gender	No	Mean	Std. deviation	Std. Error Mean
Science Process Skills	Male	51	11.92	1.468	0.205
	Female	49	12.39	1.618	0.231

The aforementioned data (Table 3) indicates that the mean for girls is (M =1 2.39, SD = 1.618) higher than the mean for males (M = 11.92, 1.468). An independent samples t-test assessed whether the gender was substantially different.

Table 4: Independent Sample T-test

		Levene's Test for Equality of Variances		**t-test for Equality of Means**			
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference
Science Process Skills	Equal variances assumed	0.790	0.376	-1.510	98	0.134	-0.466
	Equal variances not assumed			-1.507	96.185	0.135	-0.466

The science process skills of the male group (N = 51, M = 11.92, SD = 1.468) and the female group (N = 49, M = 12.39, SD = 1.618) were compared using an independent t-test; t (98) = -1.510, p = 0.376. The P-value is 0.376, greater than 0.05, meaning that HO cannot be ruled out. As a result, there is no discernible difference between male and female students' levels of science process skills.

Equal Variance assumed is selected since the p-value of Levene's Test is 0.376, which is more than 0.05 (Table 4). Male and female respondents differ in their science process skills statistically significantly, according to an independent T-test (t(98) = -1.510, p = 0.376). Nonetheless, HO is accepted because the p-value is 0.376, which is more than 0.05.

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Consequently, there is no discernible difference between male and female students' science process skills. Put otherwise, the science process skills of male and female students are comparable.

The Relationship Between Science Process Skills And Interest In Science Among Secondary Students.

Research Question 2: Is there any correlation between science process skills and interest in science among secondary students?

Table 5: Model Summary for Simple Linear Regression

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.226[a]	0.051	0.041	6.68023

Table 6: Coefficients for Simple Linear Regression

Model		Unstandardized B	Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	46.551	5.295		8.791	0.000
	Science Process Skills	-0.994	0.432	-0.226	-2.298	0.024

The summary and coefficients tables for simple linear regression are displayed in Tables 4 and 5, respectively. Table reveals $R2$ = 0.051. It demonstrates that science process skills account for 5.1% of scientific interest. $y = 46.551 + (-0.994)\, x$ is the model.

Table 7: ANOVA for Simple Linear Regression

	Model	Sum of Squares	df	Mean Square	F	Sig.
1	Regression	235.660	1	235.660	5.281	0.024[b]
	Residual	4373.300	98	44.626		
	Total	4608.960	99			

Table 8: Coefficients for Simple Linear Regression

Model		Unstandardized B	Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	46.551	5.295		8.791	0.000
	Science Process Skills	-0.994	0.432	-0.226	-2.298	0.024

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The above table displays an ANOVA table to determine the p-value of a well-fitting model (Table 7) and the coefficient for the Simple Linear Regression Test (Table 8). The ANOVA with a well-fitting model is significant (p-value = 0.024) in the table. In the meantime, a regression parameter test in the table below revealed a p-value of 0.024, which is less than 0.05. Consequently, HO is disapproved. There is a connection between curiosity in science and science process skills as HO is rejected.

The Differences In Ages And The Level Of Science Process Skills Among Secondary Students.

Research Question 1: Does the level of science process skills differ among students based on age?

Table 9: Group Statistics for Science Process Skills

		Levene's Test for Equality of Variances		t-test for Equality of Means			
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference
Science Process Skills	Equal variances assumed	0.053	0.819	2.442	98	0.016	0.740
	Equal variances not assumed			2.442	98.000	0.016	0.740

Table 10: Independent Samples Test

Age	N	Mean	Std. Deviation	Std. Error	Mean
Science	13	50	12.52	1.515	0.214
Process Skills	14	50	11.78	1.516	0.214

According to the above data (Table 10), respondents aged 13 had a mean score of (M = 12.52, SD = 1.515), and respondents aged 14 had a mean score of (M = 11.78, SD = 1.516). Regarding science process skills, it may be inferred that respondents aged 13 had a mean score marginally higher than respondents aged 14. An independent t-test assesses whether there is a significant difference in the mean score.

Equal Variance Assumed (Table 9) is selected since the p-value of Levene's Test is 0.819, which is more than 0.05. According to an independent T-test, there is a statistically significant difference in the science process skills between respondents who are 13 and 14 years old (t (98) = 2.442, p = 0.819). Nonetheless, HO is not rejected because the p-value is 0.819, which is more than 0.05. Thus, there is no discernible difference in the respondents' science process skills between the ages of 13 and 14.

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The data analysis showed that, on average, female students performed better than male students in the science process. However, the independent sample t-test revealed no statistically significant variation in the science process skill levels between the two genders. The subject of the second study project is the extent to which students enjoy science and whether this influences their capacity to follow scientific methods. This demonstrates how crucial it is to impart science knowledge to pupils and pique their curiosity about learning more. The previous study question provided specifics on the students' differing competency levels in the science process abilities. The independent sample t-test revealed no significant difference between the ages of the 13 and 14 students. This further demonstrated how well-versed the Form 1 and Form 2 students had been in science process abilities since elementary school.

Does The Level Of Science Process Skills Vary Among Students Based On Gender?

The findings indicate that female students' mean score is somewhat higher than male students'. The science proficiency of the female students has increased dramatically compared to that of their male colleagues. Individual variations in areas of interest, styles of learning, cultural upbringing, and educational attainment all influence how well people comprehend and use the scientific method. This could disprove social and cultural assumptions linking men to greater proficiency in STEM disciplines, inspiring more women to seek jobs in these areas.

The results did not reveal a significant difference in applying the science process skills between male and female students. Students' scientific knowledge and experience make a significant difference in comprehending and applying the scientific method's procedures. Science is taught to students in Malaysian schools from an early age, which helps them become more proficient in the subject, even in elementary school (Abd Rauf et al, 2013)

Nevertheless, depending on predecessors like observing, measuring, classifying, guessing, and communicating, the abilities of male and female students may differ (Shahali and Halim, 2010). The table shows that female students outperform male students, particularly in measuring, classifying, and communicating. According to a study by Yamtinah et al. (2017), people's abilities to perform basic science activities vary. According to the study, male students outperformed female students in several domains, including reasoning, control, and close observation.

In addition, female students perform better when comprehending concepts and interpreting information. Wilder and Powell (1989) state that female students do better on questions requiring them to write their answers since they are better speakers than male students. However, because they can attempt guessing, male pupils perform better when selecting questions. However, this circumstance is at odds with the study, which mainly discovered that female students outperform male students in the classroom. All these studies, however, demonstrate that male and female students differ in their mastery of science process abilities.

Is There A Relationship Between Science Process Skills And Interest In Science Among Students?

The basic line-based study results demonstrate a high correlation between students liking science and their science process skills. Children's love of science and the scientific-related abilities they acquire are intricately intertwined. The abilities required for scientific inquiry and

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problem resolution include observation, measurement, experimentation, and critical thinking. These are known as science process skills. According to research by Dolapcioglu and Subasi (2022), pupils who excel in science work abilities tend to enjoy science more. It makes sense because playing with objects, examining data, and drawing conclusions from experiments may be enjoyable and gratifying. Additionally, students who excel in science process skills can appreciate learning new things and feel confident in comprehending and interacting with the world around them (Maranan, 2017). Students may become even more willing and eager to learn about other scientific concepts due to this positive experience. Additionally, students with strong science process abilities may think creatively and tackle difficult problems in science. As a result, they become even more enthusiastic and engaged in learning.

Previous studies indicate that students with a solid understanding of science are more likely to be actively involved in their studies. Acquiring these abilities boosts academic achievement and encourages a sincere love and passion for science education (Asio & Mondejar, 2022). Consequently, motivating pupils to gain scientific knowledge may heighten their curiosity about the intriguing discipline of science. This will also help them achieve better academically.

Science assignments also involve duties that require students to work with their classmates and teachers in scientific experiments. Students who investigate, conduct studies, and analyze data are likelier to have a strong interest in science. Having a basic understanding of science encourages curiosity and flexible problem-solving techniques. Topsakal et al. (2022) assert that science is meaningful and pleasurable for students who understand the need for strong problem-solving abilities. They get better at monitoring their environment, posing inquiries, and trying to gather data through investigation or experimentation. Their natural curiosity is nourished, allowing them to remain interested in science.

Students' interest in science positively correlates with their comprehension and application of scientific principles. For example, learning becomes more interesting when students apply their analytical and problem-solving skills to scientific challenges. Over time, this maintains students' enthusiasm in science courses. Educators must create an environment where learners can learn new skills and develop a passion for science.

Does The Level Of Science Process Skills Differ Among Secondary Students Based On Age?

The study results indicate that the science proficiency of the 13 and 14-year-old children is comparable. Thus, students in Forms 1 and 2 are roughly equal in terms of scientific procedures. This trend supports the principle of equal education. It aligns with the notion that aptitude, dedication, and hard work rather than age determine academic success. Mastery of scientific processes is vital because these are key abilities that students develop when conducting experiments and solving problems. This aids in their comprehension of science. These abilities do not depend as much on age. Students typically develop and get better due to their experiences in both school and life. In addition, a student's development of certain science skills might occur at various points over their academic career. This may also occur as their capacity for thought grows. Science abilities are always changing based on our thought processes and educational experiences. Early acquisition of these abilities will prepare students for a lifetime of enjoyable nature exploration.

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Scientific skills are very important for everyone. Therefore, it is also necessary to work on scientific process skills that help students discover new things and solve scientific problems (Darmaji et al., 2022). The basic level of science skills includes observing, classifying, guessing, measuring and collecting information. It also includes sharing ideas with others. This aids in their comprehension of science. These abilities do not depend less on age. Students typically develop and get better due to their experiences in both school and life. In addition, a student's development of certain science skills might occur at various points over their academic career. This may also occur as their capacity for thought grows. Science abilities are always changing based on our thought processes and educational experiences. Early acquisition of these abilities will prepare students for a lifetime of enjoyable nature exploration.

Students' scientific methods also get better as they go through primary school. In order to help students engage in practical activities and pique their interest in science, teachers play a critical role. Students learn more about science as they become teenagers. They will use this information for their college education and future scientific professions. Therefore, their understanding of scientific processes improves with increased education. Students gain more knowledge about thinking critically and carrying out experiments by following the scientific method. Additionally, they improve their ability to do research and draw fresh conclusions from it. Every educational level affects my development. It varies according to what the students' study in class, how they apply what they learn in the real world, and how challenging the science concepts are for each grade level (Yamtinah, 2017).

Conclusion

Two major questions were the focus of this study: First, how age and gender disparities affect students' science process skills. Second is the relationship between students' enthusiasm for science and proficiency with the scientific method. The results of statistical testing refuted any significant differences and hence the bias about male and female scientific students. While there were some discrepancies between the genders regarding average scores, it was evident that both genders required similar skills to succeed. The study's results demonstrated how vital it is to do tasks, solve issues, and think critically to spark interest in science. The study also discovered a significant correlation between pupils' science process skills and their enthusiasm for the subject. Furthermore, there was no significant age-based variation in the science proficiency of Form 1 and Form 2 students. The study demonstrates the significance of gender, age, and educational attainment in understanding science process skills. The results contribute to the ongoing conversation about science education by demonstrating the need for teachers to create compassionate approaches to encourage all students to participate, ask questions, and develop a lifelong love of science.

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