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Exploring Junior High School Student's Attitude, Digital Literacy, and Self-Efficacy in Science Learning: A Survey Research

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ABSTRACT

Development of technology in the twenty-first century remarks things to work on. The demand of individuals' capability in utilising their skills and operating technological tools matters. Therefore, learners should be able to navigate to use technology effectively and think critically. Positive attitude matters to embrace individual become digitally literate. Building confidence is the fundamental state on developing skills, therefore strong self-efficacy needed. Understanding students' development on these skills is necessary in terms of learning. This study aims to explore junior high schoos students' attitudes, digital literacy, and self-efficacy in learning science in Bandung, Indonesia. Specifically, this study emphasizes more on whether gender differences existed across these dimensions and explored the factors that positively or negatively influenced students' interest in learning science. This study employed a quantitative using survey research design with a total of 334 participants were involved, including 138 male and 196 female participants. Data are collected through a form of questionnaires with a total of 42 items which utilises five likert-scale plus two-open ended questions. Data findings showcases that students demonstrate moderate levels accross all dimensions: Attitudes (M= 3.25), Digital Literacy (M= 3.20), and Self-Efficacy (M= 3.33). Independent t-test revealed no significant gender-based differences. Factors influencing students' interest are discussed. Based on students' answer to open-ended questions, science practical work, learning process, and science topics are the aspects that intrigued students to learn science. Contrastingly, scientific equation, terms, high other thinking skills, complex and abstract concepts, and teacher's personality are the aspects that makes students uninterested in learning science. This research contributes as one investigation of these dimensions in terms of learning science. Further studies may conduct research on how to enhance these dimensions.

Keywords : Self-Efficacy; Digital Literacy; Attitude; Science Learning; Junior High School Student

I. INTRODUCTION

The development of technology in the 21st century has been significantly spreading a humongous impact on society over the past few years [1]. Its prevalence accounts for the increasing demand of individuals' capability in navigating their skills to operate the newest advancement of technological tools and implementing it in real-world matters. Digital literacy has raised its corollary to be nurtured, as it maps out essential knowledge, skills, and attitudes required in the digital era [2]. Integrating information and communication technology (ICT) tools escalate the possibilities of delivering interactive learning experiences as well as boosting student motivation in comprehending scientific principles [3]. The plethora of ICT developments has changed the education paradigm [4]. Being able to scrutinise and integrate digital information is one form of being digitally literate [5]. Fully cultivating ICT requires strong and bold digital literacy skills [6]. As stated from the latest World Economic Forum meeting in The Future of Jobs Report 2025, digital literacy leads the top six of most demanded skills in recent era as well as the skill required in future jobs.

On the other hand, a positive attitude towards science might contribute students in their science learning activities [7]. Students' confidence is also an essential value to believe themselves in their abilities of achieving

what science demands [8]. Preparing students of technologically ready to compete with the digital and complex global society is a must, therefore, education systems must equip learners with both cognitive skills to enable them think critically, use technology effectively, and develop confidence in their learning potential [9]. The integration of technology enhances the way we understand phenomena and concepts in science education as a part of modern education and curricula [10]. In the 21st century, the importance of education relies on ensuring students possess the ability to learn, innovate, work, using life skills and utilising technology and information media [11]. In line with ICT integration, digital literacy emerges as a pivotal role in science education [12]. Students are prone to relying on digital resources to investigate scientific phenomena, interpret data, and communicate findings [13]. Proper digital literacy supports students to encounter new information and knowledge that accounts for their education [14].

Matter-of-factly, encompasses a belief of individuals' capability of learning and achieving, knowing as self-efficacy, serves as another notable value [15]. Students' performance could be affected by their beliefs on how well they can carry out the activities to achieve a desired outcome [16]. Without cromulent self-efficacy, the hesitation of exploring digital resources may arise. Thus, fostering both digital literacy and self-efficacy empower students to a successful course of action [17].

However, the accessibility of ICT does not always yield the intended outcome. Challenges are fond to occur, especially in Indonesia. Network connection and its infrastructure limitations and uneven resource distribution create huge barriers to effectively utilising ICT [18]. These infrastructural challenges are might contribute some hurdles for students' preparedness to leverage digital tools effectively for science learning, that may hinder the open access to resources [19]. While existing studies have examined self-efficacy in ICT learning contexts such as study about attitude, digital literacy and self-efficacy [20], the teacher digital competency [6], analysis of information and communication technologies in science education [3], learning behaviors, digital literacy, and educational outcomes [12], these investigations have not comprehensively examined gender differences in early adolescent learners. Moreover, it has not adequately addressed gender differences in digital competencies and attitudes within science learning contexts, despite evidence suggesting that gender may moderate the relationship between technology use and learning outcomes. Therefore, this study addresses the gaps by investigating how digital literacy, self-efficacy, and attitude towards ICT influence science learning among Indonesian junior high school students, with particular attention to gender differences. Specifically, this research seeks to answer the following questions:

1. How is students' attitude, digital literacy, self-efficacy toward science learning in junior high school?
2. Is there a significant difference in students' attitude, digital literacy, self-efficacy toward science learning based on gender?
3. What factors can influence students' attitude, digital literacy, self-efficacy in science learning?

By focusing on early adolescent learners in a developing country where both technological access and educational equity present ongoing challenges, this research contributes to exploring all the variables in science learning for diverse student populations.

II. METHOD

1) Research Design

This study employs a quantitative using survey research design to examine the relationships among three main dimensions: to measure the attitude, self-efficacy, and digital literacy. Followed by three supplementary dimensions: social interaction, academic interaction, and convener interaction in the context of ICT-supported science learning. Data are collected through a structured questionnaire utilizing a Likert-scale (strongly agree-strongly disagree) that was distributed to junior high schools in Bandung and the participants can fill it through Google Forms. To measure each variable and ensure representativeness, the study adopts a proportional random sampling technique, allowing for equitable selection of participants across different student populations.

2) Participants

A total of 334 junior high school students participated as the respondents of this study's questionnaire between the ages of 13 – 15 years. With a total of 138 male participants and 196 female participants. The profile shown in the table 1 below.

Table 1. Participants Profile

Demographics	N	Percentage (%)

Gender		
Male	138	41.31
Female	196	58.69
Total	334	100

Male participants accounted for 41.31% of total sample and female participants accounted for 58.59% of total sample. The distribution of data is more-likely has slightly more female participants.

3) Research Instrument

This study adopted the validated questionnaire from [20], which examined the interrelations among the students' attitude, digital literacy, and self-efficacy. Followed by three supplementary dimensions: social interaction, academic interaction, and convener interaction. The total statements across all dimensions are 40. 7 statements for attitude, 9 statements for digital literacy, 8 statements for self-efficacy, 5 statements for social interaction, 6 statements for academic interaction, 5 statements for convener interaction and two positive-negative open-ended questions. Initially, the instrument was translated to Bahasa Indonesia. To ensure the construct validity of the instrument, four science education experienced lecturers were involved, as well as reviewing the whole statements in the instrument critically, making sure of the relevance and clarity within each statement.

4) Data Analysis

The data in this research was analyzed by using Statistical Package for the Social Sciences (SPSS), version 25. The analysis focuses on three main dimensions: to measure the attitude, self-efficacy, and digital literacy. Followed by three supplementary dimensions: social interaction, academic interaction, and convener interaction. The descriptive and compare means was utilized to determine the significant difference in the level of attitude, self-efficacy, and digital literacy between male students and female students. Independent t-test was conducted to evaluate gender-based differences [21]. The data was analyzed by calculating the average of the total all of the grades. According to [22], this data analysis identifies these values to measure the average of total grades: 1.00-1.50 = very low, 1.51-2.50 = low, 2.51-3.50 = moderate, 3.51-4.50 = high, 4.51-5.00 = very high. Cronbach's alpha test was conducted to analyze the reliability of the data, including 40 items across 334 respondents. The result is .942.

III. RESULTS AND DISCUSSION

RQ1: ***How is students' attitude, digital literacy, self-efficacy toward science learning in junior high school?***

As a part of the data collection process, students were administered a standardized test comprising forty (40) items designed to assess their levels of attitude, self-efficacy, and digital literacy. The test was structured to provide quantifiable insights into each construct.

Table 2. Descriptive Statistics for The Average Score and Standard Deviation

Descriptive Statistics	N	Mean	Std. Deviation
Attitude	334	3.25	.610
Digital Literacy	334	3.20	.560
Self-Efficacy	334	3.33	.576
Social Interaction	334	3.39	.598
Academic Interaction	334	3.24	.601
Convener Interaction	334	2.98	.622

Before conducting a more comprehensive analysis, understanding the data set first is essential. Descriptive statistics were employed to analyse six dimensions measured in this study: attitude, digital literacy, self-efficacy, social interaction, academic interaction, and convener interaction. Descriptive statistics presents data in a clear and interpretable format to identify the patterns within the data [23]. Table 2 above is the concrete data for the descriptive statistics analysis across all dimensions. As presented in table 2, the highest mean score was observed in social interaction (Mean = 3.39) dimension, followed closely by self-efficacy (Mean = 3.33). Indicating that participants perceived themselves as relatively confident and socially engaged in this study. Conversely, convener interaction recorded the lowest mean (Mean = 2.98), indicating less engagement with the conveners. Meanwhile the rest of the dimensions, attitude (Mean = 3.25), digital literacy (Mean = 3.20), and academic interaction (Mean = 3.24) showed moderate levels of response. However, the data from the participants showed moderate level through all the items in each dimension.

Since the data shows a moderate–yet the second highest average–level of self-efficacy implies that students are mostly believe in their capability in science learning and succeed in learning tasks [24]. Students with strong self-efficacy often surround themselves with curiosity and related behaviour to seek long-term academic resilience [25]. Students also possess strong social interaction, indicating their active engagement and collaborative behaviour, particularly, engaging interactions with their peers [26]. This combination of self-efficacy and social interaction both empowering the adaptability and performance that later resulted in students' persistence [27].

RQ2: ***Is there a significant difference in students' attitude, digital literacy, self-efficacy toward science learning based on gender?***

Following the descriptive analysis, onward is the normality test that was conducted to analyse the distribution of the collected data [28]. Its purpose is to determine whether-or-not the sample data is normally distributed [29]. Moreover, the distribution of data is essential to overview the patterns and tendencies of the dimensions, mentioning attitude, digital literacy, self-efficacy, social interaction, academic interaction, and convener interaction. The result shown in the table below.

Table 3. Normality Test

Test of Normality						
Normality Test	**Kolmogorov-Smirnov**			**Shapiro-Wilk**		
	Statistic	df	Sig.	Statistic	df	Sig.
	334	334	.200*	.992	334	.055

Based on the normality test, the data do not significantly deviate from a normal distribution since $p = 0.055 > 0.05$. Meaning that the data is reasonably assume a normal distribution and supports the use of parametric tests such as independent samples *t*-tests [30].

Table 4 shows the average general score between male and female participant

Table 4. General score between male and female participant

General Score					
	Gender of Participant	**N**	**Mean**	**Std. Deviation**	**.Sig**
Total Score	Male	138	3.60	.493	.911
	Female	196	3.63	.502	

On table 4, it shows the total score of male and female participants to identify the general difference among both genders. Male participants had an average of 3.60 (SD = .493) meanwhile female participants had quite a very slightly higher average score, which is 3.63 (SD = .502). The 0.3 difference between both scores is minuscule, but it demonstrating both genders had a comparable and competing in an equivalent level. Moreover, the *p*-value = .911, suggest that it exceeds the conventional alpha level of .05. To determine a more sophisticated and comprehensive detail, a subsequent independent samples t-test (likely reported in Table 5) would formally confirm whether-or-not this average score difference is statistically significant.

Table 5. Independent *t*-test result to compare between gender of each dimension

Independent Samples *t*-test							
	Gender of Participant	**N**	**Mean**	**Std. Deviation**	**Sig.(2-tailed)**	***t***	**Mean Difference**
Attitude	Male	138	3.30	.644	.183	1.334	.090
	Female	196	3.20	.583	.191	1.312	.090
Digital Literacy	Male	138	3.23	.574	.452	.754	.046
	Female	196	3.18	.550	.455	.748	.046
Self-Efficacy	Male	138	3.28	.563	.297	-1.045	-.066
	Female	196	3.35	.585	.294	-1.052	-.066

Social Interaction	Male	138	3.35	.597	.362	-.913	-.060
	Female	196	3.41	.599	.361	-.914	-.060
Academic Interaction	Male	138	3.19	.603	.254	-1.144	-.076
	Female	196	3.26	.599	.254	-1.143	-.076
Convener Interaction	Male	138	2.92	.598	.176	-1.357	-.093
	Female	196	3.02	.637	.171	-1.372	-.093

Independent *t*-test was conducted to explore gender-based differences. Six domains were analysed, mentioning attitude, digital literacy, self-efficacy, social interaction, academic interaction, and convener interaction. Significance evaluated at $p < 0.05$ level [31]. The overall result shows no significant different, thereby implying that both male and female participants underscore a uniform distribution across gender-based analysis since none of the data set was > 0.05 [32]. Although there were slight variations in particular items but these differences were not large enough to considered statistically meaningful to support the whole data. This suggest that gender disparities are not the main concern to face the demands in the 21st century skills, emphasizing more into gender-equality-performance [33]. Previous study demonstrate that students' learning outcome should have been determined more into the motivational factors and related dimension(s) rather than gender differences [34]. Gender equity and equality has been acknowledged by junior high school rapidly, ensuring the awareness towards their fellow friends [35].

RQ3: ***What factors can influence students' attitude, digital literacy, self-efficacy in science learning?***
Open-ended questions were used for this analysis. There are two sections, namely the positive and negative. The positive section underlying the factors of what makes students interested in learning science (likely reported in Table 6).

Table 6. Statements of Students Interested in Learning Science

No	Statements	Percentage %
1	Because of science practical work	32.34
2	Because the learning process is intriguing	14.37
3	Because I could learn and comprehend deeper about a particular science topic	14.37
4	Because I can reconnect with nature	10.78
5	Others (Fun, Cherishable)	10.78
6	Because of teachers' personality and their teaching methods	5.09
7	Because my future career is in the field of science	3.29
8	Because I can meet and socialise with my friends during learning science	3.29
9	Because science is my favourite subject	2.40
10	Because science can support my self-development	2.40
11	Because it is integrated with daily life	1.20
Total		**100**

This table shows the statements of the factors of why students are interested in learning science. The most encountered statement is because of science practical work with a percentage of 32.34%. Students, especially those who are currently pursuing an education in junior high school are prone to enjoy hands-on activities such as practical work due to the observation and discovery [36]. It fosters a deeper engagement with their fellow peers or the topics they are demanded to learn [37].

Practical work enables students to connect their active learning, constructing their own understanding in regards to incorporating the theory to the realest context of their life [9]. The following statement is second-most encountered statements among the students with a percentage of 14.37, because the learning process is intriguing. This statement is interlinked to the prior one since practical work could also be a part of the learning process. Engaging learning process often sparks curiosity, enhances students' willingness to explore new concepts [38]. Onwards, students' intention to learn a particular topic rises as third most-encountered statements. Students interlink their cognitive and emotional resource when they perceive they could perform best and the learning material is related to their upcoming opportunities [39].

Students also perceive science is fun and cherishable, as enjoyment enhances the motivation to learn and memory retention [40]. Quite a comparable amount of percentage found on the reason that science is the subject students intended to pursue as their future career, and it's the reason they can socialize with their fellow peers. Both of this statement could intertwined to each other as a great opportunity to expand network and connection, to connect themselves with their future colleagues. Acknowledging about their future career is critical for students to generate a coherent planning in a very early setting of time [41]. Some of the students also have a keen interest with science due to it is their favorite subject, which often arises from sustained engagement, personal enjoyment, and maybe some successful experiences in some particular topics [42]. Students who see learning as a path to personal development are more likely to be a self-directed and self-regulated learners who seek the uncertainty to take active responsibility of their academic growth [43].

Students also stated that it enhances their self-development and science is integrated with their daily life. Students acknowledge that science is a subject that could support them and equip them with the most appropriate soft-skills to cultivate themselves, competing in their environment and truly discover it.

On the other hand, the negative section underlying the factors what makes science uninteresting for the students (likely reported in Table 7).

Table 7. Statements of What Makes Science Uninteresting for Students

No	Statements	Percentage %
1.	Because there are plenty of equations, high other thinking questions, and scientific terms	35.33
2.	Because of the complex and abstract concepts	19.46
3.	Because of teachers' personality and their teaching methods	13.17
4.	No reason/I like science	12.28
5.	Because I am incapable to master a topic, overwhelming amount of materials	8.38
6.	Because science is my boring and making an ineffective class condition	3.89
7.	Because of the exams	2.10
8.	Because some of the social inequality (some of my friends don't want to collaborate with me in a group activity)	1.50
9.	Because it is my least favourite subject	1.50
10.	Because it is lacking in hands-on activities and practicum	0.90
11.	Because I am incapable of solving a question	0.90
12.	Because some of the topics are difficult	0.30
13.	Because I need to collaborate with my friends in a group activity	0.30
Total		**100**

The findings in table 6 highlights various factors of what makes science uninteresting for students. Nevertheless, there are some statements of what makes science uninteresting for students with higher percentage, namely (1) because there are plenty of equations, high other thinking questions, and scientific terms with a percentage of 35.33. Students often perceive the equations are abstract and involving bizarre scientific terms for them, making it way harder to be comprehend due to they need to think even more critically [44]. Second most-encountered reason why students perceived science is not their cup of tea because of the complex and abstract concepts with a percentage of 19.46. Students found that teachers' personality and their teaching methods could interfere their interest toward science since teacher are the facilitator for students' development and understanding in learning science [45]. Teaching style and the teachers' personality may exacerbate the difficulty of the subject, once and for all [46]. The upcoming statement, which is students' incapability of mastering a topic, might be the aftermath of teacher's personality and their teaching method. Some of the students are experiencing a struggle where they need to grasp an overwhelming amount of learning materials at a time. Once students perceive themselves as incapable, they are more likely to disengage and develop a negative perception toward the subject [47].

Still related to the previous statements, this statement might be the aftermath of teacher's personality and their teaching method, since students feel boredom in learning science due to an unmanaged class environment. Exams, particularly sudden pre-test and post-test are found to be overwhelming for the students. Sudden exams can induce more anxiety level, sparks a higher pressure toward students' self-efficacy contemplating whether they could pass it or not. Furthermore, social inequality is often found in some of the classes during learning science, some of the students don't want to collaborate with each other in a group activity. Effective group work depends not only from a meticulous pedagogical planning but also the presence of inclusivity within the students, ensuring no one left behind [48]. Science is often encountered as least favourite subject for students.

When students repeatedly face challenges like mentioned before, they may begin to associate the subject with frustration or the feeling of failure. These interconnection leads to disengagement and reduces students' interest in learning science. The rest of the statements are having only a little percentage, namely: lacking in hands-on activities, incapability of solving a question, difficult topic, and forced-collaboration. Indicating that these aspects are not discouraging, with not-so-major obstacles. Challenges may occur but it built students' resilience.

IV. CONCLUSION

Based on the result and discussion of this research, it demonstrates that attitude, digital literacy, self-efficacy, social interaction, academic interaction, and convener interaction toward Information and Communication Technology (ICT) in science learning is steady in the moderate level. Attitude (3.25), Digital Literacy (3.20), Self-Efficacy (3.33), Social Interaction (3.39), Academic Interaction (3.24), and Convener Interaction (2.98). The highest was social interaction dimension and the lowest is the convener interaction dimension. Nevertheless, there is no significant difference between male and female participants through a gender-based test. There are several factors that makes science interesting, due to science practicum, students' interest to learn a particular topic, and the intriguing learning process. On the other hand, equations, high other thinking questions, scientific terms, complex and abstract concepts, teachers' personality and their teaching methods is the main reason why science is uninteresting for most students throughout this study.

Because this study is only focused in only one city; Bandung, therefore further studies could distribute the data with a broader range of participants or sample in a different and comparable area. Moreover, conducting a study on how to enhance these dimensions would be beneficial on improving all these dimensions in terms of science learning.

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