# Tapping into science and genetic literacy: Exploring gender-based disparities in a malang district high school

*by* Turnitin Instructor

**Submission date:** 03-Nov-2023 02:57PM (UTC+0700)
**Submission ID:** 2215851334
**File name:** 27294-Article_Text-106024-1-10-20230828.pdf (401.25K)
**Word count:** 6739
**Character count:** 38087

Biosfer: Jurnal Pendidikan Biologi

Journal homepage: http://journal.unj.ac.id/unj/index.php/biosfer

# Tapping into science and genetic literacy: Exploring gender-based disparities in a malang district high school

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**ARTICLE INFO**

**Article history**

Received: 03 June 2022
Revised: 11 August 2023
Accepted: 26 August 2023

**Keywords**:
Gender
Genetic literacy
Literacy ability
Science literacy

**ABSTRACT**

The influence of gender on science and genetic literacy emerges as a compelling issue within the realm of scientific education, prompting an exploration within the confines of a high school located in the Malang district. This quantitative investigation is designed to ascertain the gender-based influence on both science literacy and genetic literacy among students at a Senior High School within the Malang District. The study encompasses three distinct clusters of participants: the first cluster comprises 12 male students and 22 female students from the first-grade level, the second cluster consists of 9 male students and 22 female students from the second-grade level, and the final cluster comprises 10 male students and 19 female students from the third-grade level, amounting to a total of 94 students. The administration of science literacy and genetic literacy instruments was conducted through Google Forms, allowing the researchers to collect the necessary data. Subsequently, the accumulated data will undergo rigorous analytical scrutiny employing the One-Way ANOVA test. The outcomes of the analysis revealed a lack of statistically significant disparity in science literacy across genders [$F(1.92)=0.102$, $p=0.750$], as well as a non-significant difference in genetic literacy attributed to gender variations [$F(1.92)=0.773$, $p=0.382$]. In light of these findings, the implications for educational policies and interventions are discussed to enhance pedagogical practices and learning outcomes for both male and female students.

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Rohmah, L. F., Hindun, I., Husamah, H., Fatmawati, D., & Fauzi, A. (2023). Tapping into science and genetic literacy: Exploring gender-based disparities in a malang district high school. *Biosfer: Jurnal Pendidikan Biologi, 16*(2), 260-271. https://doi.org/10.21009/biosferjpb.27294

## INTRODUCTION

The rapid advancements in science and technology during the 21st century have engendered an imperative for society, particularly among students, to cultivate proficiency (Padmadewi et al., 2018). Literacy stands as a quintessential capacity that students must possess to effectively navigate the intricacies of the contemporary landscape (Situmorang, 2016), thereby fostering the cultivation of adept human resources endowed with elevated literacy competencies (Yuliati, 2017). The significance of mastering literate skills within the daily fabric of existence resonates in the ability to dispense information and cogitate with scientific acumen while making informed decisions (Zuriyani, 2017). The multifaceted realm of literacy comprises several facets, notably including (1) early literacy, (2) basic literacy, (3) library literacy, (4) media literacy, (5) technological literacy, (6) cultural literacy, and (7) information literacy (Purwo, 2017). Within the domain of foundational literacy education, the framework manifests in six distinct modalities, specifically encompassing (1) literacy, (2) numeracy, (3) financial literacy, (4) science literacy, (5) digital literacy, and (6) information and communication technology literacy, with science literacy constituting a pivotal component (Education & Culture, 2017). Through the prism of science literacy, students acquire the capacity to apprehend, access, comprehend, and effectively apply information (Putri, 2020). Genetic literacy, encompassing an essential facet of science literacy, assumes a consequential role in students' cognitive arsenal. One facet within the vast spectrum of scientific knowledge that often poses challenges due to its abstract nature and a profusion of technical terminology is genetic material; thus, an enhancement of genetic literacy proficiencies assumes paramount importance (Sarhim & Harahap, 2015). Genetic literacy, in its essence, denotes an informed grasp substantial enough to fathom, apply, and engage with genetics-related information pertinent to everyday life (Cebesoy & Oztekin, 2018).

The assessment of literacy skills stands as a pivotal yardstick for evaluating the educational caliber of a nation, particularly in the realm of science education, as evidenced by initiatives such as the Program for International Student Assessment (PISA) and the Trends in International Mathematics and Science Study (TIMSS) (Prabowo & Fidiastuti, 2017). Indonesia's trajectory in this context, marked by its PISA score in 2018, reflects a regressive trend, positioning the nation at the 74th rank among 79 participating countries (Hewi & Shaleh, 2020). While prior research has probed gender disparities within domains like financial literacy (Yunita, 2020), mathematical literacy (Suryaprani et al., 2016), and economic literacy (Nurhayati & Budiwati, 2020), the inquiry into potential gender variations in science literacy and genetic literacy remains uncharted. Science literacy, serving as a fundamental component in test development (Utami & Wardani, 2019), instrument construction (Novanti E. K. S., Yulianti E., 2018), skill evaluation of new students (Prabowo & Fidiastuti, 2017), and diagnostic tools for elementary school learners (Udompong & Wongwanich, 2014), converges with genetic literacy – an instrument frequently employed for identifying misconceptions associated with genetic material (Sarhim & Harahap, 2015), clarifying misconceptions concerning genetic substance (Madukubah & Taiyeb, 2017), and the development and assessment of evaluative instruments (Bowling et al., 2008). Hence, this study endeavors to explore the interplay of gender within the context of science literacy and genetic literacy within a senior high school in Malang Regency, further contributing to the understudied realm of gender-based variations in these literacies.

he process of learning is subject to considerable individual variability, influenced by distinct information absorption strategies among students. Notably, gender-oriented distinctions exert a significant impact on learning methodologies, as evidenced in Budi's research (2017). This study explicates that when engaging with evaluative instruments, female students tend to exhibit a predilection for meticulously identifying questions. They often approach this task with clarity, logical sequencing, and exhaustive comprehension, juxtaposed against their male counterparts who tend to encapsulate essential elements with precision and efficiency. Consequently, female students tend to manifest an enhanced capacity for intricate analytical and procedural processing. Rahayu's investigation (2013) corroborates these findings, revealing a proclivity among male students for convergent learning styles, while their female peers gravitate towards divergent learning paradigms.

Moreover, this gender-based variance extends into the domain of multitasking aptitude. Females showcase an innate capability for multitasking, an attribute that stems from their adeptness at engaging in concurrent activities. Nabila's research (2020) reinforces this notion, shedding light on how their propensity for multitasking in daily life seamlessly integrates into the educational context, yielding superior memory retention compared to their male counterparts. In concurrence, Pambudiono et al.

(2013) propose that structural differences attributed to gender, such as variations in neural connections density across the brain's hemispheres (Corpus callosum), confer upon females an inherent advantage in multitasking. This intricate web of gender-mediated cognitive nuances underscores the foundation for the subsequent inquiry, delving into the potential interplay between gender-based disparities, learning strategies, and the domains of science literacy and genetic literacy.

Gender-based research has been extensively conducted to assess disparities in students' cognitive abilities. For instance, a study by Cebesoy and Oztekin (2016) exploring spatial intelligence disparities reveals that both male and female students exhibit high levels of intelligence in test scenarios. However, while investigations have delved into areas such as spatial intelligence, the discourse surrounding genetic literacy and science literacy remains relatively uncharted in terms of elucidating potential gender-related discrepancies in abilities. This gap underscores the necessity for further exploration into the gender dynamics that may influence genetic literacy and science literacy. Consequently, this study's principal objective is to investigate the impact of gender on students' science literacy and genetic literacy, introducing a novel perspective to the ongoing discourse surrounding gender and cognitive proficiencies.

## METHODS

### Research Design

The research approach used in this study is a quantitative approach with the type of research used is observational research. Meanwhile, the research design chosen was using a cross sectional study. The location of this research is at one of school in Malang Regency, East Java, in the odd semester of the 2021/2022 academic year.

### Population and Samples

The population used in this study were students majoring in science at research location. The sampling method was using cluster random sampling technique. The sample size used in this study was 94 students. there are 3 classes from the cluster, class X as many as 12 male students and 22 female students, class XI as many as 9 male students and 22 female students, class X as many as 10 male students and 19 female students (Table 1). The independent variable used is gender which is distinguished by male and female sex. While the dependent variable is science literacy and genetic literacy.

**Table 1**

Respondent Demographic Data

| Criteria | Group | n (%) |
|---|---|---|
| Gender | Male | 31 (0,33) |
| | Female | 63 (0,67) |
| Age | 14 | 1 (0,01) |
| | 15 | 17 (0,18) |
| | 16 | 40 (0,42) |
| | 17 | 27 (0,29) |
| | 18 | 9 (0,10) |
| Class | 10 | 35 (0,37) |
| | 11 | 30 (0,32) |
| | 12 | 29 (0,31) |

### Instrument

Respondents were measured using the science literacy and genetics literacy questionnaire. Science literacy instrument adapted from Impey et al. (2011), thus, does not require validity and reliability testing because the instrument has been tested for validity and reliability. The science literacy instrument has three criteria for science literacy, namely basic science vocabulary, understanding of the process or nature of science investigation and the level of understanding of the impact of science and technology on individuals and society. While the genetic literacy instrument was developed based on Bowling et al., (2008) which refers to Hott et al. (2009). The genetic literacy instrument has 6 main concepts consisting of 43 sub-concepts of genetic material. The sub-concept of genetic material developed has decreased due to the existence of sub-concepts that are quite related and similar so that it becomes 17 sub-concepts of genetic material. The instrument sheet consists of 34 items (17 items about science literacy and 17 items about genetic literacy) with a correct score of 1 for each question and 0 if it is wrong.

### Procedure

The procedure in this study includes 3 stages, namely the preparation stage, the implementation stage, and the data collection stage. The preparation stage in this research includes the stage of making the instrument and preparing the tools and materials needed to support the research. The implementation stage includes the observation stage at the research location, the instrument filling stage carried out by students as respondents. Data collection in the study was obtained from questionnaire data that had been distributed to respondents. Questionnaires were distributed through a google form in the form of closed questionnaires which had available answers to the questions asked. Therefore, respondents are only allowed to answer questions according to the options provided. After the data is obtained, data analysis is carried out

### Data Analysis Techniques

The data analysis technique used to determine the effect of gender on scientific literacy and genetic literacy is the One-Way ANOVA test. After all respondents have processed the data, the things that need to be done in data analysis are grouping the data based on variables and performing calculations to answer the proposed hypothesis.

## RESULTS AND DISCUSSION

The ensuing section presents an in-depth analysis of the empirical findings, unveiling the intricate interplay between gender distinctions and science literacy, as well as genetic literacy. Through a comprehensive examination of the collected data, this study endeavors to unravel the nuanced dynamics that underlie gender-based variations in these critical realms of knowledge acquisition.

**Table 2**
Distribution Data of Student Responses to Science Literacy

| Items | Gender | Response n (%) | |
|---|---|---|---|
| | | Correct | Incorrect |
| 1. | Male | 12 (38,70) | 19 (61,30) |
| | Female | 23 (36,50) | 40 (63,50) |
| 2. | Male | 29 (93,55) | 2 (6,45) |
| | Female | 57 (90,48) | 6 (9,52) |
| 3. | Male | 26 (83,87) | 5 (16,13) |
| | Female | 52 (82,54) | 11 (17,46) |
| 4. | Male | 25 (80,65) | 6 (19,35) |
| | Female | 55 (87,30) | 8 (12,70) |
| 5. | Male | 23 (74,19) | 8 (25,81) |
| | Female | 48 (76,19) | 15 (23,81) |
| 6. | Male | 29 (93,55) | 2 (6,45) |
| | Female | 57 (90,48) | 6 (9,52) |
| 7. | Male | 27 (87,10) | 4 (12,90) |
| | Female | 58 (92,06) | 5 (7,94) |
| 8. | Male | 25 (80,65) | 6 (19,35) |
| | Female | 37 (58,73) | 26 (41,27) |
| 9. | Male | 31 (100) | 0 (00) |
| | Female | 58 (92,06) | 5 (7,94) |
| 10. | Male | 31 (100) | 0 (00) |
| | Female | 63 (100) | 0 (00) |
| 11. | Male | 29 (93,55) | 2 (6,45) |
| | Female | 48 (76,19) | 15 (32,81) |
| 12. | Male | 18 (58,06) | 13 (41,94) |
| | Female | 32 (50,80) | 31 (49,20) |
| 13. | Male | 18 (58,06) | 13 (41,94) |
| | Female | 38 (60,72) | 25 (39,68) |
| 14. | Male | 18 (58,06) | 13 (41,94) |

| Items | Gender | Response n (%) | |
|---|---|---|---|
| | | Correct | Incorrect |
| | Female | 34 (53,97) | 29 (46,03) |
| 15. | Male | 27 (87,09) | 4 (21,90) |
| | Female | 54 (85,71) | 9 (14,29) |
| 16. | Male | 17 (54,83) | 14 (45,16) |
| | Female | 40 (63,50) | 23 (36,50) |
| 17. | Male | 6 (19,35) | 25 (80,65) |
| | Female | 31 (49,20) | 32 (50,80) |

Based on the data presented in Table 2, an examination of the science literacy responses from students of a high school in Malang Regency reveals noteworthy patterns. Among the male students, a total of 31 respondents (100%) provided correct answers for item number 9 and number 10, resulting in a distinct level of proficiency. Likewise, a similar outcome is observed among female students, with 63 participants (100%) correctly responding to item number 10. Notably, all respondents, totaling 94 students, exhibited precision in their answers for item number 10. However, when considering the least accurately answered items, discrepancies emerge. For male students, question number 17 saw 6 participants (19.35%) providing correct responses, whereas among female students, the least accurate response occurred for question number 1, with 23 participants (36.50%) offering accurate responses. These findings collectively illustrate the diverse range of science literacy outcomes across genders within the studied context.

**Table 3**

Science Literacy Descriptive Statistics Results

| Science literacy | n (Total) | Mean | Standard Deviation | Maximal | Minimal |
|---|---|---|---|---|---|
| **Male** | 31 | 12,61 | 2,21 | 16 | 9 |
| **Female** | 63 | 12,46 | 2,15 | 17 | 7 |

Based on the findings presented in Table 3, a comprehensive overview of the science literacy scores among male students at this high school in Malang Regency is evident. Among the 31 male participants, the calculated mean or average score is 12.61, with a corresponding standard deviation of 2.21. The distribution of scores spans from a minimum of 9 points to a maximum of 16 points, illustrating a discernible range of performance. Specifically, there are instances where male students answered 16 item questions correctly, save for a single item that was answered incorrectly. Concurrently, the analysis of science literacy scores among 63 female students within the same context demonstrates analogous trends. The computed mean or average score for this cohort is 12.46, accompanied by a standard deviation of 2.15. The spectrum of scores stretches from a minimum of 7 points to a maximum of 17 points. Notably, some female students showcased an exceptional aptitude, achieving a perfect score by accurately answering all provided item questions. Conversely, a subset of female students secured a minimum of 7 points, signifying their engagement with a narrower set of correct answers.

**Table 4**

Distribution Data of Student Responses to Genetic Literacy

| Items | Gender | Response n (%) | |
|---|---|---|---|
| | | **Correct** | **Incorrect** |
| 1. | Male | 20 (64,52) | 11 (35,48) |
| | Female | 33 (52,38) | 30 (47,62) |
| 2. | Male | 15 (48,39) | 16 (51,61) |
| | Female | 24 (38,10) | 39 (61,90) |
| 3. | Male | 9(29,03) | 22 (70,97) |
| | Female | 18 (28,57) | 45 (71,43) |
| 4. | Male | 3 (9,68) | 28 (90,32) |
| | Female | 6 (9,52) | 57 (90,47) |
| 5. | Male | 18 (58,06) | 13 (41,94) |
| | Female | 36 (57,14) | 27 (42,86) |
| 6. | Male | 19 (61,30) | 12 (38,70) |
| | Female | 43 (68,25) | 20 (31,75) |
| 7. | Male | 12 (38,70) | 19 (61,30) |

| Items | Gender | Response n (%) | |
|---|---|---|---|
| | | Correct | Incorrect |
| | Female | 16 (26,40) | 47 (74,60) |
| 8. | Male | 20 (64,51) | 11 (35,49) |
| | Female | 42 (66,67) | 21 (33,33) |
| 9. | Male | 20 (64,51) | 11 (35,49) |
| | Female | 44 (69,84) | 19 (30,16) |
| 10. | Male | 9(29,03) | 22 (70,97) |
| | Female | 18 (28,57) | 45 (71,43) |
| 11. | Male | 16 (51,61) | 15 (48,38) |
| | Female | 15 (32,81) | 48 (76,19) |
| 12. | Male | 8 (25,81) | 23 (74,19) |
| | Female | 19 (30,16) | 44 (69,84) |
| 13. | Male | 27 (87,10) | 4 (12,90) |
| | Female | 50 (79,37) | 13 (20,63) |
| 14. | Male | 19 (61,30) | 12 (38,70) |
| | Female | 36 (57,14) | 27 (42,86) |
| 15. | Male | 1 (3,23) | 30 (96,77) |
| | Female | 9 (14,29) | 54 (85,71) |
| 16. | Male | 4 (21,90) | 27 (87,09) |
| | Female | 3 (4,76) | 60 (95,24) |
| 17. | Male | 26 (83,87) | 5 (16,13) |
| | Female | 53 (84,13) | 10 (15,87) |

Furthermore, utilizing the data provided in Table 4, an in-depth scrutiny of genetic literacy responses among students from a high school in Malang Regency unveils insightful trends. The assessment encompassed 17 questions, gauging students' grasp of genetic concepts. Notably, among male students, item number 13 emerged as the most accurately addressed question, with 27 participants (87.10%) selecting the correct answer. Conversely, within the female cohort, item number 17 stood out, with 53 students (84.13%) providing the accurate response.

**Table 5**

Genetic Literacy Descriptive Statistical Results Data

| Genetic literacy | n (Total) | Mean | Standard Deviation | Maximal | Minimal |
|---|---|---|---|---|---|
| Male | 31 | 7,93 | 2,5 | 13 | 3 |
| Female | 63 | 7,38 | 3,0 | 14 | 0 |

Analyzing the insights drawn from Table 5, a comprehensive overview of genetic literacy outcomes among male and female students at this high school in Malang Regency is evident. Focusing on the male cohort, the genetic literacy scores unveil a mean value of 7.93, accompanied by a standard deviation of 2.5. Scores span a range from a minimum of 3 points to a maximum of 13 points, exhibiting the varying levels of proficiency. Notably, male students' performance demonstrates diversity in their engagement with genetic literacy concepts. Turning to the female students, the genetic literacy scores encompass a mean value of 7.38, with a corresponding standard deviation of 3.0. The spectrum of scores spans from a minimum of 0 points to a maximum of 14 points, signifying the range of performance within the cohort. Importantly, the presence of zero scores suggests instances where female students encountered challenges in responding to the provided item questions.

**Table 6**

Normality Test on Male

| Component | Statistics | Df | Sig. |
|---|---|---|---|
| Science literacy | 0,121 | 31 | 0,200 |
| Genetic literacy | 0,105 | 31 | 0,200 |

Based on Table 6, it is known that the results of the Kolmogorov-Smirnov test inform the data on the results of science literacy in the male, namely [D(31)= 0.121, p=0.200] and the data on the results of genetic literacy in the male, namely [D(31) = 0.105, p = 0.200] so that the data obtained are normally distributed.

**Table 7**
Normality Test on Female

| Component | Statistics | Df | Sig. |
|---|---|---|---|
| Science literacy | 0,968 | 63 | 0,097 |
| Genetic literacy | 0,970 | 63 | 0,129 |

Based on Table 7, it is known that the results of the Shapiro-Wilk test inform the data on the results of science literacy in the female, namely [D(63)= 0,968, p=0,097] and the data on the results of genetic literacy in the female, namely [D(63)= 0,970, p=0,129] so that the data obtained are normally distributed.

**Table 8**
Homogeneity Test

| Component | Levene Statistic | df1 | Df2 | Sig. |
|---|---|---|---|---|
| Science literacy | 0,070 | 1 | 92 | 0,792 |
| Genetic literacy | 1,721 | 1 | 92 | 0,193 |

Based on Table 8, it is known that the Levene test results inform the variance of science literacy data in homogeneous men and women [F(1.92)=0.070, p=0.792]. The results of Levene's test inform that the variance of genetic literacy data in males and females is homogeneous [F(1.92)=1.721, p=0.193].

**Table 9**
One-Way ANOVA Test Results

| Component | Sum of squares | Df | Means square | F | Sig. |
|---|---|---|---|---|---|
| Science literacy | 0,484 | 1 | 0,484 | 0,102 | 0,750 |
| | 435,006 | 92 | 4,728 | | |
| | 435,489 | 93 | | | |
| Genetic literacy | 6,389 | 1 | 6,389 | 0,773 | 0,382 |
| | 760,728 | 92 | 8,269 | | |
| | 767,117 | 93 | | | |

Drawing insights from Table 9, the outcomes of the one-way ANOVA analysis unveil pivotal information regarding the interplay of gender and science literacy. The statistical analysis elucidates that no significant difference emerges in science literacy across genders, as indicated by the calculated F-ratio of 0.102 and a corresponding p-value of 0.750. This conveys that the gender-based variations do not manifest in a statistically discernible manner within the context of science literacy. Similarly, the outcomes of the one-way ANOVA analysis in relation to genetic literacy underscore analogous trends. The statistical findings delineate a lack of statistically significant variance in genetic literacy stemming from gender disparities, as denoted by an F-ratio of 0.773 and a corresponding p-value of 0.382. Collectively, these results emphasize the absence of robust statistical evidence for gender-mediated variations in genetic literacy outcomes.

**The influence of gender on science literacy**

The outcomes gleaned from this investigation robustly signify that gender exerts no significant impact on science literacy. Remarkably, these research findings converge with several antecedent studies, thereby attesting to the consistency of these results within the broader academic landscape. For instance, Tulaiya and Wasis (2020) delved into the science literacy proficiencies of male and female students in Sumenep Regency, ultimately revealing no statistically meaningful disparities. Notably, a parallel inquiry underscored the absence of a positive and significant correlation between gender distinctions and science learning achievements among students, as noted in Ayu et al.'s research (2018). The underlying rationale lies in the observation that gender, as a distinguishing factor, doesn't inherently predispose either males or females towards divergent learning accomplishments, as elucidated by Hidayat and Dwiningrum (2016).

Further corroborating these insights, a myriad of studies substantiates the limited impact of gender differences on various learning outcomes. As expounded in studies investigating biology (Hidayat & Dwiningrum, 2016), physics (Nurfadilah, 2019), and chemistry (Harida et al., 2012) learning achievements, gender differences exhibited negligible influence on academic performance. This consensus is underpinned by the notion that academic accomplishments are not solely contingent on gender-related factors but are more profoundly shaped by the intricate interplay of multifaceted variables. Indeed, Sandora's assertion (2018) elucidates that academic achievement cannot be neatly encapsulated within biological disparities; rather, it's a product of a complex amalgamation of cognitive, emotional, and intellectual dynamics inherent to both male and female students.

Contrastingly, divergent findings emerge in studies that underscore significant gender-based disparities in enhancing science literacy. The stance presented by Ismail et al. (2016) advocates for the existence of pronounced distinctions in science literacy gains attributed to gender. The argument stems from the premise that females exhibit superior competencies, grounded in their meticulous and assiduous approach to learning, as delineated by Fadlika et al. (2020). This notion is further fortified by research that establishes females' propensity for heightened creative thinking capabilities and a penchant for innovation as quintessential components of their cognitive approach, as illuminated by Zubaidah et al. (2018).

The findings derived from this study affirm the notion that gender does not exert a discernible influence on science literacy, owing in part to the comparable motivation exhibited by both male and female students, as illuminated by Fatmawati Zahroh (2016). A pivotal connection between motivation and learning outcomes, as established by Hidayat and Dwiningrum (2016), further elucidates this correlation. Consequently, the commonality in motivation between male and female students anticipates commensurate learning achievements, bolstering the argument that gender-related differences have a diminished impact in this context.

Delving into the intricate dimensions of motivation, Rumhadi (2017) outlines three fundamental components: needs, encouragement, and goals. Remarkably, these constituents remain consistent across gender lines, suggesting a shared motivational backdrop for male and female students. Additionally, the collective perspective shared by both genders on the perceived complexity of science material, as posited by Pratiwi et al. (2019), underscores the challenges encountered while mastering science subjects. This notion resonates with the outcomes of the Program for International Student Assessment (PISA) science literacy test in 2018, where Indonesia's placement at the 74th rank out of 79 participating nations (Hewi & Shaleh, 2020) accentuates the nation's educational quality lagging behind counterparts like Singapore, Malaysia, and Thailand (Prabowo & Fidiastuti, 2017). This global ranking is emblematic of Indonesia's quest to bridge the educational divide within the region.

**The influence of gender on genetic literacy**

The findings derived from this study distinctly affirm that gender lacks a discernible impact on genetic literacy, a sentiment mirrored by several antecedent research endeavors. In consonance with prior scholarship, Mardiani et al.'s investigation (2021) resonates with our findings, reporting a notable absence of significant gender-based disparities in knowledge and cognitive skills. Similarly, investigations into cognitive prowess by Darmawan et al. (2018) underline the shared cognitive aptitude of male and female students, thus affirming the non-discriminatory effect of gender on cognitive abilities.

Complementary to these observations, investigations spotlight the limited role of gender in shaping critical thinking capacities, as Zubaidah et al. (2018) articulate that both male and female students demonstrate comparable potential in this regard. Likewise, analyses of metacognitive skills by Syarifah et al. (2016) dismiss gender's influence on students' cognitive faculties, a sentiment echoed in Heong et al.'s study (2011).

However, divergence surfaces in comparison with Zuhara et al.'s findings (2019), suggesting superior biological literacy skills among male students. This stands in contrast to research by Wardani et al. (2018), which asseverates the enhanced critical thinking abilities of female students, attributed to their refined analytical skills. Moreover, studies accentuating female students' elevated creative thinking capabilities (Siswati et al., 2016) reinforce the idea that their cognitive acumen extends to imaginative domains, driven by their propensity for creativity and innovation in the thinking process, as posited by Ulger & Morsunbul (2016).

The dynamics of gender differences find roots in a multifaceted interplay of biological, social, and cognitive factors, as delineated by Zaduqisti (2009). Notably, Santrock & John (2009) underscore evolution, heredity, and social experiences as contributory factors for gender-based disparities in brain functionality. While intellectual prowess transcends gender roles, males exhibit enhanced visual-spatial abilities. Remarkably, our study aligns with the overarching narrative emerging from research, signifying that gender's influence on both genetic literacy and science literacy is fundamentally inconsequential. Consequently, these findings underscore the complexity of gender's role in the broader realm of literacy outcomes.

The disparities between genders in terms of science literacy and genetic literacy emerge as a noteworthy consideration within the scope of this study. In congruence with these findings, it is pivotal to recognize that genetics is a constituent of the broader realm of biological sciences, which, in turn, is encompassed by the broader sphere of science itself (Radjabessy et al., 2019). These connections underline the interrelatedness of genetic literacy within the context of science literacy, positioning the former as an integral segment of the overarching scientific narrative.

Akin to these insights, it's crucial to acknowledge the educational policies that proactively prioritize the cultivation of science literacy as a fundamental objective within the educational landscape (Narut & Supardi, 2013). This perspective inherently underscores the expansive purview of science literacy, encapsulating a wide spectrum of scientific domains, including genetics. The recognition of science literacy's comprehensive embrace aligns harmoniously with the nuanced relationships between genetic literacy and the broader dimensions of scientific understanding.

## CONCLUSION

Based on the conducted analysis, it is evident that gender differences do not significantly impact the science literacy and genetic literacy of students. Moving forward, it is recommended to foster inclusive educational strategies that cater to diverse learning styles and motivations. Additionally, exploring the influence of socio-cultural factors on gender and literacy, and tailoring pedagogical approaches to accommodate various gender identities, could yield valuable insights for future research. This study underscores the need for ongoing discussions on gender-inclusive education and the intricate relationship between gender and literacy outcomes.


## ACKNOWLEDGMENT

The successful completion of this research owes a debt of gratitude to numerous contributors. Thus, the researchers extend their heartfelt appreciation to the school administration, dedicated educators, and diligent students of a certain high school in Lawang for their invaluable cooperation in facilitating this study. Additionally, the researchers wish to express their profound gratitude to the LPPI (Research and Community Service Institute) of Universitas Muhammadiyah Malang for their unwavering support in realizing the publication of this paper.


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