INTERNATIONAL JOURNAL OF ACADEMIC RESEARCH IN PROGRESSIVE EDUCATION & DEVELOPMENT

OPEN ACCESS JOURNAL

Vol 12, Issue 1, (2023) E-ISSN: 2226-6348

Uncovering Gender Differences in Water Literacy among High Schoolers

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To Link this Article: http://dx.doi.org/10.6007/IJARPED/v12-i1/16465 DOI:10.6007/IJARPED/v12-i1/16465

Published Online: 26 February 2023

Abstract

This study aims to look into gender-based differences in high school students' water literacy knowledge, attitudes, and values. Utilizing a simple and stratified random sample procedure, 380 fourth graders from eight schools in Hulu Langat, Selangor, were selected to participate. The data were gathered using a 5-part questionnaire that had sections for respondent information, scientific knowledge, hydrosocial knowledge, attitudes, and water literacy values. A two-way MANOVA was used to examine inferential data. Male and female students scored significantly differently on average, with female students surpassing male students in knowledge and attitudes, according to the results. The value of water literacy does not differ significantly across male and female students. The results of this study may be useful in identifying knowledge and comprehension gaps regarding water-related issues, which could help in the development of educational materials and programmes as well as people with high levels of water literacy in terms of attitudes and values.

Keywords: Water Literacy, Scientific Knowledge, Hydrosocial Knowledge, Attitudes, Values

Introduction

Water is a fundamental element that makes up 70% of the earth's surface and is crucial to human life. Dean et al (2016); Mostacedo-Marasovic et al (2022); Tian et al (2021) highlighted that inadequate knowledge of water resources and systems is a significant cause of unsustainable water management and usage. Hence, it is imperative that water education play a significant role in this process to prepare the future generation with necessary knowledge on water issues in social, cultural, and economic formation for human activity (Maniam et al., 2021). It is understood that water literacy can be difficult if a generation is not raised with the necessary information, attitudes, and values. In an endeavour to encourage student learning about water literacy related to human activities, it may become more difficult if a generation without the information, attitudes, and values of water literacy is not created. Consequently, one of the subjects that needs to be highlighted in the realm of education is water education (Mostacedo-Marasovic et al., 2022).

Water is essential to both human and environmental life and health, making it crucial to increase water literacy. It plays a crucial role in most ecosystems and is essential as a source of drinking water, irrigation, and industrial activities (Kasim & Halim, 2019). People can make

wiser choices about how to utilise and manage water resources by having a greater grasp of issues related to water (Mccarroll & Hamann, 2020; Praveena & Themudu, 2022). Water literacy is viewed as the comprehension of water-related issues, as well as the abilities and attitudes required to make choices regarding its use and management (Mccarroll & Hamann, 2020; Praveena & Themudu, 2022). It covers the water cycle, the value of water to the environment and to human health, as well as the difficulties and opportunities associated with water management (Otaki et al., 2015). Understanding hydrology and the social, cultural, and economic aspects that influence water management and access are all part of water literacy (Meganck, 2010). In addition, water quality, resource management, and the significance of water in supporting ecosystems and human communities are all included in this multidimensional topic.

Water literacy can be taught in schools through a variety of topic areas, including science, social studies, and environmental studies, as well as through practical learning activities like field trips and service-learning projects (Aminrad et al., 2013). Students can learn about the significance of water in their daily lives, as well as the health and wellbeing of their communities and environment, by learning about water literacy. Additionally, it can educate students on the difficulties and problems associated with water availability, conservation, and management while also motivating them to take action to safeguard and maintain water resources (Kasim & Halim, 2019; Ladue et al., 2021; Mustakim et al., 2019). Students can have a greater awareness of the crucial role that water plays in their lives and the world around them by boosting their water literacy, which can be accomplished by educators. It may indirectly instil a sense of responsibility for this priceless resource and further inspire pupils to take steps to safeguard and preserve water for future generations (Mostacedo-Marasovic et al., 2022; Aminrad et al., 2013).

Gender generally plays a role to influence individuals' levels of knowledge, perspectives, and moral standards on a variety of subjects, including water literacy. These disparities may be influenced by several things, such as biological differences, education, subjective experience, cultural and societal standards, and even differences in experience and culture (Aydogdu & Cakir, 2016). However, the existing database has not been able to provide sufficient data to draw firm conclusions regarding the variations in water literacy knowledge, attitudes, and values.

The importance of this study lies in the potential impact it could have on gender equity in environmental education. Gender equity is crucial for achieving sustainability goals as it ensures that everyone has equal access to knowledge, resources, and opportunities to participate in decision-making processes (Çoban et al., 2011; Kasim & Halim, 2019; Praveena & Themudu, 2022). The study aims to bridge the gender gap in water literacy, which refers to an individual's understanding of the importance of water and their ability to use and conserve it effectively. By identifying the factors that influence gender differences in water literacy, this study could help promote gender equity in environmental education.

High school is an important period in a student's education because it is when many fundamental concepts are learned. During this time, focusing on improving water literacy can help to instill good habits and knowledge that will last into adulthood. Evidence-based strategies can be developed for improving water literacy among high school students, including specific approaches for addressing gender differences (Mostacedo-Marasovic et al. 2022). This can aid in the development of more effective educational programmes and policies that result in better outcomes.

Furthermore, addressing the gender gap in water literacy is vital for achieving the United Nations Sustainable Development Goal 6, which aims to ensure access to clean water and sanitation for all by 2030. Achieving this goal is critical for global sustainability, and promoting water literacy among high schoolers is one way to contribute towards this objective (Amahmid et al., 2019).

Additionally, this study is significant because it targets high schoolers, a demographic that is often overlooked in environmental education research. High schoolers are at a critical stage in their lives where they are developing their attitudes and behaviours towards the environment (Aydin et al., 2017). By identifying the factors that influence gender differences in water literacy among this demographic, this study could help educators design more effective environmental education programs that are specifically targeted towards high schoolers (Kanapathy et al., 2020).

Water Literacy in Education

Understanding and being knowledgeable about the value, usage, and management of water is known as water literacy (McCarroll & Hamann, 2020). Water is necessary for life and has a significant impact on society, the environment, and education, so it is a crucial element of education. Every level of education, from elementary school through high school, may teach students about water literacy. Science, social studies, and environmental studies are just a few of the areas that the curriculum can be implemented into. The nature and properties of water, the water cycle and how it affects the environment, the significance of water for human health and well-being, water management and conservation techniques, and issues and challenges relating to water, such as pollution, drought, and flooding, are some of the subjects that might be covered in a water literacy curriculum (Huffling & Scott, 2021; Ladue et al., 2021). Teachers may aid children in understanding the crucial role that water plays in their lives and the environment around them by promoting water literacy (Radzi et al., 2019).

Knowledge, Attitude and Value of Water Literacy Among Students

Water literacy-focused educational initiatives can improve students' knowledge of water-related topics and have an impact on their attitudes and values. For instance, McDuff et al (2008) found that educational programmes emphasising water literacy increased students' knowledge of water-related issues and improved their attitudes toward water conservation. The study involved high school students in the United States. On the other hand, Sammel (2014)’s water literacy programme for Australian primary school pupils improved students' understanding of water-related issues and shaped their attitudes toward water use and conservation. Depending on their age, education level, and prior exposure to water-related issues, students' knowledge, attitudes, and values about water literacy can differ (Yu et al., 2021). Students who have participated in water literacy education initiatives typically have a greater understanding of the value of water and how they may contribute to the preservation and sustainable management of water resources. They might also adopt behaviours that conserve water and preserve water quality as well as value water more as a resource (Soczu & Turker, 2020). But if larger efforts to safeguard and sustainably manage water resources are increased, water literacy education can be helpful in boosting knowledge and encouraging positive attitudes and values related to water (Aydogdu & Cakr, 2016). Policies, rules, and infrastructure all contribute to the promotion of sustainable water management practices (Tian et al., 2021).

Knowledge, Attitudes, and Values Related to Water Literacy by Gender

Numerous research has examined how high school students' knowledge, attitudes, and values about water literacy change depending on their gender. In general, this research discovered that there were some notable distinctions between male and female students in the field. According to several studies, men and women may perceive environmental concerns, such as those involving water, differently. For instance, a study indicated that women are more likely than men to engage in pro-environmental action and tend to have more positive attitudes regarding environmental conservation. Studies by Borges (2019), Gilbertson et al (2011); Wong and Chan (2018) as well as others imply that men may be more likely to engage in risky or unsafe behaviours that can harm the environment, especially water resources. Due to the possibility of significant individual variance in water literacy and environmental attitudes among high school students of all genders, it is crucial to stress that the findings of this study are not necessarily generalizable.

A prior study by Mariapan et al (2019) revealed that there are gender variations in secondary school students' knowledge, attitudes, and values about water literacy. Past research has shown that men tend to have a higher level of water literacy than women, particularly in terms of technical knowledge and comprehension of issues relating to water. There are a number of reasons why this can be the case, including the impact of societal gender stereotypes, variations in educational possibilities and experiences, and personal interests and motivations (Tian et al., 2021). In UK, Boys scored much higher than girls on a water literacy quiz, with boys outperforming girls in all but one of the quiz categories (Johnson & Courter, 2020). Males are more likely than females to turn off the faucet while brushing their teeth or take shorter showers (Ladue et al., 2021).

Similar findings were discovered in Senol and Koca (2022) that examined gender disparities in water literacy among high school students in the United States. It was found that the males performed better on water literacy tests than the girls. Additionally, it was discovered that men are more inclined to practise water conservation and to feel a sense of personal responsibility for water resources. It should be stressed that gender disparities in water literacy are not necessarily pervasive and can vary based on cultural, social, and economic factors (Hawke, 2012). The knowledge, attitudes, and values of water literacy among high school pupils of different genders are probably different in certain ways. On the other hand, there is a great deal of individual variety within each gender as well, so it would be incorrect to generalise about all people of a specific gender. Therefore, it is appropriate to explore how cultural and environmental influences may shape individual knowledge, attitudes, and values connected to water literacy (Johnson & Courter, 2020).

Regarding the variations in students' water literacy knowledge, attitudes, and values, there are a number of study gaps. Numerous specific problems still need to be studied, such as how gender affects water literacy. More research is required to better understand the particular variables that lead to these inequalities and to find measures to promote gender equality in water literacy, even if there is some indication that there may be gender variations in water literacy (Maqbool et al., 2021). The likelihood that there is a gender difference in students with different levels of education and water literacy is also revealed by investigating the amount of knowledge, attitude, and value of water literacy (Gilbertson et al., 2011). More research is also needed to identify ways to raise water literacy among students at all educational levels and to comprehend how education levels impact water literacy (Meganck, 2010; Owens et al., 2020; Praveena and Themudu, 2022).

Even though it is acknowledged that water literacy can influence behaviours related to water management, more research is required to determine the most effective ways to encourage students to adopt sustainable water management practices. In general, a deeper comprehension of the variations in water literacy among students and the connection between water literacy and water management practices can aid in the creation of efficient educational and outreach initiatives that encourage students to adopt sustainable water management (Nurlaili et al., 2022).

To accomplish the goal of this study, the following research questions are developed:
1. What is the level of water literacy knowledge, attitude, and value among secondary school students?
2. Is there a gender difference in the degree of water literacy among high school students?
3. Are there differences in high school students' attitudes towards water literacy based on gender?
4. Does the value of water literacy among high school students differ by gender?

The focus of this study will be on comparing the high school students' knowledge, attitudes, and values regarding water literacy based on their gender.

Methodology

This study was created using a quantitative design framework, which is especially clear in the use of questionnaires to gather data. Simple and stratified random sampling procedures were used to construct the study's sample. The District Education's Planning and Management Sector of the Selangor State Education Department, the Hulu Langat District Education Office, and the School Administrators have all given their clearance for this study to proceed based on ethical considerations. Before the respondents were included in the study, all of their data and personal information had been validated, and all information was guaranteed to be confidential and secure.

Study Sample

A group of fourth grader students in Selangor's Hulu Langat Education Office's Secondary School's serve as the study's respondents. The population of this study, comprising a total of 12092 students from 38 schools in the Hulu Langat district, was established (data from the Secondary Science and Mathematics Unit, Hulu Langat Education Office, 2022). 380 persons made up the sample for the study. Krejcie and Morgan's (1970) research sample size determination table was used to guide the selection of the respondents. According to the table used to calculate sample size, a sample size of 375 persons is required if the total population is between 10,000 and 15,000 people.

The justification for choosing a sample of that level is based on the study's primary priority, which is to compare the knowledge, attitudes, and values of water literacy among secondary school students. The study's target audience is fourth grader students because junior high school students have been studying environmental issues for three years. Since fourth grader students are thought to have more mature environmental knowledge than lower secondary students, their selection aligns with the study's main objective. Furthermore, fourth grader students were chosen based on their readiness to serve as the study population because they were exempt from participating in public exams for the duration of the year this study was conducted.

Instrument

This study made use of a questionnaire instrument. The fourth-grade students' knowledge, attitudes, and values about water literacy were measured using a questionnaire. The set of questionnaires contained 43 questions and is divided into five sections: part A collects demographic data about the respondents; part B examines their scientific understanding of water; part C examines their hydrosocial knowledge; part D gathers data for the development of water literacy attitudes; and part E examines the value of water literacy. The instruments in Sections B and C have been modified from those used by (Mostacedo-Marasovic et al., 2022). In contrast, the items created for Sections D and E were based on the questionnaire items from studies conducted by Mariapan et al (2019) and Sabriyah and Kospa (2018). To fulfil the criteria required for this research, the instrument reference based on these two studies has been modified. The designed questionnaire uses a 1–5 Likert scale for its items (1: Strongly Disagree; 2: Disagree; 3: Not Sure; 4: Agree; 5: Strongly Agree).

Before the actual questionnaire was given out, a pilot study of this instrument was conducted on 30 students who shared the same demographics as the actual study. Three experts carried out the content validity while the internal consistency and satisfactory item reliability values were at or above 0.65. (Creswell & Creswell 2018). Table 1 displays Cronbach's alpha score for each construct. As a result, the questionnaire employed is appropriate and can be utilized for the real study's goal.

Table 1
Reliability statistics

Sub construct	**Cronbach's alpha**
Scientific Knowledge	0.718
Hydrosocial Knowledge	0.874
Attitude	0.918
Value	0.845
Overall	0.839

Data Analysis

The Statistical Package for Social Science (SPSS) version 29.0 software is used for two different forms of analysis in this study, namely descriptive analysis and inferential analysis. To determine the level of knowledge, attitudes, and values of students regarding water literacy, descriptive analysis and percentages were utilised. Mahalanobis distance values are checked using a multivariate data outliers test, and data is cleaned by deleting anomalous data. The z value for skewness and kurtosis analysis is then used to determine if the data in this distribution are normal. The z value of skewness and kurtosis for each variable is less than ±1.96, indicating that the data is regularly distributed (Pallant, 2020). Use of the MANOVA test is for inferential analysis. The variations in knowledge, attitudes, and values of water literacy based on gender were examined in this study using MANOVA analysis.

Demographic Background

Table 2 displays the distribution and proportion of respondents from 380 fourth grader secondary school students in Hulu Langat Selangor, with 224 (58.9%) more female respondents than male respondents (156; 41.1%). 226 respondents (59.5%) live in metropolitan regions, whereas 154 respondents (40.5%) reside in rural areas. In this survey,

285 respondents or 75.0% were Malays, followed by 62 Chinese (16.3%), 29 Indians (7.6%), and 4 respondents (1.1%), all of whom were natives of Sabah.

Table 2
Demographic analysis of study respondents

Respondents' background		n	%
● Gender	Male	156	41.1
	Female	224	58.9
	Total	**380**	**100**
● Location	Urban	226	59.5
	Rural	154	40.5
	Total	**380**	**100**
● Ethnicity	Malay	285	75.0
	Chinese	62	16.3
	Indian	29	7.6
	Bumiputera Sabah	4	1.1
	Total	**380**	**100**

The Box's M test and Levene's test, which are both provided in tables 3 and 4, were used as a matrix test to check the homogeneity of the covariance variance before the MANOVA analysis was carried out. The results of the Box's M test on gender revealed that there was no difference in the variance and covariance between the independent and dependent variables (F = 1.792, p=0.065) (p>0.05). Because of this, the dependent variable's variance and covariance are homogeneous throughout the independent variable. Table 3's Levene's test analysis results indicate that all variables' variance and covariance are equal and good (p>0.05), which gives the impression that all variables have complied with the requirements so that the MANOVA test can be performed (Pallant, 2020).

Table 3
Box's M Test

Box's M	F value	df1	df2	Significant level (p)
18.159	1.792	10	414982.074	0.065

Table 4
Levene's gender-based test

DV	F value	df1	df2	Significant level (p)
Scientific knowledge	0.248	1	380	0.443
Hydrosocial knowledge	0.101	1	380	0.336
Attitudes	0.017	1	380	0.332
Value	0.686	1	380	0.737

Levels of Knowledge, Attitudes and Water Literacy Values Among Gender Middle School Students

Descriptive analysis was used to explain the results in the form of mean scores and standard deviations to respond to this research question. According to Azhar's (2018) scale, which is shown in Table 5, the mean range is interpreted. According to Table 6, the highest mean score is for value of water literacy (M= 4.19, SD = 0.296), followed by hydrosocial knowledge (M= 4.17, SD = 0.356), scientific knowledge (M= 3.90, SD= 0.369), and water literacy attitude (M= 3.77, SD = 0.358).

Table 5
Mean range of study variables

Mean Range	Interpretation
1.0 to 1.9	Very low
2.0 to 2.9	Low
3.0 to 3.9	Average
4.0 to 4.9	High
5.0	Very high

Source: Azhar (2018)

Table 6
Mean, standard deviation and interpretation of knowledge, attitudes, and values

Variable	n	Mean	Standard Deviation	Interpretation
Scientific knowledge	380	3.90	0.369	Average
Hydrosocial knowledge	380	4.17	0.356	High
Attitude	380	3.77	0.358	Average
Value	380	4.19	0.296	High

Differences in Water Literacy Knowledge Levels Among Secondary School Students Based on Gender

To answer the research question, MANOVA analysis was conducted to measure the difference in water literacy knowledge. The results of the analysis are shown in table 7.

Table 7
MANOVA analysis of differences in water literacy knowledge based on gender

Effect	N		Pillai's Trace	F	dF between groups	dF between groups	Significant level (p)
Gender	Male Female	156 224	0.011	1.988	2.000	349.000	0.039

The results of the MANOVA test, which was used to determine whether there is a significant difference in water literacy knowledge based on gender, are displayed in Table 6. According to research, men and women have various levels of understanding regarding water (scientific knowledge and hydrosocial knowledge). Pillai's Trace value = 0.011, F = 1.988, and p = 0.039 < 0.05 demonstrate the significance of the difference. This demonstrates unequivocally that there is a significant difference in water literacy knowledge between male and female students and that the null hypothesis is rejected.

To find out whether male and female students' knowledge of science and hydrosocial issues differed, more detailed evaluations were performed. According to table 8, male students achieved a higher mean than the group of female students. However, it was discovered that female students scored higher on average than male students in the construct of scientific knowledge. The analysis's findings also unambiguously demonstrate that there is a substantial difference between male and female students' levels of scientific and hydrosocial knowledge (F = 4.60, p = 0.037, p< 0.05; F = 2.69, p = 0.043, p < 0.05). Therefore, the null hypothesis is rejected since there is a distinct difference between male and female students' scientific and hydrosocial knowledge.

Table 8
Analysis of student test results

DV	Group	Mean	df	Squared Mean	F	p
Scientific Knowledge	Male Female	3.91 3.89	1	0.034	4.60	0.037
Hydrosocial Knowledge	Male Female	4.13 4.17	1	0.339	2.69	0.043

Differences in Levels of Water Literacy Attitudes Among Secondary School Students Based on Gender

A MANOVA analysis was done to find out how different people's attitudes toward water literacy compared to address the study issues. Table 9 displays the findings of the analysis.

Table 9
MANOVA analysis for differences in water literacy attitudes based on gender

Effect	n		Pillai's Trace	F	dF between groups	dF between groups	Significant level (p)
Attitude	Male Female	156 224	0.011	5.779	1.000	320.421	0.029

The findings of the MANOVA test used to determine if there is a significant difference in attitudes toward water literacy based on gender are displayed in Table 9. Men and women have different attitudes toward water literacy, according to the research. Pillai's Trace value = 0.011, F = 5.779, and p = 0.029 < 0.05 demonstrate the significance of the difference. The test results reveal a substantial difference in attitudes toward water literacy between male and female students, rejecting the null hypothesis.

To find out if male and female students had different views on water literacy, a detailed test was conducted. In accordance with Table 10, female students achieved a higher mean than male pupils. The results also demonstrate that opinions among male and female students differ significantly (F = 5.78, p = 0.017, p < 0.05). Therefore, the null hypothesis is rejected since there is a definite difference in views toward water literacy between male and female students.

Table 10
Analysis of attitude tests among students

DV	Group	Mean	df	Square mean	F	p
Attitude	Male Female	3.71 3.81	1	0.730	5.78	0.017

Differences in Water Literacy Values Among Secondary School Students Based on Gender

A MANOVA analysis was carried out to evaluate the differences in the value of water literacy to respond to the research question. Table 11 displays the analysis' findings.

Table 11
MANOVA analysis of differences in water literacy values based on gender

Effect	n		Pillai's Trace	F	dF between groups	dF between groups	Significant level (p)
Value	Male Female	156 224	0.011	1.988	1.000	341.383	0.737

The results of the MANOVA test used to determine whether there is a significant difference in the value of water literacy based on gender are presented in Table 11. The results also indicate that there is no difference in the value of water literacy between men and women. Pillai's Trace value = 0.011, F = 1.988, and p = 0.737 > 0.05 demonstrate the value. As a result, the null hypothesis failed to be rejected and there was no significant difference in the value of water literacy between male and female students. In conclusion, male and female students have the same value towards water literacy.

Discussion

Overall, the data clearly demonstrates that fourth grade students' attitudes and knowledge of water literacy are moderate for both genders. In spite of this, both men and women place a high value on water literacy. The findings of this study are consistent with those of Baker et al (2015); McDuff et al (2008), who discovered that women are more likely than males to have a greater understanding of water literacy. Water is the primary source of life for all species on Earth, hence it is crucial to have the knowledge, attitude, and value of water literacy (Anwar, 2014). Understanding how water functions and how to use it responsibly can be achieved via education. We can appreciate and safeguard this finite water resource by maintaining a positive attitude and understanding its importance. Additionally, having a better understanding of water might help us prevent issues with it like water scarcity or contamination (McDuff et al., 2008). Understanding how water can become contaminated enables people to avoid damaging activities while assuring the safety of the water they consume. A person's understanding of the value of clean water and how to manage it can assist them promote good health and lower their risk of contracting diseases that are spread via the use of contaminated water (Gilda Wheeler, n.d.). Additionally, a water literate mindset can assist people in realising the value of safeguarding water resources and the effects of human activity on them. Understanding how water influences the environment and nearby ecosystems can be done with the aid of water literacy knowledge, attitudes, and values. Understanding the effects of water on the environment allows for the application of appropriate action to safeguard water resources and guarantee water sustainability for future generations.

Differences in Water Literacy Knowledge Levels Among Secondary School Students Based on Gender

Overall, the study's findings regarding respondents' water literacy skills indicate that all of them have a good degree of understanding. Additionally, gender disparities reveal that women are more hydrosocially knowledgeable than males when it comes to water literacy. But for scientific knowledge, girls outperformed guys in terms of mean. This demonstrates that both male and female students are proficient in water literacy and are able to use their knowledge in daily life. The results of this study are consistent with those of Baker et al (2015) and McDuff et al (2008), who found that in some situations, women are more aware of water-related issues and are more likely to implement water-saving and water-quality-protecting actions. For instance, a study by Mariapan et al. in 2019 and one by Aydin et al. in 2017 discovered that women have better water literacy knowledge than males to manage water for home use, and as a result, women have a better understanding of the difficulties and dangers related to water access.

Differences in Levels of Water Literacy Attitudes Among Secondary School Students Based on Gender

According to a study by Baker et al (2015), there are gender differences in secondary school students' attitudes concerning water literacy. The study discovered that, in comparison to males, girls typically have more favourable attitudes toward water conservation and have a better understanding of issues related to water. Studies have revealed that there are attitudes between boys and girls about water literacy. The research (Martnez-Borreguero et al., 2020) demonstrates that women are more likely to engage in water-related activities and programmes and have a tendency to have a more positive

attitude toward water conservation and management. It is abundantly obvious from the analysis's findings that female students achieve higher means than male students, demonstrating that they have a more favourable attitude toward water literacy.

Differences in Water Literacy Values Among Secondary School Students Based on Gender

Male and female students do not differ significantly in their understanding of the value of water literacy, according to the analysis's findings. The benefit of water literacy is shared by both sexes. According to Schneiderhan-Opel & Bogner 2021 and the study by Amahmid et al. 2019, the development of a person's attitude will result in a high positive value toward a problem, particularly those relating to the environment. Everyone, regardless of gender, should value water literacy. Water management and conservation are vital roles played by both genders, and both have important insights to provide. Having a high value of water literacy is important for individuals, communities, and societies because it can assist individuals and societies grasp the significance of safeguarding water resources and the influence of human activities on these resources. In conclusion, participation from both sexes is critical to ensuring sustainable water management and conservation since both genders, whether female or male, have distinct and valuable perspectives and skills in water literacy.

Conclusions

There are a few limitations on this study. First, the assessment of the knowledge construct is only concentrated on the set of scientific and hydrosocial information, as well as the measuring of attitudes and values solely based on gender. Although the sample size satisfies the sample population's standards, a bigger or more representative sample would enable more accurate and significant data analysis to discern the differences between male and female students' knowledge, attitudes, and values about water literacy (Norkhaidi et al., 2017).

Next, the diversity of the student population presents a barrier to the research of water literacy among students in terms of knowledge, attitudes, and values. According to Coban et al (2011), different students may have various degrees of prior knowledge as well as distinct cultural or personal values. This can make extrapolating conclusions or analyses from studies on water literacy among students to a larger population challenging. It could be challenging to effectively measure knowledge, attitudes, and values, which is another limitation. Different study methodologies may yield different outcomes when measuring these constructs. Additionally, the definition and measurement of water literacy may vary from study to study, making comparisons challenging (Huffling & Scott, 2021). The availability of resources and research funds may also place restrictions on the study of water literacy among these students. This may restrict the size and reach of the study as well as the data collection techniques available.

The implications of the study on the knowledge, attitude, and value of water literacy among students can be significant because the understanding of water literacy by students can assist educators and policy makers in identifying areas that may require more education and resources to improve understanding and stewardship of water resources. The results can also aid in the creation of curricula and educational initiatives that are customised to the unique requirements and features of the student body. Environmental Sustainability, a topic covered in all Science courses, has been used to incorporate the idea of water literacy. But this title's emphasis is only a component; it does not highlight the significance of water literacy. It will be important to regularly build and implement an environmental sustainability

curriculum that addresses the topic of water literacy to create a generation with a high degree of water literacy in terms of knowledge, attitudes, and values.

Further research is required to identify any potential differences between men and women in their knowledge, attitudes, and values relating to water literacy and how these differences can affect actions related to water conservation and protection. However, it is important to foster water literacy with student understanding, attitudes, and high value standards. It is not only the school's responsibility to make an attempt to educate this generation concerning water literacy; rather, parents and community members must therefore contribute their efforts.

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