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A Situational Study to Understand Health Literacy on the Conceptualizations of Scientific Literacy in Bangladesh: Where are We?

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ABSTRACT

Scientific literacy encompasses many other big ideas, such as health literacy. In Bangladesh, there is still a dearth of studies to determine the current state of scientific literacy and health literacy. Therefore, our goal is to fill this research gap. That is to say, what is Bangladesh's current state of scientific and health literacy? A descriptive study was carried out, the data gathered from surveys was arranged, and statistical calculations were performed. This study finds that the participants are not very interested in learning about their surroundings and are not willing to engage in scientific discussions or use scientific knowledge to influence decisions or claims made by others about common health issues. The science curriculum does, however, subtly aim to prepare the next generation of knowledgeable scientists. Therefore, one may legitimately contend that the science curriculum still lacks the clarity necessary to properly train stakeholders. The results have implications for new curricula, curriculum materials, the teaching and learning process, and the public.

Key Words: *Scientific Literacy, Health Literacy, National Curriculum.*

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Background setting

Scientific literacy is the issue that UNESCO (2020) has suggested to revitalize after the outbreak of the COVID-19 situation and is expected to reshape education after this global challenge. In the commission report, UNESCO emphasizes ensuring scientific literacy within the curriculum (UNESCO, 2020). This is because, along with the outbreak of COVID-19, the COP26 also reminds us of anthropogenic involvement in climate change because of denial of scientific knowledge. It not only reminds us of the degree of interference but also targets protecting communities by working together. These are explicit concerns that we have been exposed to in our everyday lives, as according to UNESCO (2020), we fight against the rejection of

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scientific understanding (UNESCO, 2020). Such a situation is further intensified by some more news and information sources. Some of this news sometimes makes us alert, whereas others are found to be fake and undependable. UNESCO (2020) mentions that the spread of fake news and misinformation is destroying our lives and continues to mention the urge to fight against this misinformation. In line with that, concurrently, Hoq, Toma, and Rahman (2019) studied ten cases of unreliable news and information sources about COVID-19 and how the mass population of Bangladesh responded to those. The result is somewhat like the situation mentioned by UNESCO (2020). They found most people were less suspicious about the claims of the media and reluctant to discuss the erroneous news to understand the world around them. They were not interested in applying scientific knowledge to make informed decisions. In their conclusion, Hoq, Toma, and Rahman (2019) mentioned that seven out of ten responses were made without any acceptable scientific explanation, meaning a lack of scientific literacy.

Therefore, scientific literacy remains an area for further exploration in Bangladesh. Godrum (2004) defines a scientifically literate person as someone who is keen to better understand the surroundings of the world. Scientific literacy enables people to participate in discussions on and about science matters relating to everyday life. Such literacy is important to raise questions posed by others and become sceptical. Subsequently, it helps people relate and consider questions to reach an evidence-based conclusion and select the best option for betterment. Long before Godrum, Shen (1975) defined science literacy as not only encompassing knowledge but rather the knowledge that could be useful to solve everyday issues related to health and survival.

As a result, the concept of scientific literacy is broad and encompasses other concepts, such as health literacy. Health literacy is one of the scientific literacy concepts (Ploomipuu, Holbrook, and Rannikmäe, 2020). Initially, the niche of health literacy was confined to developing understandings of public health and clinical approaches only (Nutbeam, 2008; Pleasant and Kurivilla, 2008). Later, health literacy was defined as the capability to understand and process health-related information. Such information can be used to deal with healthcare, to prevent disease, and for health promotion (Sørensen & Brand, 2013; Sørensen et al., 2015). Soon, the concept of health literacy started to encircle a broader territory, like a critical and dynamic skill that involves both knowledge and information to interact with the societal and cultural environment while making health-related decisions (Ma˚rtensson, Hensing, 2012). Most recently, Ploomipuu, Holbrook, and Rannikmäe (2020) have come up with a multifaceted concept of health literacy on the conceptualizations of scientific literacy. But, in Bangladesh, barely any study is found that conceptualizes health literary under the spectrum of scientific literacy not only academia but also in public life. Sizear and Islam (2023) mentioned that there has been a significant shift in the previous two decades from communicable to noncommunicable diseases (NCDs) globally. In Bangladesh, there is a double disease burden, with NCDs accounting for 67% of fatalities (Sizear & Islam, 2023). NCDs are primarily lifestyle-related and can be mitigated with lifestyle treatments. Basic health literacy is the key to addressing

this catastrophic situation. According to them, low health literacy was evident in Bangladesh, and it has become a matter of concern immediately after the pandemic situation, demanding urgent attention. More than 60% of people in Bangladesh initially reach out to informal healthcare providers, such as drug vendors and village physicians, for medical advice. These doctors frequently administer medications, including antibiotics, without a correct diagnosis, increasing the risk of taking the wrong antibiotic, resulting in negative health consequences and antibiotic resistance, a developing issue.

As mentioned earlier, most of the studies of Bangladesh are confined to understand whether status of scientific literacy or the challenges to achieve it. Therefore, the purpose of this study is to explore the current state of health literacy under the domain of scientific literacy in Bangladesh.

The research question is: RQ: what is the current state of scientific and health literacy in Bangladesh?

Literature Review

The purpose of this article is not to place health literacy in the ongoing arguments over statutory and non-statutory subjects, but rather to get an understanding of the nature and currency of health literacy under the concepts of scientific literacy and how these two literacies are intertwined. The interrelationship between these two concepts is further described by developing a conceptual framework, which in turn will look for the answer to the main research question. What is the state of health and scientific literacy in Bangladesh?

The aim of literature review is to set a connection between science curriculum and literacies. Therefore, this section first discusses the basic concepts of both scientific literacy and health literacy. Then it explains how health literacy is linked to scientific literacy by the conceptual framework. Further, it explains the characteristics of a health literate person. Finally, it emphasizes the significance science curriculum to develop health literacy among young and adolescents as it has a long-term impact on life-expectancy.

Scientific Literacy:

According to the OECD (2015), scientific literacy entails the successional involvement of knowledge, competencies, and attitudes. These elements are elaborated on below.

Knowledge

The OECD divides knowledge into three main categories. These are-

- content knowledge: basically, means knowing the fundamental facts, theories, and

ideas of science.

- procedural knowledge: the procedures and theories that ground empirical analysis.
- epistemic knowledge: compassion to understand the importance of theories, hypotheses, observing qualities, measuring, classifying, inferring, and many more science process skills

Competencies

Like knowledge, competencies are further categorized into three main groups.

- explain scientific phenomena: understand and assess the justifications of experiences and events.
- evaluate and design scientific inquiry: can critically address and analyse questions.
- scientifically interpret data and evidence: can draw an informed decision based on facts and evidence.

Attitudes

Under this category of scientific literacy, an individual performs the above-mentioned competencies by exhibiting several social engagements and motivating others. This stage is characterized by participation of an individual in social activities. An individual with scientific literacy attitude will encourage others to undertake personal and social responsibilities as well.

Health literacy:

In its simplest way, most recently, Ploomipuu, Holbrook, and Rannikmäe (2020) has come up with a multifaceted concept of health literacy that involves:

Basic knowledge: It means having some basic knowledge about health with some reading and writing skills.

Information skills to improve quality of life: These are set of skills and abilities to search for and apply and validate information to make health related decision.

Self-regulation: It means having attitudes and interest to know about health-related information and consider several domains of literacy like ethical, societal and many more.

Social and civic issues: It means having insights about the impact of health literacy on society and behave socially in response to health issue.

Nutbeam (2000), on the other hand, identified three levels of health literacy.

- Functional literacy

This type of literacy entails having the ability to read and write to perform the tasks of daily life. It means people will be able to read leaflets with health-related labels.

- Interactive literacy

This type of literacy is defined as having the attitude to contribute to social activity. Such a type of literacy enables one to obtain information and understand implicit meaning from different sources of health, which in the long run helps to deal with changing situations. To make it simple, it is the level of literacy at which people come by information from the internet, TV, or other sources and can understand the pivotal concept of that information and further discuss and negotiate.

- Critical literacy

This is the most advanced level of health literacy. It combines functional literacy with social skills to better grasp different aspects of life events. Such literacy helps to make informed decisions in times of need.

Therefore, to sum up, according to Nutbeam (2000), the characteristics of a health-literate person are shown in the following table.

Table 1.

Characteristics of health literate person according to Nutbeam (2000)

Health literacy	Characteristics
Functional literacy	• Basic cognitive knowledge and skills to perform in everyday situation • Ability to read and understand health related information
Interactive Literacy	• Involves social skills along with the cognitive knowledge • Understands and interprets derived meaning from different sources • Participates in health-related discussion
Critical literacy	• More advanced than both functional and interactive • Ability to critically analyse information and apply over situations • Make informed decisions

Conceptual framework:

Based on the above discussion, it is understandable that both scientific literacy and health literacy have some common ground and are complementary to one another in some respects.

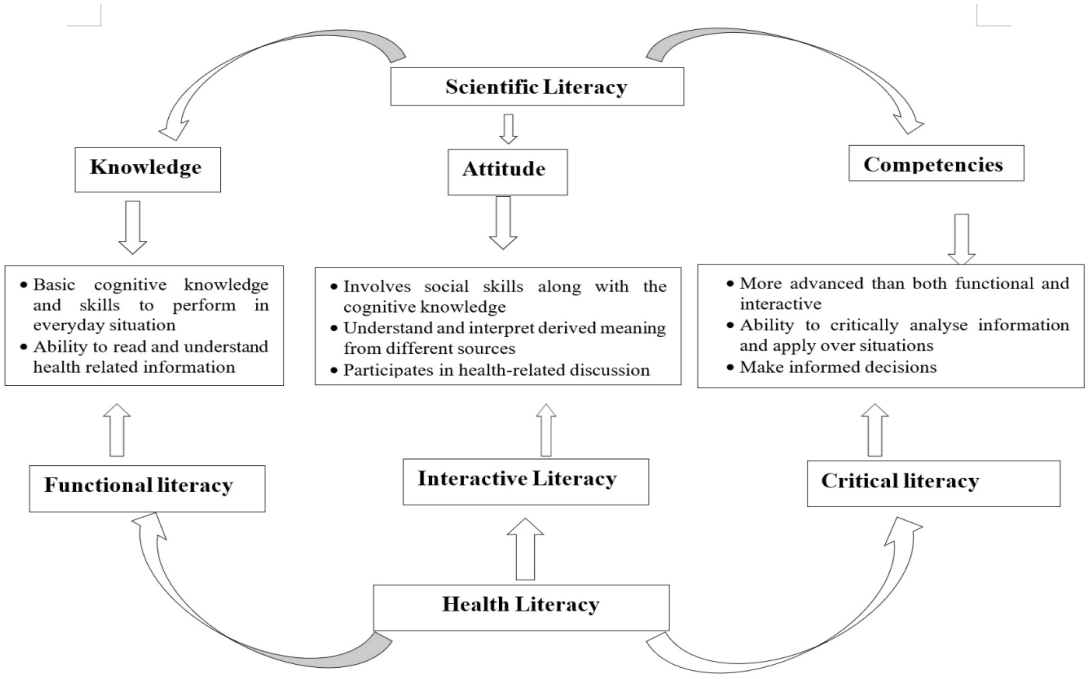
Both consider the importance of

- having adequate and fundamental knowledge
- understanding and processing information
- having attitudes toward science and health
- making participation in social activity
- making an informed decision

Both the framework of the Organisation for Economic Co-operation and Development [OECD] (2015) to define scientific literacy and the levels of health literacy of Nutbeam (2000) will provide the conceptual framework. Some aspects of scientific literacy and health literacy are combined below to develop the conceptual framework. The framework is shown in figure 1.

Figure 1.

The Conceptual Framework



Health literacy and its importance:

According to Sizear and Islam (2023), health literacy is the ability to receive, process, and comprehend essential health information and services required to make informed health decisions. As a result, comprehending the necessary information and making the correct decisions for improved health is critical (Sizear & Islam, 2023). Health literacy enables individuals to control their own health by making informed healthcare decisions, increasing communication with health-related individuals, and improving their capacity to comprehend complicated medical information in a medical environment.

A health-literate person understands how to read food and drug labels, allowing them to make educated decisions about consumption-related things that benefit their health. Low health literacy, on the other hand, has individual, family, and societal implications such as prescription mistakes, inefficient chronic disease care, longer hospital stays, inadequate responses to public health emergencies, and higher death rates (Sizear & Islam, 2023).

Science curriculum and health literacy:

Schools are increasingly viewed as pivotal sites for the spread of health messages via curriculum and other on-site provisions, as childhood and adolescence can determine health throughout life. Freedman et al. (20112) emphasized the importance of prioritizing health education and development for children and young people, as it has a long-term impact on their health and well-being. Schools may enhance students' health literacy through courses and learning environments. School-based health education programs engage and assist students in developing knowledge and skills essential for health literacy (Ofsted, 2012). Schools are responsible for educating and encouraging young people to eat properly and be physically active, in accordance with existing health promotion guidelines (DfE, 2011a). This comprises laws governing layout building and recreational places, catering (including vending machines), and the curriculum, which includes physical education (DfE, 2011b).

Methodology

The central phenomenon of the study is to explore the status of scientific literacy and health literacy. According to Creswell (2015), research design is guided by a strategy of inquiry.

A descriptive study was conducted to understand the status of health literacy and scientific literacy. The information collected from questionnaires was organized, and statistical computations were made to explore the relationships among different variables. The quantitative data obtained through open-ended questions in the questionnaire is described qualitatively in sentence form. Responses to the closed-ended questions are fed into a computer and analysed using SPSS version 20.0 software. Descriptive statistics were applied to compute the percentage and frequency distributions of the respondents on the variables. Finally, the results are summarized,

and meaningful interpretations of the results are made to draw conclusions and implications. A questionnaire was developed for an in-person survey. The questionnaire had four sections.

- Firstly, the demographic information of respondents including education
- Secondly, knowledge and safety about health and source of knowledge and advice seeking practice related to health and capacity to influence social norms and interact with social groups

The Flesch reading ease score of the questionnaire was estimated to be 52.2, and the Flesch-Kincaid grade level score was 6.5. Such scores denote that the questionnaire is difficult to read and is applicable to 10th to 12th grade school levels. To understand health literacy, the Rapid Estimate of Adult Literacy in Medicine—Short Form (REALM-SF) test was adopted.

Respondents above 18 years old, irrespective of sex and a variety of socioeconomic backgrounds, were first provided with a consent form. Respondents were assured confidentiality and anonymity to avoid individual identity. The data was collected from 5 pharmacies around New Market Area, Dhaka, Bangladesh, and the collection tenure was from March 8, 2021, to April 30, 2021. Participants were requested to complete the questionnaire as they entered or left the pharmacy. Immediately after the release of the lockdown phase in Bangladesh, a total of 150 respondents participated in this study. Each was greeted with vitamin C for their participation.

Demographics

The participants' demographic data are summarized in Table 1. Female (54%) comprises major participant numbers within the varying age-groups.

Table 1.

Demographic Data of Participants

Age	No.	%
15-20	23	15.33
21-30	37	24.67
31-40	48	32.00
41-50	28	18.67
50+	14	9.33
Gender		
Male	69	45
Female	81	54

Education Level	No.	%
No Education (0)	13	8.76
Below Primary (1-7)	13	8.67
Primary (8-9)	32	21.33
Secondary (10-11)	32	21.33
Tertiary 12+	60	40

Health Literacy	No.	%
0	21	14
1	12	8.00
2	13	8.67
3	06	4.00
4	11	7.33
5	12	8.00
16.67		
33.33		

25
50
6
7

Knowledge and functional literacy:

The following parts reveal the findings on participants' knowledge and functional literacy. It considers risk awareness, health services, and participation in population health programs. It consists of-

- over the counter (OTC) medication and paracetamol use
- baseline paracetamol knowledge and
- three key paracetamol assessment questions

OTC Medication and Paracetamol Use:

Table 2.

Over the Counter (OTC) Medication and Paracetamol Usage

	Number	Percentage (%)
Taken OTC medications in past 6 months for pain/fever		
Yes	104	69
No	46	37
Ever used Paracetamol		
Yes	135	90
No	15	10
Ever used or given a liquid formulation of paracetamol		

Yes	37	24.67
No	113	75.3
Ever used Napa		
Yes	141	94
No	9	6
Look at active ingredients when purchasing OTC products		
Yes	29	19.33
No	121	80.67

As shown in Table 2, the majority (69%) of participants reported taking an OTC medication in the past 6 months for pain or fever. Almost all (90.0%) participants used paracetamol, though almost 81% did not notice active ingredients when purchasing OTC products. According to Nutbeam (2000), a health-literate person was supposed to read and interpret health information from the label on a pill bottle to exhibit functional literacy and interactive literacy.

Baseline Paracetamol Knowledge

At baseline, participants were asked to identify which products contained paracetamol from a list of common OTC cold and pain medications. Half of them (53.33%) did not select paracetamol, and the rest associated paracetamol with other OTC medications. For example, Napa (32.30%), Ace (22.60%), Xcel (10.01%), Tufnil (6.5%), Anadol (2.5%), Myolox (8.5%), Histacin (12.5%), Alatrol (3.68%), Fexo (1%), and Rupa (0.41%).

When asked whether participants knew what paracetamol was, almost two-thirds (115p, 76.66%) responded “yes”; alternatively, when asked if Napa contains paracetamol, more than half responded “no” (80p, 53.3.0%). This means that participants in this study lack advanced cognitive knowledge and interactive health literacy. Above all, do not show the characteristics of a scientifically literate person, as a lack of content knowledge is evident here.

Three Key Paracetamol Assessment Questions

Participants were asked three key paracetamol assessment questions to determine general scientific literacy and health literacy, exploring basic paracetamol knowledge

Table 3.

Paracetamol Assessment Questions

Questions	correct answers	correctly answered	incorrectly answered
Does Napa contain paracetamol?	Yes	9.33% (14p)	90.66% (136p)
What is the maximum daily dose of paracetamol	3-4 in number or 3500-4000 mg	4% (6p)	96% (144p)
What is the primary concern with excessive paracetamol use?	Liver damage	30.0% (45p)	70% (105p)

** P denotes Participants

Before the condensed educational consultation, 90.66% (136p) of participants did not correctly answer that Napa contains paracetamol. Regarding the maximum daily dose, 4% (6p) correctly chose the 3500–4000 mg range. The most chosen paracetamol dosing range was 1500 to 2000 mg per day, or 93.33% (140 p). About toxicity from excessive Napa use, only 30.0% (45p) correctly identified liver damage. Participants who completed secondary and tertiary education were more likely to answer all three assessment questions correctly than those with a primary, below average, or low level of education. Similar results were seen in participants who had the highest REALM-SF score (7 of 7) compared to those who had lower REALM-SF scores. 33% of those surveyed had achieved the maximum REALM-SF health literacy score of 7 out of 7. REALM-SF scores also indicate that most participants lacked sufficient basic skills in reading and writing to be able to function effectively in everyday situations. Regardless of educational and health literacy level, most participants were unable to answer all three basic paracetamol questions correctly at baseline.

Therefore, health literacy was not as dominant as it was needed among the participants in general, and education was not found to influence their health literacy level. Lack of knowledge leads to the conclusion that participants will need to go a long distance to behave like scientifically literate people.

Attitudes and interactive literacy

Attempts to understand attitudes and interactive literacy were made by exploring the source of knowledge and seeking advice. Less than half (36.0%) of the participants have ever received information on the potential harm from excessive paracetamol. Of these, the most common source came from a pharmacist (45.33%), followed by media such as television (TV), the Internet, radio, and newspapers (27.33%), with only 24.67% stating they received such information from a physician.

As a result, even though participants were using various forms of communication, they needed to interpret health information from the internet and discuss it with a physician when negotiating treatment.

On the other hand, participants were surveyed to determine their preferred method of receiving medication safety education. They most frequently chose TV/radio/newspaper announcements (51.33%), followed by improved/easier labelling on medication containers (20.66%) and educational poster displays in the pharmacy aisle (22.66%). Only 5.33% of total participants rated a face-to-face consultation with family members.

Therefore, participants lack competencies and more advanced cognitive skills, which, together with social skills, enable them to critically analyse information and use this information to exert greater control over life events and situations.

Competencies and Critical Literacy

It was explored for its capacity to influence social norms and interact with social groups.

Table 4.

Competencies and Critical Literacy

1. Have you invited community participation to resolve any health issue	
Yes	No
34.67%(52p)	65.33 (98p)
2. Have you developed core group to resolve any health issue	
Yes	No
28.67% (43p)	73.33% (107p)
2.1 Have you explored health issues with core group	
Yes / No	
4.67% (7p) / 95.33% (36p)	
2.2 With the core group, have you explored health issues with broader community	
Yes / No	
6% (9p) / 64% (34p)	
3. Have you set priority to resolve any health issue	
Yes	No
7.33% (11p)	92.67% (139p)
4. Have you created community action plan	
Yes	No
6.00% (9p)	94%(141p)
5. Have you monitored community progress	
Yes	No
2.67% (4p)	97.33% (146p)

According to the table, over 65% of people did not participate in resolving any health issues individually. When asked whether they had worked in groups, only 28% of participants mentioned their participation, and the rest were unaware of their involvement in any social issues. Even though around 28% of participants-initiated participation, they hardly monitored any community progress. The number of participants who set any action plan or priority service to absolve health issues was nominal.

Therefore, the ability to critically analyse information to apply to situations was lacking among the participants.

Recommendation and conclusion

This study explored the status of scientific literacy and health literacy. According to it, people of Bangladesh in general lack health literacy when studied under the scientific literacy. It has an impact on science curricula, and mass populations. There are some implications for future research from the findings as well. The following section responds to these implications.

According to the analysis, the general public is not very interested in learning about their surroundings, is not willing to participate in scientific discussions or use scientific knowledge to influence decisions, and is not very sceptical of assertions made by others related to everyday science and health issues. However, the current science curriculum's goal is to train the next generation of scientifically informed individuals, albeit subtly. For this reason, it is reasonable to argue that our science curriculum is still lacking in clarity to effectively instruct its stakeholders (Halder & Rahman, 2015). In contrast, curriculum serves as a comprehensive set of guidelines for learning experiences that all educators must follow to ensure access to challenging academic experiences (Wortham, 2006). Therefore, our curriculum might offer extra, useful guidelines to encourage scepticism and curiosity, as well as activities to get children more interested in science. The curriculum may also offer opportunities to help people make evidence-based decisions, including decisions for their own health and well-being as well as the environment. Curriculum designers should consider these flaws for future improvement and provide a full education in scientific literacy to help people make well-informed decisions based on facts.

This study identifies deep concern about these kinds of literacies. As the Government of Bangladesh has approved a new national curriculum framework-2021, therefore, this study recommends developing the contents of science in such a way that it will influence the development of science literacy; the corollary is health literacy, and proposes a pedagogy that provides ground for science with health literacy so that a person with scientific literacy will be health literate too. The results show that our general population still needs to acquire the necessary skills, information, and mindset. Individuals are unable to make educated decisions because they do not know as much about the world as they should. Therefore, the goal of the curriculum has not been fully achieved. To help our teachers adopt the desired attitude, values,

and conduct, textbooks and teacher guides may thus contain more interactive exercises.

The goals of teaching and learning are knowledge transfer, skill development, and the development of attitudes, values, and behaviours. The study's conclusions show that the public is less sceptical, uninterested in scientific debate, and lacks the investigative abilities necessary to make well-informed decisions. This suggests that the activities used to teach and learn may not provide the public with a sufficient level of scientific literacy. Incorporating interactive activities into science education may be necessary, as it has the potential to positively impact students' attitudes and behaviours. The study's conclusions will also help our school's science teachers encourage more intriguing lesson plans for students to advance.

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