



Relationship between Science Literacy and Disaster Preparedness: The Possible Role of Curriculum in Behavior Theories

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ABSTRACT

While classical behavior theories assume that knowledge is linked to change in human behavior, there is a growing trend reporting the dissociation between these two constructs. This study aimed to determine the relationship between knowledge as measured by science literacy and behavior as represented by the disaster preparedness of the students. It mainly employed a correlation research design involving 280 Grade VIII students in a public high school in the Philippines during the school year 2018-2019. The psychometric properties of the instruments used were established. The descriptive and inferential statistics provided the mean, percentage, standard deviation, and correlation coefficient for the variables under this research. Results showed that the students have a moderate level of science literacy and a low level of disaster preparedness. The results further revealed that there is a negative and weak relationship between the science literacy and disaster preparedness of the students. A broader explanatory context of this result is further discussed with the possible role of the curriculum. The conclusions and recommendations are offered in the paper.

Keywords: science literacy, disaster preparedness, behavior theories, science education, curriculum studies

INTRODUCTION

A good curriculum ensures that the intended knowledge will be taught to the students with the ultimate expectation that such knowledge will change behavior. In the Philippines, the Republic Act 10121 was passed into law with a provision to integrate relevant knowledge on disaster risk reduction into the current K to 12 Science curriculum in the expectation that such move will enhance the behaviors of the students in terms of disaster preparedness. Hence, for example, a course in disaster risk reduction in high school focuses on the application of scientific knowledge and the solution of practical problems in a physical environment. It is designed to bridge the gap between theoretical science and practical living (Pineda, 2016).

Classical behavior theories typically support the association between knowledge and behavior. One of the widely cited theories is the social cognitive theory by Bandura (2014). This theory suggests that education designed to activate people toward positive behaviors is supposed to improve knowledge of the effects of behavior change and positively influence

outcome expectations. Hence, if this theory is applied in the current study, it can be cogently assumed that knowledge on natural disasters is expected to catalyze positive behavior change of disaster preparedness. It is hypothesized that there is a direct and positive causal link between science literacy and disaster preparedness of the students.

However, an emerging dissociation between knowledge and behavior has been reported for the past years, challenging the typical claim of classical behavior theories. For instance, a review of selected studies (e.g. Silver Wallace, 2002; Ananth & Koopman, 2003; Guerra et al., 2005) shows a trend that knowledge was either uncertainly related or largely unrelated in predicting behavior. If this possibility is reimagined in the interest of the present study, it can be cogently presumed that knowledge on natural disasters is not necessarily influential for positive behavior change in disaster preparedness. Thus, it can be conjectured that a weak or negative relationship is possible between science literacy and disaster preparedness of the students.

Amidst this dissonance in theories and studies, Ajzen et al. (2011) further took the discussion forward by specifically noting that “appropriate” knowledge is the predictor of behavior. They explained in their study that association or disassociation between knowledge and behavior may result from an inappropriate focus of knowledge at the expense of its relevance to the desired behavior. If this argument is to be followed in this study, a possible association or disassociation between knowledge on disasters and disaster preparedness may be attributed to the inappropriate focus of the knowledge as intended in the science curriculum in support supposedly for the development of disaster preparedness of the students. Despite this interesting viewpoint in the studies of behavior theories, however, such a possibility has barely made a dent in the current theories and studies.

Research Problem

Considering the conflicts and possible new trajectory in the discussion of behavior theories, this present study intends to determine if knowledge influences behavior and further probe in the process the role of an “appropriate” or “inappropriate” knowledge in the scenario. Operationally, this study will determine if knowledge, as measured by science literacy, is associated with behavior as measured by disaster preparedness. Furthermore, it will attempt to discuss the role of the “appropriateness” or “inappropriateness” of the kind of knowledge as intended by the science curriculum.

It should be further noted that no empirical evidence has been presented regarding the relationship between science literacy and disaster preparedness. Najafi et al. (2017) reviewed a vast body of studies that have been conducted on the factors, mostly affective variables, that influence disaster preparedness. Some of the interesting factors were: critical awareness (McIvor, 2007), risk perception (Armas & Ivram, 2008), preparedness perception (Lindell & Whitney, 2000), self-efficacy (McClure et al., 2001), anxiety (Ronan et al., 2008), and coping style (Paton et al., 2001). However, there has been no study focused specifically on cognitive variable such as science literacy to explain the variability in disaster preparedness of students.

The result of this study may be significant to social scientists, scholars, researchers, curriculum developers, administrators, and teachers. This paper will provide a shred of

evidence on the association or disassociation between knowledge and behavior. Furthermore, it will assist curriculum developers, school administrators, and science teachers in evaluating the knowledge contained in the science curriculum and reflecting on its effectiveness in promoting disaster preparedness.

Research Focus

Hence, this paper mainly aimed to determine the relationship between science literacy and disaster preparedness of the students. The science literacy in this study operationally refers to the knowledge of the students particularly on prevalent natural disasters such as typhoons and earthquakes.

METHODOLOGY OF RESEARCH

General Background of Research

This study employed a correlation research design. A correlation is a research design that describes the degree of association or relationship between two or more variables (Creswell, 2012). This design is appropriate for this study because it primarily determined the relationship between the independent variable which is the science literacy and the dependent variable which is the disaster preparedness of the students.

Subject of Research

The respondents in this study were 280 Grade VIII. These students had completed the three major topics during the second grading period of school year 2018-2019, thus were exposed to the unit on typhoons and earthquakes. This study was conducted in a public high school in the Philippines.

Instrument and Procedures

This research used two instruments to gather the needed data. The first instrument is a tailored cognitive test consisting of 70 multiple-choice items designed to measure the science literacy of the students in the earth science unit on typhoons and earthquakes. The analysis of the results of the pilot test showed its reliability index at 0.926, considered as excellent for classroom tests. Based on arbitrary class intervals made for this study, the scores were categorized into very low, low, average, high, and very high to indicate students' level of science literacy. The items also loaded on four components based on the cognitive skills set for the test, accounting for 27.48% of the variance. On the other hand, the second instrument is an affective scale on disaster preparedness modified from the study of Inal et al. (2018). It consists of 30 statements to assess students' preparedness for disasters such as typhoons and earthquakes. Students responded by indicating their level of agreement to these statements. The instrument was likewise subjected to pilot test. The internal consistency of the scale was 0.75, considered acceptable. The factor analysis also extracted six components corresponding to the dimensions of the original scale. The six dimensions jointly accounted for 41.72% of the

variance. Based on arbitrary class intervals made for this study, the scores were categorized into very low, low, average, high, and very high to indicate the students' level of disaster preparedness.

After obtaining permission from the school principal, the researchers visited the school and administered the test and scale to the students. The researchers sought the assistance of proctors who were given orientation on the objectives and procedures of the conduct of the test to ensure that the validity and reliability of the test would not be affected by the manner the proctors administered the tests. After ample time, questionnaires were retrieved, and data were computed, analyzed, and interpreted.

Data Analysis

Descriptive statistics provided the mean, percentage, and standard deviation for the variables under this research. Pearson Product Correlation Coefficient was employed to test the relationship between science literacy and disaster preparedness. The test was done at 0.05 level of significance using Statistical Package for Social Sciences Version 17.

RESULTS AND DISCUSSION

The aim of the study is to determine the relationship between science literacy and disaster preparedness of the students. This section shows the results as follows.

Science Literacy

This paper initially determined the level of science literacy of the students. The result is shown in Table 1.

Table 1. Performance of the Students in the Science Literacy Test

Score	f	%	Description
57-70	29	10.07%	Very High
43-56	67	23.26%	High
29-42	101	35.07%	Average
15-28	90	31.25%	Low
0-14	1	0.003%	Very Low
Mean	37.10	100%	Average

N=280

Table 1 shows that 101 students (35.07%) got a score between 29 to 42 described as average; 90 students (31.25%) between 15-28 described as low; 67 students (23.26%) between 43-56 described as high; 29 students (10.07%) between 57-70 described as very high; and 1 student (0.003%) described as very low.

Overall, the group mean of the science literacy of the students in the earth science unit on typhoons and earthquakes is 37.10 described as average. It could be further gleaned from the data that the majority of the students obtained an average score. Only one-third of the

students who took the test have scores considered as high or very high. Generally, this implies that students have a moderate level of science literacy.

Disaster Preparedness

This paper further determined the level of disaster preparedness of the students. The result is shown in Table 2.

Table 2. Performance of the Students in the Disaster Preparedness Scale

Components	Mean	Description
Self-efficacy	2.00	Low
Cues to action	1.77	Low
Perceived barriers	2.14	Low
Perceived benefits	1.58	Low
Perceived severity	2.29	Low
Perceived susceptibility	1.84	Low
Overall	1.94	Low

N=280

The results in Table 2 show that the students have a low level of preparedness in terms of perceived severity (M=2.29); perceived barriers (M=2.14); and self-efficacy (M=2.00). It was further uncovered that they have a low level of preparedness when it comes to perceived susceptibility (M=1.84); cues to action (M=1.77); and perceived benefits (M=1.58).

Overall, the disaster preparedness of students obtained a weighted mean of 1.94 described as a low level of preparedness. This implies that the level of disaster preparedness of the students is low.

Science Literacy and Disaster Preparedness

Lastly, this paper determined the relationship between science literacy and disaster preparedness of the students. The result is shown in Table 3

Table 3. Relationship between Science Literacy and Disaster Preparedness

	Science Literacy
Disaster Preparedness	($r=-.215$) 0.00*

* $p < .01$.

The result of correlation test in Table 3 reveals that there is a negative and weak relationship between science literacy and disaster preparedness of the students ($r=-.215$, $n=288$, $p=0.00$). It could be further noted that the negative and weak relationship implies that the higher the one variable, the lower the other variable though such a relationship is mostly low in probability.

The relatively low mastery level of the students in science in the Philippines has been documented over the years. For example, in the 2005 and 2006 National Achievement Test in Science of the fourth year students, the national performance in science recorded mean percentage scores of 39.49% and 37.98% respectively. Based further on the recent 2012 National Achievement Test in Science of the fourth year students, the mean percentage score was noted at 40.53%.

On the other hand, the low level of disaster preparedness of the students in this study is supported in the recent related study of Mamon et al. (2018) on the disaster risk reduction knowledge of high school students in the Philippines. They found out that out of 120 respondents, 33.33% understood when a disaster will take place, followed by 30.00% who find it unclear on this disaster risk issue. This implies that a considerable majority of students are not completely prepared for disasters, supporting the result of the current study.

Bringing the discussion further to the relationship between science literacy and disaster preparedness, this study found a weak and negative relationship, revealing a stance that knowledge may not necessarily influence desired behaviors. This result, though may present a surprising reaction, can be explained in several emerging studies in the domain of health sciences (e.g. Schlueter, 1982; Spirito et. al., 1993; Sheeran & Taylor, 1999; Silver Wallace, 2002; Ananth & Koopman, 2003; Feeley & Servoss, 2005; Guerra et al. 2005), which proved an either weak or no association between certain knowledge and its desired behavior.

Ajzen et al. (2011) explained that most educational campaigns, particularly in the health domain, concentrated on sharing accurate knowledge of a general nature. It is expected that once people have acquired this knowledge, they will engage in the desired behavior. However, this approach often resulted in disappointment as people continue to take unnecessary risks or engage in socially undesirable behavior. As such, for example, Sheeran & Taylor (1999) discovered that knowledge about sexually transmitted diseases has a relatively weak association with the behaviors expressed as intentions to use contraceptives.

Such a disappointing correlation is attributed by Ajzen et al. (2011) to an inappropriate focus on the accuracy of the information at the expense of its relevance to and support for the behavior. They elaborated that knowledge is neither sufficient nor necessary and try to show why knowledge (DiClemente, 1989; Fisher & Fisher, 1992), as typically conceptualized and assessed, fails to predict behavior. As an alternative way of viewing this result, they proposed a need to find out what knowledge people possess and how this knowledge affects behavior regardless of whether the knowledge is accurate or not.

Applying such argument to the current study, it could be possible that the inverse and weak relationship may result from “inappropriate” emphasis on the accuracy of earth science content at the expense of its relevance and in support for disaster preparedness. It should be recalled that the science literacy in this study was measured through items designed based on the unit on typhoons and earthquakes previously learned by the students. Reviewing the curriculum materials on natural disaster contents such as typhoons and earthquakes, it could be observed that competencies developed are focused on the lower cognitive levels, mostly remembering and understanding based on the taxonomy of Bloom (1956). These levels usually target skills on recall of knowledge.

It should be noticed that such competencies desirably express the promotion of knowledge on typhoons and earthquakes which are assumed to be requisite for disaster preparedness. However, following the argument of Ajzen et al. (2011) earlier, there is a necessity to examine how such type of knowledge affects behavior regardless of its accuracy or not. Thus, a valid question is: Could the type of low level cognitive demand as intended by the curriculum cause the disassociation between science literacy to disaster preparedness? Teimourtash and YazdaniMoghaddam (2017), in their study in language, appeared to associate behavior not from the lower order thinking skills, but to higher order thinking skills. There is still no conclusive evidence from this present study nor from other related empirical studies to probe this assumption; future responses should head towards this area of interest.

CONCLUSIONS

Based on the results of this study, it can be generally concluded that there is a negative and weak relationship between science literacy and disaster preparedness of the students. This study provides a piece of evidence in the educational context aligned to the growing body of researches proving the dissociation between knowledge and behavior, stimulating the usual assumption of behavior theories that link knowledge and behavior.

A review of the science curriculum may be done to translate performance standards into classroom activities that create opportunities for students to demonstrate disaster preparedness. It should be underscored, however, that stronger pieces of evidence need to be presented as regards the mediating role of the curriculum content on the relationship between science literacy and disaster preparedness of the students. Thus, future studies should be conducted in this area of interest.

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