Students' Meteorological Knowledge and Its Relationship on Their Levels of Resiliency

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Abstract

The study explore the relationship between the students' knowledge of Disaster Readiness and Risk Reduction (DRRR) and its relationship on their levels of resilience. A 30-item locally made test was utilized to determine students' knowledge on DRRR, and an adapted 10-item Connor-Davidson Resilience Scale survey was used in assessing the students' resilience levels. Results showed that the students were proficient in the elements of the topic of disaster and hazards and adequate in the application of DRRR concepts. The result of the resilience scale survey showed that the students toughness is high (3.86), motivation is also high (3.88). Results revealed that there was a significant correlation between the two variables. Furthermore, it was recommended that the provision of pieces of training for the teachers to improve DRRR education in terms of teaching strategies and techniques and that a revisions of the curriculum could be conducted to include the introduction of DRRR subject across all strand and track.

***Keywords*:** Disaster Readiness and Risk Reduction, levels of resilience, students, disaster risk reduction management.

1. Introduction

Studies in recent literature about the disaster preparedness in schools has taken various styles in terms of research topics. Mamon, Suba, and Son Jr. (2017) found out that Grade 11 students have high levels of disaster-related knowledge, awareness, readiness, and preparedness. This is possibly the outcome of the incorporation of Disaster Readiness and Risk Reduction (DRRR) subjects in the curriculum of senior high school. The study of Lopez et al. (2018) revealed that public schools have the right compliance level on disaster preparedness. In the study of Thi and Shaw (2016) training activities for rural students are necessary for the future to focus on skills development and resilience to reduce the risk of future disasters. Research also suggests that rural schools have at least two advantages over urban schools which are: they have strong relationships among school members and a narrower curriculum, which, in turn, provides more time for extra-curricular activities, including disaster activities.

Subjects like DRRR are added to prepare students in times of disaster. As such, studies have found evidence that theoretical knowledge of disaster preparedness may lead to practical skills if combined with training for family and community. However, as the current research literature stands, theoretical disaster knowledge should still translate to behavioral change (Codreanu, Celenza and Jacobs, 2014). One way to measure the behavioral change in terms of disaster preparedness is in resilience. For instance, a study among Indonesian students in a post-disaster state finds that students' resilience levels were high, and were significantly different based on gender (Taufik and Idfil, 2016). Assessing resilience among students may open possibilities for measuring behavioral change as influenced by their theoretical knowledge of disaster preparedness.

One issue to consider is categorizing the Philippines as one of the most disaster-prone countries in the world. The Philippines is ranked second in the World Risk Index of 2014 in terms of experiences with

different natural hazards and ranked first as the most affected country in Global Risk Index of 2013. The Philippines also belongs to the top 10 countries affected by extreme weather disturbances by having 311 extreme weather events between 1993 to 2012 (Banwell et al., 2012).

Moreover, it is estimated that the annual loss caused by various disasters and hazards was roughly US$7.893 million, which is equivalent to 69 percent of government funding for social services. (Alcayna et al., 2016). As the Philippines takes on these challenges, disaster risk reduction management must be given more importance. Integration of subject DRRM in the senior high school curriculum is a significant step in spreading awareness among the Filipino people, particularly the young in what to do when disaster strikes.

The present study discerned the connection between the students' knowledge of DRRR and their levels of resilience. More specifically, the study identified their specific relationship by determining their DRRR knowledge and perceptions, as well as their levels of resistance first. This study utilized a quantitative method by using survey questionnaires to assess their DRRR attitudes as well as their levels of resilience.

This study contributed to the research literature by exploring the DRRR knowledge among senior high school students and providing insights on the implementation of the subject in the top high school curriculum. It addresses the need for study specified by Codreanu, Celenza, and Jacobs (2014) that there is still more to explore in terms of the impact of theoretical knowledge in the students' behavioral change; which, in the context of this study, refers to the variable of resilience.

1.1 Statement of the Problem

The present study wants to explore the relationship between the students' knowledge of DRRR and their perceptions on disaster preparedness. Specifically, the study seeks to answer the following questions:

1. How can the students' DRRR knowledge be described in terms of:
    1.1 elements of disaster;
    1.2 hazards; and
    1.3 application of DRRM concepts?
2. What are the students' level of resilience in terms of:
    2.1 Toughness; and
    2.2 Motivation?
3. Is there a significant relationship between students' DRRR knowledge and their resilience levels?
4. What implications may be drawn from the findings of the study?

2. Methodology

The study utilizes a descriptive-correlational research design. It makes use of descriptive method's ability to gather quantitative data derived from a phenomenon with the use of data collection methods like surveys or experiments. According to Scott and Usher (2011), correlational research uses "various statistical devices, relationships between phenomena are identified, and a calculation of the probability of those relationships occurring in other settings is made." In the context of the study, a test is constructed to measure the students' knowledge of DRRR that they have learned in class, and a survey instrument to assess their resilience levels. These data are to be analyzed using statistical treatment to determine the probability of the relationship between students' knowledge of DRRR and their resilience levels.

2.1 Instruments of the Study

There are two instruments to be used in the study: a multiple-choice DRRR test and a resilience survey.

First, a test item is to be constructed to analyze the students' knowledge of DRRR. The test is comprised of 30 multiple-choice questions involving the following questions: Items 1-10 on Elements of Disaster; Items 11-20 on Hazards; and Items 21-30 on Application of DRRM Principles. The constructed test is validated by three experts in the field of science. The test was subjected to item analysis for item validation.

Second, the resilience survey adapted the 10-item Connor-Davidson Resilience Scale (CDRS) as formulated by Aloba, Olabisi, and Aloba (2016). The CDRS has initially been formulated with 25 items and five factors. However, the 10-item version retains two factors: Toughness and Motivation. Reliability of the instrument demonstrates a Cronbach alpha value of .81 for the entire scale. The CDRS is answered using a 5-item Likert scale ranging from Very High/Always (5), High/Often (4), Average/Sometimes (3), Low/Rarely (2), and Very Low/Never (1).

Table 1 shows the result of the content and face validation of the exam utilized in the study.

Table 1
Validation Result of the Exam

Indicators	Expert 1	Expert 2	Expert 3	Average	Interpretation
Content	4	4	3.2	3.73	Highly Acceptable
Language and Style	4	3.8	3.8	3.87	Highly Acceptable
Format and Design	4	4	3.2	3.73	Highly Acceptable
Average	**4**	**3.93**	**3.4**	**3.78**	**Highly Acceptable**

Table 1 shows the result of the content and face validation of the exam utilized in the study. The average rating of the three science experts in the indicator "Content" is 3.73. The average rating for "Language and Style" is 3.87, and the average score for "Format and Design" is 3.73. All indicators' average rating has an interpretation highly acceptable. The total average given for the exam is 3.78; thus, the instrument was deemed highly acceptable by the three science education experts. The panel of science experts was assembled to validate the device used in the study.

3. Results and Discussion

3.1 Students' Knowledge on DRRR

The result of the test on DRRR revealed the knowledge and performance scores of the grade 11 students in terms of elements of disaster, hazards, and application of DRRM concepts.

The first chapter of the subject DRRR discusses the different elements that pertain to disaster. It also tackles the basic concept of disaster risks, nature, and possible effects. Table 2 shows the performance scores of students in DRRR on the topic "Elements of Disaster." There are seven students, or 2% of the sample got a score lower than 55%. Meanwhile 37 students or 12% of the sample got a score

between 56% to 65%, or considered within "Low Proficiency"; 117 students or 39% of the sample got a score between 66% to 75%, or classified within "Adequate"; 119 students or 40% of the sample got a score of 76% to 85%, or categorized within "Proficient" and 20 students or 7% of the sample got a score of 86% to 95% who were grouped under the scale of "Very Proficient". On the other hand, no student from the sample got a score of 96% and above. The students' scores on the topic "Elements of Disaster" showed a mean value of 5.22 with a standard deviation of 1.69. This implies that the mean score of the students are just at the average level, and the majority of the students' scores falls in the middle of the distribution.

Table 2
Performance of Students in DRRR – Elements of Disaster

Scales	Range (%)	Number of Students	Percentage
Needs Improvement	< 55	7	2
Low Proficiency	56 – 65	37	12
Adequate	66 – 75	117	39
Proficient	76 – 85	119	40
Very Proficient	86 – 95	20	7
Excellent	96 - 100	0	0
Mean: 5.22			
SD: 1.69			

The second chapter of the subject DRRR confers the lessons about hazards. It deepens the understanding of the concept of risks, the different types of, and its impact. Table 3 shows the performance scores of students in DRRR on the topic "Hazards." There are six students, or 2% of the sample got a score lower than 55%. Meanwhile 35 students or 12% of the sample got a score between 56% to 65%, or considered within "Low Proficiency"; 118 students or 39% of the sample got a score between 66% to 75%, or classified within "Adequate"; 119 students or 40% of the sample got a score of 76% to 85%, or categorized within "Proficient" and 22 students or 7% of the sample got a score of 86% to 95% who were grouped under the scale of "Very Proficient". On the other hand, no student from the sample got a score of 96% and above. The students' scores on the topic "Hazards" showed a mean value of 5.25 with a standard deviation of 1.64. This implies that the mean score of the students are just at the average level, and the majority of the students' scores falls in the middle of the distribution.

Table 3
Performance of Students in DRRR – Hazards

Scales	Range (%)	Number of Students	Percentage
Needs Improvement	< 55	6	2
Low Proficiency	56 – 65	35	12
Adequate	66 – 75	118	39
Proficient	76 – 85	119	40
Very Proficient	86 – 95	22	7
Excellent	96 - 100	0	0
Mean: 5.25			
SD: 1.64			

The last chapter of the subject DRRR deals with the application of DRRM concepts. It focuses on the critical principles of DRRM and its importance. It also discusses the policies of DRRM and its implementing rules and regulations. Table 4 shows the performance scores of students in DRRR on the topic "Application of DRRM Concepts." There are 11 students, or 4% of the sample got a score lower than 55%. Meanwhile 41 students or 14% of the sample got a score between 56% to 65%, or considered within "Low Proficiency"; 123 students or 41% of the sample got a score between 66% to 75%, or classified within "Adequate"; 92 students or 31% of the sample got a score of 76% to 85%, or categorized within "Proficient" and 33 students or 11% of the sample got a score of 86% to 95% who were grouped under the scale of "Very Proficient". On the other hand, no student from the sample got a score of 96% and above. The students' scores on the topic "Application of DRRM Concepts" showed a mean value of 5.11 with a standard deviation of 1.79. This implies that the mean score of the students are just at the average level, and the majority of the students' scores falls in the middle of the distribution.

Table 4
Performance of Students in DRRR – Application of DRRM Concepts

Scales	Range (%)	Number of Students	Percentage
Needs Improvement	< 55	11	4
Low Proficiency	56 – 65	41	14
Adequate	66 – 75	123	41
Proficient	76 – 85	92	31
Very Proficient	86 – 95	33	11
Excellent	96 - 100	0	0
Mean: 5.11			
SD: 1.79			

The next table reveals the overall scores of students that indicate their knowledge in DRRR subject. It also shows their expertise on the three chapters of DRRR; elements of disaster, hazards, and application of DRRM concepts. Table 5 shows that no student got a score lower than 55%. 12 students or 4% of the sample got a score between 56% to 65%, or considered within "Low Proficiency"; 123 students or 41% of the sample got a score between 66% to 75%, or classified within "Adequate"; 147 students or 49% of the sample got a score of 76% to 85%, or categorized within "Proficient" and 18 students or 6% of the sample got a score of 86% to 95% who were grouped under the scale of "Very Proficient". Similarly, no student from the sample got a score of 96% and above.

The mean value of the overall raw scores of the students is 14.89, with a standard deviation of 3.38. These results show that most of the students who took DRRR subject were proficient on the said field. This also manifests that they have the grasp of the essential concepts and topics of the DRRR subject on an average level. This result can be improved by giving more emphasis and focus on the item itself mainly on the application of the DRRM Concepts, which is discussed in the latter part of the course.

Table 5
Overall Performance of Students in DRRR

Scales	Range (%)	Number of Students	Percentage
Needs Improvement	< 55	0	0
Low Proficiency	56 – 65	12	4
Adequate	66 – 75	123	41
Proficient	76 – 85	147	49
Very Proficient	86 – 95	18	6
Excellent	96 - 100	0	0
Mean: 14.89			
SD: 3.38			

3.2 Levels of Resilience

Motivation in terms of disaster management and resilience pertains to a person's willingness and eagerness to recover from different disaster aftermaths. In the present study, the respondents were asked several questions that relate to motivation.

Table 6 presents the level of resilience of the grade 11 students in terms of motivation. The first item "Bounce back after illness or injury", showed a mean score was 3.75; followed by "Deal with whatever comes my way" with a mean score of 3.79; "See humorous side of things" with a mean score of 3.85 and "Adapt to change" with a mean score of 3.75. These four items are interpreted as High. This means that grade 11 students often adapt to changes in the environment during different disasters, and they can deal with whatever problems and obstacles that come their way. They also tend to see quickly recover or bounce back after such illnesses and injuries during disasters and calamities. This also means that students have a high level of resilience in terms of motivation.

Table 6
Resilience Scales – Motivation

Item	Average	Interpretation
1. Bounce back after illness or injury	3.75	High
2. Deal with whatever comes my way	3.79	High
3. See humorous side of things	3.85	High
4. Adapt to change	4.04	High

Toughness, in terms of disaster management and resilience, relates to a person's capacity to endure the outcomes of different disaster a person could experience. In the present study, the respondents were asked several questions that pertain to toughness. Table 7 presents the level of resilience of the grade 11 students in terms of toughness. The first item, "Stress makes me stronger," showed a mean score of 3.43, interpreted as Average. On the other hand, the article "Not easily discouraged by failure" with a mean score of 3.73; both things "Under pressure I stayed focus" together with "Able to handle unpleasant feelings" gathered a mean score of 3.82; article "Think of myself as a strong person when facing challenges"

gathered a mean score of 4.05; The question "Believe I can achieve goals despite obstacles", showed a mean score was 4.40 These five items were interpreted as High. This means that grade 11 students often believed that they can still achieve their goals in life even if such disasters happen. They thought that they are strong enough as a person in facing challenges in life during disasters and calamities. They were also very able to handle unpleasant feelings and emotions, and they can stay focused under pressure in times of emergency. These students also tend to be not easily discouraged by failures in life. On the other hand, they sometimes considered stress as a factor that can make them secure in times of disaster. It reveals that the level of resilience of grade 11 students in terms of toughness is high.

Table 7
Resilience Scales – Toughness

Item	Average	Interpretation
1. Stress makes me stronger	3.43	Average
2. Not easily discouraged by failure	3.73	High
3. Able to handle unpleasant feelings	3.82	High
4. Under pressure I stay focused	3.82	High
5. Think of myself as a strong person when facing challenges	4.05	High
6. Believe I can achieve goals despite obstacles	4.40	High

Resilience in terms of disaster is defined as the extent of an individual, a community or an organization to organize themselves to learn from past failures and calamities and to reduce the risks and damage from the future ones at different levels (GSDRC, 2014). Table 8 shows the overall result of the survey about the resilience of the students.

Table 8 summarizes the overall result of the resilience scales of the present study. The resilience scale "Motivation" showed a mean value of 3.88, and the resilience scale "Toughness" showed a mean value of 3.86. Both resilience scales are interpreted as High, both with standard deviation values of 0.84 and 0.97, respectively. Overall, this reveals that the level of resilience of the grade 11 students is high.

Table 8
Resilience Scales – Overall Result

Scale	Mean	SD	Interpretation
1. Motivation	3.88	0.84	High
2. Toughness	3.86	0.97	High

3.3 Relationship Between Students' DRRR Knowledge to Their Levels of Resiliency

The findings of the study of Codreanu, Celenza, and Jacobs (2014) reveals that the concepts that the students learned during DRRR subject must be translated to actual practices of what they have learned, which can be measured in their resilience. According to Galvez in 2018, it is evident that students'

experiences of the programs are highly effective when the students can physically see proofs of the quality of programs.

Table 9 presents the relationship between students' DRRR knowledge and their level of resistance.

The study utilized Pearson-r Correlation Test to describe the relationship between the two variables. Findings of the correlational test revealed that the two variables were correlated with the students' performance on DRRR. Both variables have a positive relationship; therefore, the higher performance of students on DRRR indicates higher resilience, both in terms of motivation and toughness. All variables were significantly correlated, both in terms of motivation ($r=0.173$; $p<0.05$) and toughness ($r=0.120$; $p<0.05$)

Table 9
Relationship Between Students' DRRR Performance and Resilience

Factor	Pearson r	P-value	Interpretation
Motivation	.173	.003	Significant
Toughness	.120	.038	Significant

3.4 Implications on Disaster Preparedness Education

Findings of the study revealed the need to articulate theoretical knowledge on DRRR to actual behavioral change. According to Codreanu, Celenza, and Jacobs (2014), the concepts that the students learned during DRRR subject must be translated to actual practices of what they have learned, which can be measured in their resilience. For example, the lesson on things to do before, during, and after an earthquake will be more relevant if they will be able to do it in an actual quake. The concepts taught during the course together with its application through drills and simulation in school will be able to translate to students' behavioral changes in terms of disaster preparedness and positive changes on their resilience. The higher levels of resistance of the student manifest more positive behavioral change. This shows that there was behavioral change on the student, particularly on the actual times of disaster.

The following are the factors to be considered to improve the quality of DRRR education in the Philippine setting. First is the promote awareness among students and teachers about disaster risk reduction education. Boon and Pagliano (2014) emphasized that school disaster education is essential to raise awareness among students and people in the community, which encourages preparedness action. Next is the proper training of teachers in the field of DRRM. On the actual times of disaster, the teachers are the immediate and first responders on the safety of the students. They are the ones who will ensure the safety and security of their students at school. With this, proper and adequate actual training must be given to the teachers teaching DRRM. As the same with the students, behavioral changes must begin with the teachers first.

Another is the inadequate resources and materials needed by the teachers in teaching DRRR, both in the public and private sector. This problem serves as significant difficulty in translating what they have learned in the subject to actual applications of DRRR concepts. Students' resilience can be more evident if these resources are available for all learners. Students will be able to act and perform the necessary

responses if they can experience simulated disasters which these additional resources and teaching materials can provide.

Lastly, not only STEM students are vulnerable to different natural disasters. Thus, articulation of the DRRR subject to all students is necessary, starting from elementary up to tertiary level. Integration of DRRR concepts in other subjects can be a possible way of introducing the DRRR as early as the elementary level. Exposure of students to different movies and documentaries about disaster can also be an excellent eye-opener for them to be more aware in times of emergency.

4. Conclusions and Recommendations

4.1 Conclusion

1. The study explored the relationship between students' knowledge of DRRR and their levels of resilience. The results of the study revealed that majority of the STEM students who took the DRRR subject were "Proficient" in terms of elements of disaster and hazards and "Adequate" in terms of the application of DRMM concepts.
2. The results of the study also showed the students' levels of resilience in terms of toughness and motivation. The average scores for both scales of resilience were interpreted as "High".
3. The correlation analysis also showed that there is a significant correlation between the two variables. Therefore, the null hypothesis is rejected.
4. In terms of implications, the study proposes insights such as the importance of translating students' knowledge on DRRR to positive behavioral changes, promoting awareness on disaster risk management education among students and teachers.

4.2 Recommendations

The following recommendations are made in light of the findings of the study.

1. With the results of this study, the school administrators may be able to give more emphasis on DRRR education by providing pieces of training and seminars to the DRRR teachers. This will provide the teachers more opportunities to improve in terms of choosing appropriate teaching strategies and approaches in teaching the subject.
2. Results from this study show that the students' levels of resilience are commendable. This provides us information that the students are prepared and resilient enough during the times of disasters and calamities. Such a level of resistance must be maintained and sustained through resilience-building activities.
3. Insights from this study will help the teachers to develop the level of resilience of their students in selecting more effective teaching methodologies in approaching topics on DRRR. It will also address issues about alternative methods and instructional materials that are available in their immediate environments and communities.
4. The study can help the teachers to evaluate their effectiveness in translating students' knowledge on DRRR through gauging students' resilience levels.

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