Relationship between science anxiety and science achievement of grade 8 students in selected basic education schools in Myanmar

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Abstract
The purpose of this study is to investigate the relationship between Science Anxiety and Science Achievement of Grade 8 students in Myanmar. The sample consisted of 660 students (330 males and 330 females) with the mean age of 13 years. Modified form of Science Anxiety Questionnaire designed by Czerniak and Chiarelott (1984) and researcher made Science objective test were used to measure science anxiety and science achievement. According to descriptive statistics, students' science anxiety was the highest in laboratory experiment situation. According to the results of t-test, female students showed significantly higher anxiety levels in global science anxiety and all dimensions of science anxiety than male students at $p < .001$. However, males and females are not significantly different in science achievement. According to the result of correlation analysis, there was significant negative correlation between science anxiety and science achievement at $p < .001$. It can be concluded that science anxiety has negative contributions to the development of achievement in Science

Keywords: Science, Science Anxiety, Science Achievement, Gender

1. Introduction
Globalization has created a sense of competition among the nations of the world. Different nations are striving for their survival and advancement to play the leading role in this global village. Politicians, educators, and business leaders alike emphasize the critical importance of scientific literacy among citizens for both individual and national success in the 21st century. Economically advanced country attends science education to a vital role in individual's live. People now use science on a daily basis to make decisions on evolving issues and technologies such as air travel, national security, cloning, and genetically modified organism and their possible incorporation into our food. However, fear of learning science affects large numbers of people. Avoidance of science results in a scientifically uneducated citizen. Everyone experiences anxiety in various ways. Anxiety can seriously inhibit the ability of concentration and dealing with things in a more positive way. It is considered as an unpleasant state evoking avoided behaviours and defences. It can also be defined as a specific emotion necessary for an individual to prepare for potential and threatening situations. According to Huberty (2004), anxiety is apprehension or excessive fear about real or imagined circumstances. The central characteristic of anxiety is worry, which is excessive concern about situations with uncertain outcomes. Excessive worry is unproductive, because it may interfere with the ability to take action to solve a problem. The literature in psychology indicates a consistent negative relationship between anxiety and academic achievement. Science anxiety results from intervening self-message rather than from the science learning itself (Mallow & Greenburg, 1983, cited in Wynstra & Cummings, 1990).Science anxiety was not occurring only in the students doing poorly – those who might have a valid reason for feeling anxious. This also

occurred in students who were succeeding. The anxiety continued throughout the academic term, in some cases seeming to lessen slightly. But it never disappeared among these students (Phillips, 2004). Anxious students in science classes will not ask questions, even if they do not understand the material. They may also become so frightened while taking an exam that they forget much of what they studied. These same students may try to memorize the material for a test by using poems or songs or other memory tools, but frequently do not grasp the concepts of the material (Mallow, 1986, cited in Phillips, 2004).They may hide their grades from other students in the class, and avoid discussing anything with the teacher. Students who have science anxiety may be doing well in all their other courses, even math, but are so anxious about one or more science courses that they are unable to function effectively in them. This difficulty in concentrating on course material eventually results in panic on exams and subsequent poor performance (Anderson & Clawson, 1992).The persistence of science anxiety is linked to poor performance of students in high school and college science classes (Battista, 1999).Ultimately, poor performance and inadequate learning of science results in an uneducated citizenry that may not understand scientific concepts well enough to make difficult decisions in the workplace or in the political realm (Anderson & Clawson, 1992). Thus, anxiety is an important component of science education and its thorough understanding is very necessary to enhance students' achievement and success and their participation in science related careers. It would be of interest to find out what extent our students feel anxious in learning science so that measures could be taken to reduce science anxiety and to promote science learning. Therefore, the main aim of the study is to investigate into science anxiety and science

achievement of Grade 8 students in Sint Kaing Township. The questions that explored in this study are:
1. What dimension of science anxiety is the highest in Grade 8 students?
2. Is there a significant difference in science anxiety between male and female?
3. Is there any gender difference in science achievement?
4. Is there a significant relationship between science anxiety and science achievement of students?

2. Method
Survey method and descriptive research design were taken in this study to examine whether there was a relationship between students' science anxiety and science achievement.

2.1 Participants
The researcher selected 2 Basic Education High Schools (BEHS) and 5 Basic Education High Schools (branch) (BEHS branch) randomly. 660 participants (330 males and 330 females) with the mean age of 13 were chosen randomly from Grade 8 students of selected schools for this study.

2.2 Instruments
The instrument, namely Science Anxiety Questionnaire (SAQ) designed by Czerniak and Chiarelott (1984) was transformed into Myanmar version and Science Achievement Test was constructed by the researcher. The Science Anxiety Questionnaire consists of 40 items which were divided into four categories of science anxiety: 14 items for science related situations (e.g. Planning a well-balanced meal to pack for lunch), 9 items for testing situation (e.g. Studying for a test in science), 8 items for laboratory/experiment situation (e.g. Having someone watch you do an experiment) and 9 items for classroom/lecture situation (e.g. Starting science class) and these statements were examined by using a four-point Likert-type scale (Very Calm=1, Fairly Calm=2, A Little Nervous=3, Very Nervous=4). The lowest total generalized science anxiety possible score was 40 and the highest possible score was 160. For science achievement, a limited number of objective type test items from chapter 1 to 4, Science Textbook (Grade 8) prescribed by the Department of Education, Planning and Training, Myanmar, Ministry of Education was prepared. To validate these instruments, experts' reviews were requested. Moreover, pilot test study was conducted with 100 Grade 8 students from Basic Education High School, Tada U, Tada U Township, Mandalay Region, Myanmar to test the reliability of the Science Anxiety Questionnaire and Science Achievement Test. Then, reliability coefficient for SAQ was .892. For science achievement, the data obtained from science achievement test were analyzed by item analysis. According to this result, a 37-item test was constructed for science achievement. The reliability coefficient for science achievement test was .641. After testing the validity and reliability of the instruments, actual testing was implemented at two Basic Education High Schools and five Basic Education High Schools (Branch) in Sint Kaing Township, Mandalay Region, Myanmar.

3. Results
As mentioned above, the anxiety questionnaire was categorized into four-categories in this study. They were science-related situations, testing situations, laboratory/experiment situations and classroom/lecture situations. For each focused category, descriptive analysis was conducted to examine research question 1.

Table 1: Descriptive Statistics for Dimensions of Science Anxiety

Variables	N	No. of Items	Minimum	Maximum	Mean	Mean %	SD
Science-related Situations	660	14	16	46	32.01	69.59%	5.264
Testing Situations	660	9	10	35	22.93	65.51%	4.907
Laboratory/Experiment Situations	660	8	9	29	20.41	70.38%	3.491
Classroom/Lecture Situations	660	9	9	33	19.18	58.12%	4.316

According to Table 1, students had the highest mean percentage in laboratory/ experiment situation than other three. This result indicated that the students have the highest anxiety about laboratory experiment situations. Independent sample t test was conducted to examine research question 2 and 3. According to the results of t test, there was significant difference in science anxiety between male and female at 0.001 level ($p < 0.001$). This result indicated that females had more science anxiety than males (See Table 1). To be specific, the researcher investigated whether there were significant differences in all dimensions of science anxiety by gender. The result of t test showed a significant difference between science anxiety scores of males and females in science-related situations, laboratory/experiment situations ($p \leq .001$), and in testing situations ($p < .05$). In the rest dimension, classroom/lecture situations, no significant difference was found. This result revealed that female students were more anxious than male students in science-related situations, testing situations and laboratory/experiment situations. Anxiety in classroom/lecture situations was slightly higher in female students without significance (See Table 2).

Table 2: The Results of t test for Global Science Anxiety and Different dimensions of Science Anxiety by Gender

	Male (n=330)		Female (n=330)		t	df	p
	M	SD	M	SD			
Science related situations	31.35	5.170	32.67	5.282	-3.247	658	.001
Testing situation	22.48	4.653	23.38	5.116	-2.380	658	.018
Laboratory/experiment situation	19.65	3.489	21.16	3.330	-5.695	658	.000
Classroom/lecture situation	19.09	4.555	19.28	4.067	-.559	658	.576
Global Science Anxiety	92.57	12.282	96.50	11.932	-4.166	658	.000

For science achievement, male ($M = 27.29$, $SD = 4.720$) and female ($M = 27.18$, $SD = 4.576$) are not significantly

different, $t = .301$, $p > 0.05$. Therefore, it can be interpreted that male and female students' science achievement was not a large gap.

In order to determine whether there was any relationship between science anxiety and science achievement, Pearson Product-Moment Correlation was applied. According to the result of Pearson Product-Moment Correlation, significant negative relationship was found between science achievement and science anxiety ($r = -.231$, $p < .001$), which indicates that as science anxiety score increases, science achievement scores decreases accordingly. Moreover, significant negative correlations were found between all dimensions of science anxiety and science achievement scores, specifically for science-related situations ($r = -.161$, $p < 0.001$), for testing situations ($r = -.176$, $p < 0.001$), laboratory/experiment situations ($r = -.212$, $p < 0.001$) and for classroom/lecture situations ($r = -.090$, $p < 0.05$) (see Table 3). Thus, it could be concluded that science anxious students had less science achievement reciprocally.

Table 3: Correlations of Science Anxiety with Science Achievement in Different Categories

Variables	1	2	3	4	5	6
1. Science-related Situations	1	-	-	-	-	-
2. Testing Situations	.539**	-	-	-	-	-
3. Laboratory/Experiment Situations	.590**	.542**		-	-	-
4. Classroom/Lecture Situations	.010*	-.048*	.037*		-	-
5. Global Science Anxiety	.817**	.769**	.768**	.348**	-	-
6. Science Achievement	-.161**	-.175**	-.211**	-.090*	-.231**	1

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Discussion

First of all, the comparison of science anxiety according to gender will be discussed. There is no consensus on the literature regarding gender differences and anxiety (Yayli & Hasirci, 2009, cited in Dilek, 2013). In the study of Westerback (1984), male and female were not significant for science anxiety. Wynstra and Cummings (1990), Foo and Ong (1996), Chuen (1999), Udo, Ramsey and Mallow (2004) found that male students had less science anxiety than female students. So, it could be said that most studies found large gender effect on science anxiety. In the present study, according to descriptive statistics, science anxiety of female students was higher than that of male students and there was significant difference according to the result of t-test. So, the present study was in line with the findings of Wynstra and Cummings (1990), Foo and Ong (1996), Chuen (1999), Udo, Ramsey and Mallow (2004).

To be specific, the difference of male and female students in each dimension of science anxiety will be presented. Female are more anxious than male in science-related situations, laboratory/experiment situations and testing situations with significant difference. There was no significant difference in classroom/lecture situations of male and female students with tiny amount of higher anxious scores of female.

The second comparison was between the science achievement scores of male and female students. In the studies of Greenfield (1996), Sencar and Eryilmaz (2004), Zohar and Sela (2003) female had been found to be higher than male in science achievement. However, Burkam, Lee and Smerdon (1997) indicated that male achieved higher level than female in science. In the study of Oludipe (2014), there was no significant effect of gender on students' academic achievement in basic science. In the present study, according to descriptive statistics, science achievement of male students was slightly higher than that of female students, but there was no significant difference according to the result of t-test. So, the present study was in line with Oludipe's (2013) findings.

Finally, the relationship between science anxiety and science achievement will be discussed. In the studies of Czerniak and Chiarelott (1984), Wynstra (1991) and Yurkewicz (1988) found that science anxiety was significantly and negatively correlated with science achievement. In consistence with the results of Czerniak and Chiarelott (1984), Yurkewicz (1988) and and Wynstra (1991), in the present study, the result of Pearson correlation analysis showed that there was significant negative correlation between science anxiety and science achievement. Besides global science anxiety, all dimensions of science anxiety have significant negative correlation with science achievement. This result points out that students with high science anxiety scored lower in science achievement. Thus, the finding of the present study was in line with that of Mallow (1981, cited in Chuen, 1999) who claimed that science anxiety was reflected in lower achievement scores.

Conclusion and Implication to Research and Practice

The finding of this study revealed that students are more anxious in laboratory experiment situation than other situations. Moreover, female students showed a higher level of science anxiety. Teachers should eradicate the myth that males were naturally better than females in math, science and technology (Reyes & Padilla, 1985, cietd in Chuen, 1999). By considering the gender differences in science anxiety, the teachers can become effective in providing their instructions to students. Thus, teachers should be aware of the needs and the capabilities of the students with different science anxiety levels when designing teaching strategies for them. Science teachers should strive to understand science anxiety and implement appropriate teaching and learning strategies which can help the students overcome their science anxiety.

Future Research

To investigate whether the findings of this study are generalizable, replication of the present study could be carried out on a bigger sample involving more schools. It is suggested that the same research or any other research similar to this one can be conducted on all levels i.e., from primary level up to university level. Moreover, age level should be considered as variables in further studies to investigate their effects on students' anxiety. Additionally, other behavioral components such as attitude toward science

are also recommended for further research. More researches of this kind on other subjects are recommended since the present study investigated students' anxiety in Science. Besides, it is required to determine the effects of using different affective strategies in reducing students' science anxiety. It is also important to explore the sources of students' science anxiety. Actually, further studies should be conducted to help students overcome their anxiety in learning that would cause low science achievement.

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