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Education Science

An Investigation into Non-verbal Intelligence of Primary Students

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ABSTRACT: The main purpose of this study is to examine the non-verbal intelligence of primary students. The quantitative approach was used in this study. A total of 460 students (223 boys and 237 girls) as a sample were used in this study. From the selected school of Yangon Region was selected by using sample random sampling technique. Based on the results of descriptive statistic, the mean percentage for odd-one-out was the highest and picture arrangement was the lowest among the subscales. According to the results of independent sample t-test, there were no significant differences in non-verbal intelligence of primary students between genders and grades. The results revealed that the student's grade or education level and genders were not significantly related with the non-verbal intelligence for visual reasoning skill of primary students.

Keywords: Verbal Intelligence, Non-verbal Intelligence, Visual Intelligence

1. INTRODUCTION

The assessing the construct of intelligence without communicative language requires on the students or the teachers is the assessment of non-verbal intellectual. Without the confusing effect of language ability, to common cognition designed most of these tests. For students assumed of no having ability, the assessing should be a comprehensive assessment and may or may not include a standardized test of intelligence.

There are an imbalance high percentage of African-American students accepting exceptional education services under the branch of emotionally disability and more detail educable mentally handicapped in Florida (McCallum & Brack, 1997).

In common, it is recommended that for students who are preferred for assessment, within the context of a collaborative problem-solving method that examines children and context characteristics should evaluate all related areas of suspected disability be interpreted and the information or data obtained.

1.1 Purposes of the Research

- 1) To examine the non-verbal intelligence of primary students.
- 2) To find out the various factors that related to nonverbal intelligence of primary students by gender
- 3) To find out the various factors that related to non-verbal intelligence of primary students by grade

2. REVIEW OF RELATED LITERATURE

2.1 Verbal and Nonverbal Intelligence Tests

Intelligence without placing language demand on either the student or the teacher is assessed non-verbal intelligence tests. The examinees' degree of intelligence through their ability to synthesis data and evaluate problems using visual data was examined by nonverbal intelligence tests. It involves matrix test where a series of formats are exhibited and to complete the series or reject any unique plan that does not relate to the series required examinees. It is used to measure the learner's level of intelligence (Nicholson, 1999). Some intelligence tests effort to reduce, or to remove altogether, the power of verbal ability on the test scores. The pictures or figures and require arranged, categorize, order, selection, manipulation or some other answer based the tasks. Sometimes even the instructions that involve no words, but are given in action without using any words.

2.2 Non-verbal Reasoning in Everyday Life

Everyone's life requires both verbal and nonverbal reasoning. Though non-verbal reasoning is not, verbal reasoning is unique. However, everybody use nonverbal reasoning more, it is look like the submerged part of the iceberg. Most of the people make judgment by visual evaluation and make predictions under non-verbal reasoning.

Fluid reasoning is too called non-verbal reasoning. It is an international cognitive process that does not occur automatically. It is the ability to analyze information and problems solving using visual and handson reasoning. In other words, it is the ability to make sense of and act on the world with necessarily using words.

Nowadays, non-verbal intelligence is essential and crucial parts for many areas such as mathematical concepts, physics reasoning, computer tasks, science problems solving and so on. Moreover, it allows to everyone by reasoning through, plan for, and develops projects. Furthermore, non-verbal reasoning may be described as common sense that gives us through future days.

3. METHODOLOGY

3.1. Sampling for Quantitative Study

 Table 1. Number of participating students across

 grade and gonder

gı	aue	anu	genuer	

Cradad	Ge	Total	
Grades	Male	Female	Total
Grade-3	110	120	230
Grade-4	113	117	230
Total	223	237	460

To collect the required data, Grade-3 and Grade-4 students were selected as the participants of this study. 460 students, both males and females were selected in total only from B.E.P.S (18) North Okkalarpa and B.E.P.S (1) Insein.

3.2 Instrumentation

In this research, the "Non-verbal Intelligence Questionnaire" which are in tune with Myanmar Students' age level or maturity was constructed by Ma Myat Mon Kyaw who was a M.Ed student in 2014.

The non-verbal intelligence is composed of 3 subtests and it has a total of 25 items. They are odd-one-out, picture arrangement, and matrix reasoning. The subtest of odd-one-out includes 10 items, picture arrangement includes 8 items and matrix reasoning was 7 items.

3.3 Procedure

Literature review was made from related books, educational journals, thesis, World Wide Web and other relevant sources to grasp the outline of the research. The research designs for this study were descriptive research survey method and quantitative study. Before data collection, the expert review and pilot study were carried out to get content validity and face validity. After modifying the survey questionnaires, the actual data collection was done and analyzed these data by using SPSS software. 110 primary students from B.E.P.S (18) North Okkalarpa and 350 primary students in B.E.P.S (1) Insein were used to collect the data from online with the help of their parents and teachers. A total of 460 primary students were used to collect the data in this study.

4. DATA ANALYSIS AND FINDINGS

Since the number of items included in each subscale of non-verbal intelligence questionnaire were not the same, the mean scores were transformed to the corresponding mean percentages.

Based on the descriptive statistics shown in Table 2, the mean percentage for odd-one-out subtest was the highest (90.44%). In the odd-one-out subtest, the given pictures were so appealing that they were very willing to find out and tick to the one which is different from others.

Table 2. Descriptive statistics of primary students' non-verbal intelligence

Subtest	No. of Students	Mean %	Standard Deviation
Odd-one-out	460	90.44	13.451
Picture Arrangement	460	42.01	19.870
Matrix Reasoning	460	62.65	21.786
Non-verbal Intelligence	460	79.90	10.637



Figure 1. Mean percentage comparison of primary students' non-verbal intelligence

The second highest mean percentage was matrix reasoning. In the subtest of matrix reasoning, students were required to fill in a missing design from a number of choice items. Mean percentage of this subtest was 62.65%. Although this item format may be difficult for younger children such as Grade 3 and Grade 4, they seemed familiar with this type of item format. It can be interpreted that students have the high visual reasoning skill.

It was observed that the mean scores for nonverbal intelligence were almost the same between male and female students. Therefore, it may be concluded that there was no difference in non-verbal intelligence between genders. To explore whether these differences are significant or not, independent sample t-test was conducted.

 Table 3. Descriptive statistics of primary students' non-verbal intelligence by gender

Subtests	Gender	Mean%	Standard Deviation
Odd-one-out	Male	91.30	11.90
	Female	93.30	13.26
Picture	Male	42.12	20.28
Arrangement	Female	40.90	22.20
Matrix	Male	64.19	24.90
Reasoning	Female	65.01	20.17
Non-verbal	Male	72.22	13.90
Intelligence	Female	70.98	11.21



Figure 2. Mean percentage comparison of primary students' non-verbal intelligence by gender

According to the result of independent sample ttest, it was found that there was no significant difference between male and female. This may be due to the fact that both boys and girls are interested in non-verbal intelligence. So, it can be said that there was no significant difference in the non-verbal intelligence of primary students across gender.

Table 4.	The resul	lt of ind	lepende	ent sampl	e <i>t</i> -test for
primary	students'	non-ve	rbal int	telligence	by gender

Subtest	t	df	Sig. (2-tailed)
Odd-one-out	-0.960	458	0.35
Picture Arrangement	6.816	458	0.00
Matrix Reasoning	-0.531	458	0.59
Non-verbal	1.830	458	0.45
Intelligence			

t = t - valuedf= degree of freedom Sig = Significant

According to Table 5, students from Grade 3 were higher than students from Grade 4 in picture arrangement items. To explore whether the differences are significant or not, the sample t-test was conducted.

 Table 5. Descriptive statistics of primary students' non-verbal intelligence by grade

Subtest	Grade	Mean %	Standard Deviation
Odd one out	Grade 3	90.32	13.92
Oud-one-out	Grade 4	92.78	11.20
Picture	Grade 3	43.98	17.24
Arrangement	Grade 4	35.23	18.70
Matrix	Grade 3	62.21	18.52
Reasoning	Grade 4	65.34	24.19
Non-verbal	Grade 3	71.21	10.21
Intelligence	Grade 4	69.34	14.28



Figure 3. Mean percentage comparison of primary students' non-verbal intelligence by grade

According to Table 6, students from Grade 3 and Grade 4 have no significant difference in non-verbal intelligence apart from picture arrangement items. Therefore, we can consider that there was no significant difference at all.

 Table 6. The result of independent sample *t*-test for primary students' non-verbal intelligence by grade

Subtest	t	df	Sig.(2-tailed)
Odd-one-out	1.301	458	0.21
Picture Arrangement	0.415	458	0.60
Matrix Reasoning	-0.319	458	0.76
Non-verbal	0.455	458	0.56
Intelligence			

5. CONCLUSIONS

5.1 Summary of the Major Findings

As participants in this study, 230 primary students from Grade 3 and 230 from Grade 4 were selected. To explore the non-verbal intelligence of primary students, the researcher developed the non-verbal intelligence test based on theoretical framework and literature reviews. The instrument was involved three subtests such as odd-one-out, picture arrangement and matrix reasoning.

As mentioned in research objectives, it is also interesting to find out whether there are any differences of students' non-verbal intelligence for visual reasoning across gender. Therefore, a comparison of mean scores for non-verbal intelligence between male and female was conducted. According to research findings, male students had slightly higher than females in non-verbal intelligence. Moreover, the result of independent sample *t*-test showed that there was no statistically significant difference in non-verbal intelligence between male and female. However, the result of independent sample *t*-test confirmed that there was significant difference of students' picture arrangement in non-verbal intelligence by gender.

To compare the non-verbal intelligence of primary students from Grade 3 and Grade 4, the descriptive statistics for non-verbal intelligence was conducted. The analysis revealed the differences in means and standard deviations of non-verbal intelligence by Grade 3 and Grade 4. The mean scores of students from Grade 3 are slightly higher than that of Grade 4 in picture arrangement subtest. The independent sample *t*-test was used to examine whether these differences are significant or not. The result of independent sample *t*-test confirmed that there was no significant difference of students' non-verbal intelligence in visual reasoning skill across grade. It is said that Grade 3 students may have high non-verbal intelligence like Grade 4 so there is no significant between Grade 3 and Grade 4.

These findings showed that students' non-verbal intelligence on visual reasoning skill was not independent on grade and gender.

5.2 Limitation

Moreover, the generalizability of the research findings in this study may be weak due to the small sample used in this study.

5.3 Recommendation

The study should be conducted as a future research to investigate the non-verbal intelligence of students relate to their academic achievement in later grades. Therefore, this study of non-verbal intelligence of primary students should be extended to middle and high school level.

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REFERENCES

- C. Nicholson, "Comprehensive Test of Nonverbal Intelligence (CTONI)", *Diagnostique*, 1999, (1-4), 57-68.
- [2] S. McCallum & B. Brack, "The Universal Non-verbal Intelligence Test. InD ", 1997.
- W. K. Estes, "Learning, memory and intelligence". In R. J. Sternberg (Ed.), Handbook of human intelligence. Cambridge: Cambridge University Press, 1982.

An Investigation into Adolescents' Emotional Creativity and the Influence of Personality Traits on it

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ABSTRACT: This study aims to investigate adolescents' emotional creativity and the influence of personality traits on it. A quantitative approach and survey research design were selected. A total of 600 university students participated and Emotional Creativity Inventory and NEO Five-Factor Inventory were used to acquire the data for this study. The emotional creativity score of adolescents was higher than average. In comparison among the four subscales of Emotional Creativity Inventory, the mean percentage of Preparedness was the maximum and that of Novelty was the minimum. A comparative study of male and female found significant differences in Emotional Creativity and its subscales of Novelty and Effectiveness. The determination by education level expressed a significant difference in Effectiveness and found that first-year students were the weakest in contrast to others. Concerning the universities, the significant differences were in Emotional Creativity, and its subscales of Preparedness and Novelty. The results of examining the influence of personality traits on adolescents' emotional creativity expressed that Extraversion had the strongest influence on adolescents' emotional creativity. Regarding the traits, the results revealed a significant difference in adolescents' emotional creativity by Extraversion and Conscientiousness.

Key words: Adolescents; Emotional Creativity; Personality traits

1. INTRODUCTION

The property of emotional creativity is an urgent need for individuals to adjust to the current changing life conditions (Frolova & Novoselova, 2015). Nowadays, adolescents confront a variety of challenges from all the standpoints of their everyday lives. The increasing anticipations for them, new resources for teachinglearning processes, technological novelties, demanding more and more skill requirements, and increasing emotional and social issues by using social media are the common facing issues. Besides, adolescence itself is a period of change and it leads to challenges for them. To cope up with these challenges, adolescents should be emotionally creative because the time has changed.

Personality is a form of persistent, unique emotions, thoughts, and behaviors that demonstrate the strategy a person adjusts to the world (Nelson, 2011). Each person has the dominant personality trait and the difference in their personality makes them vary in their emotional creativity. If the influence of personality traits on adolescents' emotional creativity can be examined, the parents and teachers will be able to nurture their children to be people who are strong in good personality traits. Furthermore, the current situations demand the researchers investigate the emotional creativity of these adolescents.

1.1. Purpose of the Study

The primary purpose of this study is to investigate adolescents' emotional creativity and the influence of personality traits on it.

The specific purposes of this study are (a) To explore the emotional creativity of adolescents

- (b) To determine differences in adolescents' emotional creativity by gender, education level, and university
- (c) To examine the influence of personality traits on adolescents' emotional creativity

1.2. Research Questions

- i. How high do the adolescents have emotional creativity?
- ii. Is there any difference in adolescent's emotional creativity by gender, education level, and university?
- iii. How do the personality traits influence on emotional creativity of adolescents?

1.3. Definitions of Key Terms

Emotional creativity. Emotional creativity is the prosperity of a person's emotional life (Ivcevic, Brackett & Mayor, 2007).

Personality traits. Personality traits reflect people's characteristic patterns of thoughts, feelings, and behaviors (Diener & Lucas, 2020).

Adolescents. Adolescents are individuals at a significant period of maturation of the neurological processes that produce higher emotional, cognitive, and social behaviors (Yurgelun-Todd & Deborah, 2007).

2. REVIEW OF RELATED LITERATURE

2.1. Emotional Creativity

Emotional creativity is the capacity to experience and express unique beneficial blends of emotions (Averill & Thomas-Knowles, 1991, cited in Martsksvishvili & Sordia, 2017). According to Averill (2011), emotional creativity has three main dimensions for an emotional response to be judged creative: novelty, effectiveness, and authenticity and an additional fourth dimension that is crucial is preparedness.

Novelty. The criterion of novelty infers that something new or that does not exist before is brought into being. Thus, novelty is a relative concept as it assumes a standard of comparison. That standard may be the own past behavior of a person, or the behavior of the group within which a person lives (Averill, 2009).

Effectiveness. A novel emotional response must also be effective to consider as a creative emotion. An effective response is one that is beneficial to self and/or others. A response profiting the larger group may be risky to self and vice versa. Similarly, a response that is harmful in the present may turn out to be valuable in the future and vice-versa (Cooney, 2018).

Authenticity. Authenticity involves possessing an individual's personal experiences, including their thoughts, emotions, needs, preferences, likes, desires, beliefs, or attitudes which are processes captured by the consent to "know oneself". It implies that a person performs following the true self, expressing oneself in reliable ways as their inner thoughts and feelings (Harter, 2001).

Preparedness. Preparedness implies that an individual learns to use the previous emotional experiences for supervision his/her life in the present, but is not afraid of new life events. This infers that an individual believes everything which happens in life helps his/her emotional development according to the knowledge extracted from the previous emotional experiences (Frolova & Novoselova, 2015).

2.2. Personality Traits

According to Kassin (2003), personality is defined as an individual's patterns of emotions, thoughts, and behaviors. According to John, et al. (2008), the Big Five represents a variety of personality traits; each dimension embodies a range of distinctive and particular personality features.

Openness to experience. According to Costa and McCrae (1992), openness to experience is defined as originality, insight, knowledge, contemplation, and art that are related to the thoughts, imagination, and art of an individual (as cited in John, et. al, 2008). According to Lebowitz (2016), an individual who is high in openness to experience usually enjoys learning, the arts, meeting new people, and participates in a creative occupation or hobby.

Conscientiousness. According to Goldberg (1990), conscientiousness pertains to the extent to which an individual is purposeful, industrious, persistent, and endeavor for achievement. Conscientious people excel in their ability to delay gratification, work within the rules, and plan and organize effectively (as cited in Sung, & Choi, 2009).

Extraversion. Raja and Johns (2004) suggested that extraversion actually reveals an individual's drive to be enthusiastic, vigorous, and ambitious (as cited in Sung & Choi, 2009). Creativity may result from an individual's

proactive behavior, such as actively performing a task, or seeking for different ideas. Thus, the enthusiasm of extraverts may lead them to be inquisitive about evenly routine events and to investigate them. They also lead to seek novel ways of performing tasks and to confront problems instead of avoiding them, which in turn, increase creative performance (Sung & Choi, 2009).

Agreeableness. According to Lebowitz (2016), people high in agreeableness are respectful and pay attention to the necessities of others. They prefer to have few enemies and are kindhearted to their friends and loved people, as well as benevolent to the troubles of strangers (as cited in Attia, 2013).

Neuroticism. As opposed to emotional stability that is meant by an individual's degree of calmness and security, neuroticism refers to an individual's personality characterized by bad feelings such as anxiety, nervousness, worry, bad temper, depression, and guilt and high irritability (Barrick, Mount & Judge, 2001, cited in Sung & Choi, 2009).

2.3. Researches regarding Emotional Creativity and Personality Traits

Previous researches regarding Emotional Creativity and Personality Traits explained that the Emotional Creativity Inventory in correlation with the "Big Five" personality traits presented the following results: (a) the scores of Emotional Creativity Inventory-Total Scale and the three subscales correlated significantly with Openness to Experience; (b) the scores of Emotional Creativity Inventory-Total Scale and the Preparation and Effectiveness/Authenticity subscales correlated with Agreeableness; (c) the Novelty component of Emotional Creativity Inventory correlated negatively with Conscientiousness, but the score of Effectiveness/ Authenticity subscale correlated positively with Conscientiousness, (d) the score of Novelty subscale correlated positively with Neuroticism, and (e) the score Effectiveness/Authenticity subscale of correlated positively with Introversion-Extraversion, but negatively with neuroticism (Averill, 1999, cited in Fuchs, 2004).

Moreover, scores on the Emotional Creativity Inventory are related predictably with a variety of other personality dimensions. The total Emotional Creativity Inventory score significantly correlated with Openness to Experience (r = .57) and Agreeableness (r = .20), but not with Neuroticism, Extraversion, or Conscientious, as measured by the NEO-PI (Averill, 2011). Cooney (2018) also conducted a study of the effects of openness to experience on emotional creativity. However, there is a gap in research investigating the effect on the adolescents' emotional creativity by their respective personality traits.

3. METHOD

3.1. Sample of the Study

The researcher randomly selected a total sample of 600 university students from Yangon University of Education (YUOE), Sagaing University of Education (SUOE), and University for the Development of National Races of the Union (UDNR) by taking 200 students (males 100, females 100) from each university.

3.1.1. Instrumentation of Emotional Creativity Inventory (ECI)

Emotional Creativity Inventory (ECI) was a selfreport questionnaire developed by Averill (1999). It contains 30 items with four dimensions: preparedness (7 items), novelty (14 items), effectiveness (5 items), and authenticity (4 items). It included two negative items. For positive items, a 4-point Likert scale (1=Strongly Disagree, 2=Disagree, 3=Agree, 4=Strongly Agree) was used, but for negative items, the values were reversed such as 4=Strongly Disagree, 3=Disagree, 2=Agree, 1=Strongly Agree. The reliability of the instrument was .90 which intended a high degree of internal consistency. Test-retest reliability was .91. Studies carried out in Western countries had supported the evidence of good construct, discriminant, and incremental validity, as well as internal consistency reliability. Nezhdyan and Abdi (2010) conducted a confirmatory factor analysis and its results showed that their study matched the results of Averill's original study. The pilot study revealed that among the range of the total scores on this inventory from a low 30 to high 120, Cronbach's Alpha of the 30-item scale was 0.8. Thus, the scale showed a high degree of internal consistency and was appropriate to be used in this study.

3.1.2. Instrumentation of NEO Five-Factor Inventory (NEO-FFI)

The NEO Five-Factor Inventory (NEO-FFI) was an abbreviated version of the NEO-PI-3 (240 items) and it was comprised of a 60-item self-report instrument. It had strong support concerning psychometric properties (Costa & McCrae, cited in Murray, et al., 2009). Costa and McCrae (2007) suggested that the internal consistency of this instrument was within the range .72 to .88 in adolescents and adult samples (as cited in Cooney, 2018). This instrument intended the participants of 12 years and older. The total scores on this inventory lie between 60 and 240. Cronbach's Alpha of this instrument was 0.76 in the pilot study. Thus, it was appropriate to be used in this study by its high degree of internal consistency.

4. DATA ANALYSIS AND RESULTS

Firstly, the means and standard deviations were examined for the emotional creativity scores and its subscale scores. Then, it is to investigate whether differences in emotional creativity and each subscale are significant according to gender, education level, and selected universities. Then, the influence of personality traits on adolescents' emotional creativity was explored.

4.1. Descriptive Statistics of Adolescents Emotional Creativity

Descriptive statistics on means and standard deviations concerning emotional creativity were computed. The results were shown in Table 1 and Table 2.

The mean value of Emotional Creativity was higher than the average score (83). This result pointed out that adolescents can adjust to dramatic changes and confronts and they can react to emotions, feelings, and sufferings to a certain extent well. Thus, the teachers and parents need to give great consideration to emotions, the ways of responding to the events, and thoughts of their children besides their academic achievements.

Table 1. Descriptive Statistics of Adolescents'Emotional Creativity

Dependent Variable	No. of students	Mean	SD		
Emotional Creativity	600	83	6.9		

Note: SD = Standard Deviation

Table 2. Descriptive Statistics of the Subs	scales of
Adolescents' Emotional Creativity	V

Hubbertes Emotional creating				
Subscales of Emotional Creativity	No. of Items	Mean (%)	SD	
Preparedness	7	72.85	6.26	
Novelty	14	66.10	8.66	
Effectiveness	5	70.59	9.88	
Authenticity	4	71.68	9.06	

Note: SD = Standard Deviation

The results indicated that the mean percentage of Preparedness was the highest (72.85) and that of Novelty was the lowest (71.68) among the subscales of Emotional Creativity.

The mean percentages of Preparedness, Authenticity, and Effectiveness were higher than those of Novelty. It meant that the adolescents in our Eastern society should be encouraged the new and novel emotions that will make intrapersonal and interpersonal contexts better. These results revealed that the culture in our society is collectivist and does not emphasize novelty well rather than conformity. This may be because the culture and social customs emphasize emotional development, maturity, authenticity, and the benefits to oneself and others.

4.2. Comparative Study of Adolescents' Emotional Creativity by Gender

For the aim to find any differences by gender, the researcher took the samples of 300 boys and 300 girls. The results were shown in Table 3.

 Table 3. Results of Independent Sample t-test

 of Adolescents' Emotional Creativity by Gender

Dependent Variable	Gender	Mean	SD	р
Emotional	Μ	83.81	6.812	0.004

Creativity	F	82.19	6.904		
Preparedness	Μ	20.48	1.742	0.244	
	F	20.31	1.760	0.244	
Novelty	М	37.56	4.604	0.006	
	F	36.47	5.031	0.000	
Effectiveness	Μ	14.32	1.954	0.011	
	F	13.91	1.978	0.011	
Authenticity	Μ	11.44	1.373	0.673	
	F	11.49	1.525	0.075	

Note: SD = Standard Deviation, N=Male, F=Female *The mean difference is significant at the 0.05 level **The mean difference is significant at the 0.01 level

It expressed the significant differences in Emotional Creativity and Novelty at the 0.01 level and Effectiveness at the 0.05 level. The mean scores of males were higher than those of females. The results indicated that the culture, values, social norms, and expectations are key reasons for these differences. Our society encourages females to obey social norms and does not usually guide them to diverge from the common. Since the females are weak in emotional creativity and novelty, they are also lower in Effectiveness characterized by good consequences of emotional change. It pointed out that there may be weaknesses in nurturing females to be emotionally creative. However, the differences in Preparedness and Authenticity between males and females were not significant.

4.3. Comparative Study of Adolescents' Emotional Creativity by Education Level

To find out whether there was a significant difference in T emotional creativity by their education levels. Descriptive data and One-Way Analysis of Variance (ANOVA) were computed.

 Table 4. ANOVA Results of Adolescents' Emotional Creativity by Education Level

Dependent Variable	Year	Mean	SD	р
	First Year	82.23	6.36	
Emotional	Second Year	83.39	7.27	271
Creativity	Third Year	83.65	6.83	.271
	Fourth Year	82.73	7.09	
	First Year	20.39	1.67	
Preparedness	Second Year	20.39	1.76	1.00
	Third Year	20.41	1.76	1.00
	Fourth Year	20.40	1.83	
	First Year	37.02	4.43	
Novelty	Second Year	37.02	5.09	000
Noverty	Third Year	37.22	4.74	.909
	Fourth Year	36.81	5.14	
	First Year	13.55	2.07	
Effectiveness	Second Year	14.31	1.92	000
	Third Year	14.47	1.99	.000
	Fourth Year	14.14	1.80	
Authenticity	First Year	11.27	1.59	.078

Second Year	11.67	1.47
Third Year	11.55	1.32
Fourth Year	11.39	1.39

Note: SD = Standard Deviation

***The mean difference is significant at the 0.001 level.

Based on the results shown in Table 4, the difference in Effectiveness was statistically significant by educational level. But there were not found statistically significant differences in Emotional Creativity, Preparedness, Novelty, and Authenticity. It pointed out that they were nearly the same except in Effectiveness and it may be because the age group studied is late adolescence. To obtain detailed information, a post hoc analysis was conducted and the results can be seen in Table 5

 Table 5. Post hoc Analysis of Adolescents' Emotional

 Creativity by Education Level

Dependent Variable	(I) Year	(J) Year	Mean Difference (I-J)	р
		Second Year	767**	0.004
Effectiven ess	First Year	Third Year	927***	0.000
		Fourth Year	593*	0.043

*The mean difference is significant at the 0.05 level **The mean difference is significant at the 0.01 level. *** The mean difference is significant at the 0.001 level

A post hoc analysis was investigated by Tukey HSD. The results described that first-year students were lower than all of second-year, third-year, and fourth-year students in Effectiveness. It can be concluded that as firstyear students, they may be weak in dealing with emotional changes effectively. It can also be said that it is due to their young age and they have to face the changes and new experiences in their environment for the very first time.

4.4. Comparative Study of Adolescents' Emotional Creativity by University

The data was collected from three universities, which exist in different regions. To find out whether there were significant differences in the Emotional Creativity of adolescents by University, One-Way Analysis of Variance (ANOVA) was computed.

 Table 6. ANOVA Results of Adolescents' Emotional Creativity by University

Dependent Variable	University	Mean	SD	р
Emotional Creativity	University 1	84.15	6.58	0.000
	University 2	84.04	7.15	0.000

	University 3	80.82	6.46	
	University 1	20.22	1.72	
Preparedness	University 2	20.70	1.81	0.010
	University 3	20.27	1.70	
	University 1	38.21	4.64	
Novelty	University 2	37.71	4.79	0.000
	University 3	35.14	4.56	
	University 1	14.19	2.08	
Effectiveness	University 2	14.15	1.94	0.679
	University 3	14.02	1.91	
	University 1	11.54	1.52	
Authenticity	University 2	11.48	1.51	0.601
	University 3	11.39	1.31	

Note: SD = Standard Deviation

The mean difference is significant at the 0.01 level * The mean difference is significant at the 0.001 level.

The results in Table 6 explained that the differences in Emotional Creativity, Preparedness, and Novelty were discovered. In Emotional Creativity, the mean score of University 1 was the maximum and that of University 3 was the minimum. In Novelty, the results were the same as Emotional Creativity since both of them highlighted to vary from the usual and common responses. In Preparedness, the mean score of University 2 was the highest, that of University 3 was the second-highest and that of University 1 was the lowest.

For the sake of obtaining detailed information, a post hoc Tukey HSD analysis was conducted

 Table 7. Post hoc Analysis of Adolescents' Emotional

 Creativity by University

Dependent Variable	(I) Univer sity	(J) Univer sity	Mean Difference (I-J)	р
Emotional	1		3.335***	0.000
Creativity 3	3	3.220***	0.000	
Preparedn ess 2	2	1	.480*	0.017
	3	.430*	0.037	
Novelty	1	2	3.075***	0.000
	2	3	2.570***	0.000

*The mean difference is significant at the 0.05 level. *** The mean difference is significant at the 0.001 level.

The mean scores of University 1 and University 2 were significantly higher than that of University 3 in Emotional Creativity and its subscale, Novelty. It revealed that the emphasis on the obedience of the rules and norms makes the adolescents different in their novel and unique responses. In Preparedness, the mean score of University 2 was significantly higher than those of both University 1 and University 3. Adolescents growing up in environments where there are plenty of things to pay attention may be weak in Preparedness. It meant that they are weak to contemplate their personal emotions and also weak to try to understand their own and others' emotions. Thus, this result showed that the nurturing means of their society, and the culture in which they grew up, and the emphasized values significantly impact the emotional ability of these adolescents.

4.5. Comparative Study of Adolescents' Emotional Creaativity by Personality Traits

The participants were grouped by their particular personality traits based on their raw scores. One-Way Analysis of Variance (ANOVA) was computed.

Table 8. ANOVA Results of Adolescents' Emotion	al
Creativity by Personality Traits	

Dependent Variable	Personal ity Trait	N	Mean	SD	р
	Ν	10	83.60	4.88	
	Е	132	84.43	7.59	
Emotional Creativity	0	167	83.67	5.98	0.005
	Α	37	82.62	7.30	
	С	254	81.85	6.91	

Note: SD=Standard Deviation, N= Neuroticism, E=Extraversion, O= Openness, A= Agreeableness, C= Conscientiousness

**The mean difference is significant at the 0.01 level

Based on the results shown in Table 8, there were significant differences in the Emotional Creativity of adolescents at the 0.01 level according to their personality traits. This result indicated that the personality traits they possess may influence their emotional creativity. The mean score of Extraversion was the highest, so the individuals who are strong in Extraversion may be emotionally creative more than those who are strong in other personality traits. The mean score of Openness was the second-highest, that of Neuroticism was the third-highest, that of Agreeableness was the fourth-highest, and that of Conscientiousness was the lowest.

According to the mean comparison results, the mean score of Extraversion was the highest among the personality traits. To obtain detailed information about these significant differences, a post hoc analysis of Tukey HSD was computed.

 Table 9. Post hoc Analysis of Adolescents' Emotional

 Creativity by Personality Traits

Dependent Variable	(I) Personal ity trait	(J) Personal ity trait	Mean Differ ence (I-J)	p
Emotional Creativity	Extravers ion	Conscien tiousness	2.585*	0.015

*The mean difference is significant at the 0.05 level

According to the results revealed in Table 9, the mean value of Extraversion was significantly higher than that of Conscientiousness in Emotional Creativity. Individuals with strong Extraversion are enthusiastic, so their proactive behavior leads them to seek unique ideas and challenge the problems instead of avoiding them. Consequently, they may have positive effects on their whole lives and be much more emotionally creative than others. Among other personality traits, there were no significant differences.

5. CONCLUSION AND DISCUSSION

5.1. Conclusion

The descriptive data of adolescents' emotional creativity showed that the sample mean was above average. It can be concluded that adolescents in our society are emotionally creative to a certain extent even if they are not very well. Moreover, the results for each subscale of adolescents' emotional creativity expressed that the mean percentages of all subscales of the Emotional Creativity Inventory were all above average. Among them, they are the highest in Preparedness and the lowest in Novelty. It may be because our Eastern society encourages to empathize with others' feelings and opinions, good heart, and emotional development, so they are strong in Preparedness. Conversely, the society doesn't emphasize the divergence from the common and cultural norms but on conformity, oneness, and obedience. Thus, it is essential to be sensible in nurturing the children as emotional creativity is a central emotional talent in the modernized world.

The gender that is designated by the culture they live in makes differences in the emotional creativity of adolescents. Since the mean score of the males was higher than that of females in Emotional Creativity, Novelty, and Effectiveness, the teachers and parents should aware of the significance to produce emotionally creative women. Additionally, they need to encourage diverging from the social norms instead of compelling them to conform to the norms. If so, they can manage to face and adjust the challenging situations well.

The significant difference in Effectiveness by education level expressed that they may have different capacities in altering their emotional responses to valuable ones for themselves and/or others. Among them, the youngest first-year students were the weakest in Effectiveness and it may be as they have less experience in social interaction and deal with more burdens and struggles in case of transforming from their home life to university life. As the emotional creativity gradually develops in accordance with their age, it is essential to care about their emotions since they were young. The teachers and parents should train their children to handle the facing situations well and give the practice of effective emotional change.

The significant differences were found in Emotional Creativity and its subscales of Novelty and Preparedness by universities that exist in different regions. It explained that the upbringings they obtained through their life and the cultures they experience make these differences. The adolescents who grew up in the environment emphasized to obey the norms and rules may weak in Emotional Creativity and Novelty that mean to diverge and unique. Furthermore, the adolescents who experience the emphasis on emotional aspects may be high in Preparedness than those who have a lot of things to pay attention to and competitions. It indicated that the people who are in charge of nurturing their children must recognize to balance the customs and the demanding emotional skills of the current age and should concentrate on children's emotional perspective.

The comparative study of adolescents' emotional creativity by personality traits expressed that Extraversion was significantly higher than Conscientiousness. However, there were no significant differences among other traits. If an individual possesses the personality trait of Extraversion, he/she is enthusiastic, energetic, and ambitious. This proactive behavior supports them to be creative, to seek unique ideas and innovative ways of performing their tasks, and to tackle problems instead of escaping them. Therefore, the results can be concluded that the adolescents who had the personality trait of Extraversion are better in Emotional Creativity than other personality traits. Among the Big-Five personality traits, Extraversion had the strongest effect on the emotional creativity of adolescents. Thus, the teachers and the parents should nurture their children to be strong in the trait characteristics of Extraversion. Consequently, they may be emotionally creative to be enough to adjust to these challenging and changing periods. The previous research conducted by Ling, Yujiao, and Xiaoyun found that Extraversion, Openness, and Conscientiousness were positively correlated with emotional creativity. It can be concluded that their results supported the findings of this study. On the other hand, Averill (2011) revealed that the total score on the Emotional Creativity Inventory (ECI) was not significantly correlated with Extraversion. It was inconsistent with the results of this study.

5.2. Discussion

The teachers and parents need to recognize how they should cultivate their children to be emotionally talented people besides being cognitively skillful people. There is an urgent need for adolescents to be able to face the fast-moving variations and challenges in this modern world. If they had this emotional talent, they may adjust to current situations and possess successful and blissful lives.

As teachers and parents play an essential role in producing brilliant good people, the findings of how the personality traits influence the emotional creativity of adolescents need to be passed to teacher educators, student teachers, and parents and may provide the knowledge and guidelines to the nurturing people to a certain extent. Consequently, they can guide their children better and take notice of their cultural and social norms. The teachers and parents may pay more attention to the emotional perspectives of students besides the hard skills that have been emphasized before.

Since the personality of an individual makes influences his/her emotional life, it requires to train children in order to be people with a good personality that makes them behavioral and emotional improvements. The personality trait, Extraversion is found to have good results in emotional talents, so it suggests to emphasize producing the children who are strong in Extraversion. Therefore, we should encourage them to perform the tasks actively, to seek different ideas, and to confront the problems they face instead of avoiding them. These can generate emotionally creative people.

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REFERENCES

- Averill, J. R. (2009). Emotional Creativity: Towards "Spiritualizing the Passions". In S.J. Lopez, & C. R. Snyder (Eds.), *Oxford handbook of positive psychology* (p. 172-185). New York, NY: Oxford University Press.
- [2] Averill, J. R. (2011). Emotions and creativity, presented at the 12th Conference on Creativity and Innovation, Faro, Portugal, September 2011. Retrieved from ProQuest database.
- [3] Averill, J. R., Chon, K. K., & Hahn, D.W. (2001). Emotions and creativity, east and west. Asian Journal of Social Psychology, 4(3), 165-175. Retrieved August 22, 2019 from

http://onlinelibrary.wiley.com/doi/abs/10.1111/1467-839X.00084

- [4] Attia, N. (2013). Big Five personality factors and individual performance. Master of Organizations Management Thesis, University of Quebec. Retrieved from http://scholar.google.com/scholar?q=Big+Five+personalit y+factors+and+individal+performance&hl=en&as sdt=0
- &as_vis=1&oi=scholart
 Barthelemy, J. J. (2005). Aggression and the big five personality factors of grades and attendance. PhD dissertation, The University of Tennessee, Knoxville. Retrieved from ProQuest database.
- [6] Cooney, J. M. (2018). The effect of gender, age, spirituality, openness to experience, and subjective wellbeing on emotional creativity. PhD Dissertation, Alliant International University. Retrieved from ProQuest database.
- [7] Diener, E. & Lucas, R.E. (2020). Personality traits. In R. Biswas-Diener & E. Diener (Eds), Noba textbook series: Psychology. Champaign, IL:DEF publisher. Retrieved from http://noba.to/96u8ecgw
- [8] Frolova, S.V., & Novoselova, K. I. (2015). Emotional creativity as a factor of individual and family psychological wellbeing. *International Annual Edition of Applied Psychology: Theory, Research, and Practice*, 2(1), 30-39. Retrieved from http://cyberleninka.ru/article/n/emotional-creativity-as-afactor-of-individual-and-family-psychological-wellbeing
- [9] Harter, S. (2001). Authenticity, Origins: "To Thine Own Self Be True". In Snyder, C. R., and Lopez, S. J. (Eds), *Handbook of Positive Psychology* (p. 382-383). Oxford University Press.
- [10] Ivcevic, Z., & Brackett, M. A. (2015). Predicting creativity: Interactive effects of openness to experience and emotion regulation ability. *Psychology of Aesthetics, Creativity, and the Arts,* 9(4), 480 – 427. Retrieved September 12, 2019 from http://dx.doi.org/10.2037/a0039826
- [11] Ivcevic, Z., Brackett, M. A., & Mayer, J. D. (2007). Emotional intelligence and emotional creativity. *Journal* of *Personality*, 75(2), 199-231. Retrieved August 10, 2019 from DOI: 10.1111/j.1467-6494.2007.00437.x
- John, O. P., Naumann, L. P., & Soto, C. J. (2008). Paradigm shift to the integrative big five trait taxonomy: History, measurement, and conceptual issues. Retrieved August 1, 2019 from http://www.researchgate.net/publication/289963274
- [13] Martsksvishvill, K., Abuladze, N., & Sordia, N. (2017). Emotional creativity inventory: Factor structure, reliability and validity in a Georgian-speaking population. *Problems of Psychology in the 21st Century*, 11(1), 31-39. Retrieved August 15, 2019 from http://www.scientiasocialists.lt/ppc/node/131
- [14] Nelson, K. W. (2011). *Motivation and personality: An examination of the big five personality trait factors and their relationship with sales performance in a non-cash incentive program.* PhD Dissertation, Capella University. Retrieved from ProQuest database.
- [15] Nezhdyan, F. G., & Abdi, B. (2010). Factor structure of emotional creativity inventory (ECI-Averill, 1999) among Iranian undergraduate students in Tehran Universities. *Procedia Social and Behavioral Sciences*, 5, 1836-1839. Retrieved from DOI:10.1016/j.sbspro.2010.07.374
- [16] Raja, U. Z. (2004). The relationship of the big five personality dimension to personal and organizational outcomes: Answering the questions who? and when? PhD

Dissertation, Concordia University, Montreal, Quebec,

[17] Sung, S. Y., & Choi, J. N. (2009). Do big five personality factors affect individual creativity? The moderating role of extrinsic Motivation. *Social Behavior and Personality*, 37(7), 941-956.

An Investigation into Personality and Career Interest of High School Students

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ABSTRACT: The main purpose of this study was to investigate the personality and career interest of high school students. A total of 300 high school students participated in this study. Quantitative research design and descriptive survey method were used in this study. The international item pool and Oregon Vocational Interest were used to measure the career interest and personality of grade 10 students. There was a significant difference by gender in neuroticism and consciousness. Mostly found personality type was agreeableness (31.3%) and mostly found career interest was social career (54.6%). Furthermore, significant difference was found in social realistic and artistic by gender. Female students were more interested in social career like teacher, nursing and marketing than males. Male students were more interested in realistic career which involved more practical work. By knowing the students' career interest and personality, parents, teachers and counsellor can support and guide the students to get the most appropriate college, major and their future career paths.

Keywords: career interest, neuroticism, openness, extraversion, conventional

1. INTRODUCTION

Educational Psychology studies personality based on theories of individual differences. A person's characteristics, behaviors, thoughts, and feelings define his or her personality. These behaviors, thoughts, and feelings start developing and strengthening from childhood into adulthood. A developmental process that extends throughout life and includes a series of decision is a career choice.

Actually, personality is related with career goals and success that helps them to get the right career which is related with their personality type (Barger, 1998). Personality and vocational interest effects the choice individuals make, how much effort to exert on those tasks, and how long to take those tasks. Some careers request a certain personality to match with the occupation's qualities. For example, marketing people tend to be outgoing.

Knowledge about different careers early will help students to better understand the types of jobs they may want to explore. This career exploration process should start as early as possible especially in middle school and should continue throughout high school with hopes to narrow their decision before applying to colleges. Personality is important in the career choice process. The researcher believed that students must know themselves and apply the self-knowledge as equipment when making a career choice. Therefore, the more people know their personality, the better they know their interest in careers the better choices they can make about their career (Chen, 1997).

The main problem in a real situation is the lack of congruency between the student's personality and the studying environment. This deficiency has resulted in low satisfaction in their study, resulting in low academic achievement. The congruency between individuals and their working or studying environment will enable them to understand and predict the suitability of their career choosing, career achievement and education achievement (Holland, 1968). For these reasons, the relationship between personality and career interests of high school students are investigated in this study in order to give valuable guidance and suggestions for the student to make their right career choices. From these right choices, it is hoped to get success in their careers and be a useful member of our society. The results will support useful ways to give advice to have good personality and future career success.

1.2 Purpose of the Study

The general objective of the study is to investigate the personality and career interests of high school students. The specific objectives of the study are as follow,

- 1. to investigate the personality of high school students by gender
- 2. to investigate the career interest of high school students by gender and school.
- 3. to investigate the relationship between personality and career interest of high school students.

1.3 Definitions of Key Terms

Personality Trait: A key intendant of an individual's cognition and affective states are personality traits. It may influence his or her tasks and interpersonal or socio-emotional role behaviors (Goldberg, 1993).

Career interest: Career interest is not the same with abilities or skills. However, people are likely to be attracted to activities that they enjoy and are interested in, that provide the chances to develop skills and abilities (Holland, 1968).

2. REVIEW OF RELATED LITERATURE

2.1 Personality

A set of traits and characteristics which stable over time is personality." Personality is unique. Every person has its own personality and it may be different from one another. Furthermore, the overall profile or combination of characteristics that capture the unique nature of a person is personality. Person reacts and interacts with others, how he views himself and how the others think also represents his personality.

The development of personality or determinant of personality of an individual depends upon the following factors.

- (i) The Physiological and Physical factors (Genetic or Biological Determinants).
- (ii) The environmental or social factors (Social Determinants).
- (iii) The Physiological or Mental factors.
- (iv) The Cultural Determinants or Cultural factors.

2.2 Big Five Personality (or) Five Factor Model

There are many accepted personality models. According to Holland (1968) interest are direct expressions of a person's personality. Holland (1968) states that personality dispositions are strongly and consistently related with career interest. One of the most widely accepted measures of personality is Big Five personality dimensions (Goldberg, 1992). They are:

- **Extraversion:** traits like being talkative, merge, and assertive.
- Agreeableness: traits like being sympathetic, kind and affectionate.
- **Conscientiousness:** traits like being organized and through.
- **Neuroticism (Emotional Stability):** traits like being tense, moody and anxious.
- **Openness to Experience**: traits like having wide interest, and being imaginative and insightful.

2.3 Holland's Theory of Career Interest

Career Interest can be defined by pattern in an individual's interest in different careers. RIASEC structural model of career interest defined the relations between each of six interest types (Holland, 1997). People usually may have one of six personality types. Each personality type has its own relevant job environment. People can be successful and satisfied if they choose a job environment that matches to their personality type. For instance, realistic persons are more likely to be successful and satisfied if they choose job with realistic work environment which has more practical work.

People of the same personality type are likely to "flock together". That means that enterprising people are attracted to making friends with enterprising people. People of the same personality type working together in a job create a joyful and pleasant job environment that rewards creative thinking and behaviour.

Individuals are products of their environment, as they choose their careers according to their personalities and the members of an occupational group have similar personalities. If people get the right career choice based on their personality, they can possess success in their future life. Holland (1997) classified the vocational interest into six main types: Realistic, Investigative, Artistic, Social, Enterprising and Conventional (RIASEC).

Table 1. Six Career Type and Their Relevant Jobs

Holland Type	Preferred Activities	Possible Jobs
Realistic	working with one's hands or manipulating machinery, tools, or animals	mechanics, carpenter, farmer
Investigativ e	observing and systematically investigating physical, biological, or cultural phenomena in a creative way in order to understand and control them	scientist, mathematician , economist
Artistic	free, unsystematized opportunities of expression to create art or products	actor, writer, artist
Social	helping people with personal problems, training, curing, or informing other people	humanitarian, priest, teacher, social worker
Enterprising	dominanceandmanipulation of otherstoattainorganizational or self-interest goals	politician, sales, leader, manager
Convention al	ordered, systematic manipulation of data according to a prescribed plan	secretary, administrator, accountant, bank teller

3. Methodology

3.1 Sample

By using simple random sampling technique, the sample was selected from Dagon (South) Township, Tamwe Township and Hlegu Township Yangon Region. A total of 300 students participated in this study. The sample of Grade 10 students included 131 male students and 169 female students.

3.2 Research Method

The quantitative research design and the descriptive survey method were used in the present study.

3.3 Instrument

"The International Personality Item Pool (IPIP) developed by Lawis R Goldberg (1999) and The Oregon Vocational Interest Scales (ORVIS) developed by Pozzebon et al., (2010) were used in this study to collect required data. IPIP questionnaire included 30 items with 5 subscales. In the study, ORVIS included 40 items with 4-point Likert scale.

3.4 Data Collection and Procedures

Firstly, the instruments were adapted to Myanmar version and reviewed by the experts from the Educational Psychology Department. Some items were modified and students were administered by the final version of instruments. Data collection process was carried out in the second week of August, 2018. The collected data were analyzed by using descriptive and inferential statistics.

4. DATA ANALYSIS AND RESULTS

4.1 Mean Comparison for Personality of Grade 10 Students

In order to find out which personality the students possess mostly among the five personality types, descriptive statistics was conducted. (see Table 2).

Table 2. Descriptive Statistics for Personality of Students

Variables	Mini.	Maxi.	Mean	SD
Neuroticism	11	29	21.30	3.465
Extraversion	12	29	20.77	2.867
Openness	11	28	20.13	2.516
Agreeableness	13	32	24.04	2.729
Conscientiousness	12	32	23.48	3.427

According to Table 2, it was found that the mean value was highest in agreeableness variable and lowest in openness variable. Therefore, it can be concluded that most of the Grade 10 students had agreeableness personal type and the least found personal type in Grade 10 students was openness. Visual presentation of these findings was shown in Figure 1.



Figure 1. Mean Comparison for Personality of Grade 10 Students

4.2 Mean Comparison for Personality of Students by Gender

The mean and standard deviation of male and female students for each subscale was reported in Table 3.

 Table 3. Descriptive Statistics of Students' Personality

 by Conder

by Gender					
Variables	Gender	Ν	Mean	SD	
	Male	131	21.18	3.467	
Neuroticism	Female	169	20.63	3.318	
	Male	131	20.85	3.071	
Extraversion	Female	169	20.70	2.705	
Openness	Male	131	20.23	2.668	
	Female	169	20.06	2.397	
Agreeableness	Male	131	23.97	2.845	
	Female	169	24.09	2.643	
	Male	131	22.98	3.641	
Conscientiousness	Female	169	23.87	3.208	

According to Table 3, the mean values of males were higher than that of females in neuroticism, extraversion and openness variables. In contrast, the mean values of females were higher than those of males in agreeableness and conscientiousness variables. Therefore, it can be concluded that most of the male students had neuroticism, extraversion and openness personal types than that of females but most of the female students had agreeableness and conscientiousness personal type than that of males.

To better support the descriptive statistics, an independent sample t test was conducted. The result of the independent sample t test was shown in Table 4.

 Table 4. Result of Independent Sample t test for

 Personality by Gender

Variables	t	df	Р	MD
Neuroticism	3.931* **	29 8	0.000	1.548
Extraversion	0.451	29 8	0.652	0.151
Openness	0.579	29 8	0.563	0.170
Agreeableness	-0.375	29 8	0.708	-0.119
Conscientiousne ss	-2.253*	29 8	0.025	-0.893

*p<0.05; **p<0.01: ***p<0.001

According to Table 4, there were significant differences in neuroticism and conscientiousness variables by gender at 0.001 level and 0.05 level respectively. But there was no significant difference in other variables by

gender. It can be concluded that the mostly found personality type in males was neuroticism. Differently, mostly found personality type in females was conscientiousness. Visual presentation of these findings was shown in Figure 2.



Figure 2. Mean Comparison for Students' Personality by Gender

4.3 Mean Comparison for Career Interest of Grade 10 Students

Career interest consisted of six types: realistic, investigative, artistic, social, enterprising and conventional. In order to find out which career type the students are interested in mostly; the descriptive statistics was conducted.

Table 5. Descriptive Statistics for Career Interest of Grade10 Students

Giudeito Students					
Variables	Mini.	Maxi.	Mean	SD	
Enterprising	5	19	12.02	2.696	
Conventional	7	20	13.07	2.731	
Social	5	20	16.04	2.544	
Realistic	5	19	12.68	2.583	
Investigative	5	20	12.57	3.145	
Artistic	5	20	11.91	3.247	



Figure 3. Mean Comparison for Career Interest of Grade 10 Students

Acording to Table 5, it was found that the mean value of social career (16.04) was greater than other career interest areas. So, it can be said that the students were more interested in social career and the least interested in artistic career. Most of the students were rarely interested in artistic career because an artistic career requires special talent and aptitude. Moreover, if they do not have aptitude and only have interest, they will not succeed in that artistic career. Visual presentation of these findings was shown in Figure 3.

v	Gender	Mean	SD	t	Р
Б	М	11.95	2.81	0.206	0.00
E	F	12.07	2.61	-0.390	0.09
C	М	13.24	2.89	0 954	0.34
C	F	12.94	2.59	0.991	0.51
c	М	15.42	2.84	2 770***	0.00
3	F	16.51	2.17	-3.119	0.00
P	М	13.23	2.46	3 31/**	0.001
ĸ	F	12.25	2.59	5.514	
т	М	12.21	3.03	1 722	0.09
1	F	12.85	3.21	-1.755	0.08
A	М	11.31	3.26	-2.853*	0.005
	F	12.38	3.16	2.000	0.000

 Table 6. Mean Comparison and Result of Independent

 Sample t test in Career Interest of Student by Gender

*p<0.05; **p<0.01: ***p<0.001

M= Male, F= Female, E=Enterprising, C=Conventional, S= Social, R=Realistic, I=Investigative, A = Artistic, V=Variable

Table 6 showed the mean comparison of males and females according to their career interest. It was found that the mean values of males were higher than that of females in conventional and realistic variables. The mean values of females were higher than that of males in enterprising, social, investigative and artistic variables. It can be said that male students were more interested in conventional and realistic career than females. Differently, female students were more interested in enterprising, social, investigative and artistic than males.

To investigate whether there was a significant difference between males and females in each career type, an independent sample t test was used.

According to the t test result, there were significant differences in social, realistic and artistic variables by gender. There was no significant difference by gender in enterprising, conventional and investigative variables. It can be concluded that male students were more interested in realistic career like engineering, practical and job, etc. Furthermore, females were more interested in social and artistic career like teacher, nurse and actress, models, etc. Visual presentation of these findings was shown in Figure 4.



Figure 4. Mean Comparison for Career Interest for Grade 10 Students by Gender

4.4 Mean Comparison for Career of Students by School

In this study, the descriptive statistics for career interest of students was analyzed by school (See also in Table 7).

Table 7. Mean Comparison of Student	s' Career
Interest by School	

Interest by School				
Variables	School	Ν	Mean	SD
Enterprising	B.E.H.S (2)	100	12.24	2.35
1 0	South Dagon			
	B.E.H.S (3)	100	11.98	2.96
	Tamwe			
	B.E.H.S	100	11.83	2.73
	Sartalinn			
Conventional	B.E.H.S (2)	100	13.15	2.68
	South Dagon			
	B.E.H.S (3)	100	12.76	2.71
	Tamwe			
	B.E.H.S	100	12.37	2.78
	Sartalinn			
Social	B.E.H.S (2)	100	15.92	2.35
	South Dagon			
	B.E.H.S	100	15.78	2.82
	(3)Tamwe			
	B.E.H.S	100	16.41	2.40
	Sartalinn			
Realistic	B.E.H.S (2)	100	12.31	2.66
	South Dagon			
	B.E.H.S	100	12.44	2.36
	(3)Tamwe			
	B.E.H.S	100	13.24	2.64
	Sartalinn			
Investigative	B.E.H.S (2)	100	12.63	3.16
	South Dagon			
	B.E.H.S	100	12.27	2.97
	(3)Tamwe			
	B.E.H.S	100	12.82	3.29
	Sartalinn			
Artistic	B.E.H.S (2)	100	12.18	3.06
	South Dagon			
	B.E.H.S	100	11.79	3.13
	(3)Tamwe			

B.E.H.S	100	11.70	3.56
Sartalinn			

The mean and standard deviations of each career interest for three schools were reported. The result showed that the mean values of B.E.H.S Sartalinn students was higher than that of B.E.H.S (2) South Dagon and B.E.H.S (3) Tamwe in social, realistic, investigative. However, the mean values of B.E.H.S (2) South Dagon students were higher than that of B.E.H.S (3) Tamwe and B.E.H.S Sartalinn in artistic, conventional and enterprising.

To examine if the differences by school were significant or not, one way analysis of variance (ANOVA) was used.

Table 8. One Way ANOVA Results of Students' Career Interest by School

v	School	Sum of Squar e	Mean Squar e	F	Р
Е	Betwee	8.61	4.303	0.591	0.55
	n Groups				5
	Within	2164.3	7.287		
	Groups				
С	Betwee n Groups	14.22	7.110	0.956	0.38 6
	Within Groups	2208.7	7.437		
S	Betwee n Groups	21.887	10.943	1.699	0.18 5
	Within Groups	1912.7	6.44		
R	Betwee n Groups	50.727	25.363	3.862*	0.02 2
	Within Groups	1950.3	6.567		
Ι	Betwee n Groups	15.607	7.803	0.787	0.45 6
	Within Groups	2943.8	9.912		
A	Betwee n Groups	13.02	6.510	0.612	0.54 3
	Within Groups	3158.9	10.634		

^{*}The mean difference is significant the 0.05 level.

E=Enterprising, C=Conventional, S=Social, R=Realistic, I=Investigative, A=Artistic

Based on the result of ANOVA, a statistically significant difference was found in realistic career interest by school. Therefore, it is necessary to find out which school has a different, Post Hoc analysis (Tukey method) was conducted (See also in Table 9).

Test for Career interest of Students						
Variable	School (I)	School (J)	Mean Difference (I-J)	Р		
Realistic	B.E.H.S	B.E.H.S	-0.93*	0.029		
	(2)	Sartalinn				
	South					
	Dagon					

Table 9. The Results of Tukey HSD Using Post HocTest for Career Interest of Students

*The mean difference is significant at the 0.05 level.

It was observed that there was a significant difference in realistic career between two schools. The mean value of students from B.E.H.S Sartalinn was higher than that of students from B.E.H.S (2) South Dagon at 0.05 level in realistic. Sartalinn is far from the downtown area so they are more interested in work that requires more practice.

4.4.1 The Relationships between Personality and Career Interest

Table (10) showed the relationships between the career interest and personality type of Grade 10 students.

Table 10. Cross Tabulation of Personality and Career Interest

р	Career Types									
r	Е	С	S	R	Ι	Α	2 C	3 C	4 C	Total
Ν	0	0	0	0	0	1	0	0	0	1
%	0	0	0	0	0	0.3	0	0	0	0.3
Е	0	2	3	0	0	1	1	1	1	9
%	0	0.7	1	0	0	0.3	0. 3	0. 3	0.3	3
0	4	3	31	3	2	4	5	2	0	54
%	1	1	10. 3	1	0.7	1.3	1. 7	0. 7	0	18
	3									
A	2	7	51	6	3	7	14	3	1	94
%	0	2.3	17	2	1	2.3	4.	1	0.3	31.
	7						7		%	3
С	3	5	51	2	6	7	7	5	2	88
%	1	1.7	17	0.7	2	2.3	2. 3	1. 7	0.7	29. 3
2 P	1	1	27	3	5	3	8	1	1	50
%	0	0.3	9	1	1.7	1	2.	0.	0.3	16.
	3						7	3		7
3 P	0	0	1	1	0	0	1	1	0	4
%	0	0	0.3	0.3	0	0	0. 3	0. 3	0	1.3
Т	1	18	16	15	16	23	36	13	5	30
	0	-	4	-	5.0		10	4	1.7	0
%	3	6	54. 6	5	5.3	7.7	12	4. 3	1.7	10 0%
	3		0					5		070



E=Enterprising, C=Conventional, S=Social, R=Realistic, I= Investigative, A=Artistic, 2C= more than two career types, 3C= more than three career types, 4C= more than four career types

Among the 300 students, 54.6% (164) of students were interested in social career type. Only 3.3% (10) of students were interested in enterprising career type. In other career types, students were not much different. 12% of students had more than one personality type and 4.3% of students had more than two personality types. Moreover, 1.7% of students had more than three career interest.

Among the five types of personality, 31.3% (94) of students had agreeableness personality type. 29.3% (88) of students had a conscientiousness personality type. In the other three personality types, students were not very much different. Agreeableness was highest found personality type and conscientiousness was the second highest found personality type, the least found personality type was neuroticism (0.3%). 16.7% (50) of students had more than two personality types.

The mostly found career interest in students of each personality type was social career. It was about 54.6% of students. To be specific, 1% of extraversion personality type, 10.3% of openness personality types, 17% of students who have agreeableness personality type, 17% of students with conscientiousness personality type were mostly interested in social career type. Among them, students with agreeableness personality type were more interested in social career. This is because the children who have agreeableness personality type are easily acceptable, compassionate, kind, sympathetic and happy to help. So, children having agreeableness and social personality type are tendency to take part in social work. The children having extraversion personality type are not interested in enterprising realistic, investigative and two career types.

5. CONCLUSIONS

According to the descriptive statistics, most of the students had agreeableness personal type and the least found personality type in Grade 10 students was neuroticism. Descriptive statistics revealed that male students had slightly higher mean values than female students in neuroticism, extraversion and openness subscales while female students had slightly higher than male students in agreeableness and conscientiousness subscales.

However, the result of an independent sample t test indicated that there was significant difference in neuroticism in which the mean value of male students was higher than that of female students, but in conscientiousness, the mean value of female students was higher than that of male students. It can be concluded that the mostly found personality type in males was neuroticism. Differently, mostly found personality type in females was conscientiousness. This means that female students easily accept their peers' advice and are more flexible than male students.

According to the result of descriptive statistics, it was found that the mean value of social career (16.04) was higher than other career interest areas. So, it can be said that the students were more interested in social career and they were least interested in artistic career. This finding is consistent with the previous research. In the research "The Relationship between Personality Types and Career Choice of Secondary School Students in Federal Government Colleges in Nigeria" conducted by Onoyase (2009), students were more interested in Realistic, Investigative, Enterprising and Conventional careers whereas they were least interested in Artistic career.

In this study, the result of descriptive statistics revealed that male students had higher mean values than female students in conventional and realistic while female students had higher mean values than male students in enterprising, social, investigative and artistic. According to the result of an independent sample t-test, there were significant differences in social, realistic and artistic variables by gender. There was no significant difference by gender in enterprising, conventional and investigative variables.

It can be concluded that male students were more interested in a realistic career. It is consistent with reality because a realistic career is the work with tools, mechanical or electrical drawings machines and arithmetic abilities. And then, female students were more interested in social career than male students. This may also be possible since female students are more patient and sociable than male students.

In order to see the significant difference in career interest of students by school, a one-way analysis of variance (ANOVA) was conducted. Based on the result of ANOVA, statistically significant difference was found in realistic career interest by school. Therefore, it is necessary to find out which school had a difference; Post Hoc analysis (Tukey method) was conducted. The mean value of B.E.H.S Sartalinn students was higher than that of B.E.H.S (2) South Dagon.

Among the 300 students, 54.6% (164) of students were interested in social career type. Only 3.3% (10) of students were interested in enterprising career type. Among the five types of personality, 31.3% (94) of students had agreeableness personality type. 29.3% (88) of students had a conscientiousness personality type. The mostly found career interest in students of each personality type was social career. It was about 54.6% of students. People who choose to work in an environment matched with their personality type are successful and satisfied.

6. DISCUSSION

The results of this study support the theory of Holland, six hexagon career types. In 1997, he also found that men were more interested in Realistic, Investigative or Enterprising areas whereas women were more interested in Social, Artistic and Conventional areas and were likely to have low scores on the Realistic. Pulmer (1998) stated that females get higher scores on Social, Artistic and Conventional career whilst males get higher scores on Realistic related career (cited in Bastien, 2014). In fact, the vocational interests of women are influenced by their culture and traditional gender roles. It is hoped that the better they know about the career they want and their interest; they can work happily in their workplace and have a better life in their future.

7. LIMITATION OF THE STUDY

First limitation of this study is sampling. It is necessary to collect more samples so that the results could be representative. Another limitation is that only one grade was used in this study. So, the length of the age difference is not much and the results were not affected by age factor. If more than one grade is studied, the differences in the results affected by age will be explored. Next, crosssectional study was used in this study because of time limitation. In order to get more valid data, further researches are necessary to conduct longitudinal study to the same people from Grade 10 to 11 in order to determine whether their minds, ideas and interests about career choice will change or not. Last limitation is that if the data was collected from different demographic background, and locations, the result can be more valuable because students mostly choose their careers depending on their background knowledge and local needs. There are many features that influence the career interest of students including family, environmental factors like location, ethics, religion, etc.

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REFERENCES

- [1] Burger, J. M. (1998). Personality characteristics of job applicants and success in screening interviews. Pers. Psychol., 51.
- [2] Chen, CP (1997) Career projection: Narrative in content. Journal of Vocational Behavior. 54, 279-295.
- [3] Holland, J. L., & Whitney, D.R. (1968). Changes in the Vocational Plans of College Students: Orderly or Random? (Report No. ACT-PR-25). American College Testing Program, Iowa Research and Development Div.
- [4] Goldberg, L. R. (1992). The development of markers for Big Five Factor Struct. Psychol. Asses., 4(1): 26-42.
- [5] Goldberg, L. R. (1993). The Structure of Phenotypic Personality Traits. Am. Psychol., 48(1): 26-34.
- [6] Goldberg, L. R. (1999). A broad-bandwidth, publicdomain, personality inventory measuring the lower-level facets of several five-factor models. In I. Mervielde, I. Deary, F. DeFruyt, & F. Ostendorf (Eds.), Personality psychology in Europe (Vol. 7, pp. 7-28). Tilburg, The Netherlands: Tilburg University Press.
- [7] Holland, J. L. (1973). Making Vocational Choices: A theory of Careers. Englewood Cliffs, NJ: Prentice-Hall.
- [8] Holland, J.L. (1997). A theory of vocational personalities Holland cited by 1840.

- [9] Onoyase, D., & Onoyase, A. (2009). The relationship between personality types and career choice of secondary school students in Federal Government Colleges in Nigeria. The Anthropologist, 11(2), 109-115.
- [10] Bastien, R. (2014). Vocational Interest of Secondary School Students Career Development: Factor Influencing the Vocational Interest of Secondary School Students at the Prestige High School.

Analysis of Gender and Grade Differences on Abstract Reasoning Test for High School Students

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ABSTRACT: Many research conducted for IQ gap in gender, age, and culture differences showed that differences in cognitive ability for decades. Abstract reasoning test is one of several measures for aptitude, ability, and achievement tests. The main aim of the study is to explore gender and grade differences on abstract reasoning test for high school students. A total sample of 1070 high school students was administered in four districts of Yangon Region. In this study, the descriptive survey research design was used. The test was constructed by researcher using Item Response theory (IRT) and contains the four sub-scales, i.e., figure sequence, figure equivalent, figure odd one out and figure progressive matrices. Examining the gender differences by using independent sample t-test in this study, the result showed that there was no significant difference in male and female high school students. Concerning with the grade difference by using independent sample t-test, the findings was that tenth grade students were higher than eleventh grade students in abstract reasoning skills. Therefore, this study highlighted that abstract reasoning test was not significant in gender difference, but grade invariance for high school students was found in the test.

Keywords: Abstract Reasoning Test, Gender Difference, Grade Difference

1. INTRODUCTION

General reasoning ability can be implied that a person's high-level abstract thinking capability and learning potential. Individuals who have high reasoning ability are moreable to understand complex ideas, infer implicit relations, and generate rules based on available information (Shaw, 2015). One of the distinct features of human cognition in the world is the ability to produce new ideas by thinking alone (Walker, 2015). On the other hand, Professor Dr. Khin Zaw (2001b) distinguished between reason and intelligence. Reason is man's faculty for grasping the world by thought, but intelligence is man's ability to manipulate the world with the help of thought. Additionally, reason is man's instrument for arriving at the truth, while intelligence is his instrument for manipulating the world more successfully; the former is essentially human, the latter belongs to the animal part of man.

The prediction of the future success will enable students to learn more appropriate things with their abilities effectively. Abstract reasoning test can separate low-performing, mid-performing and high-performing students by measuring analytic reasoning skills. By doing so, genius students can learn more advanced learning materials and low-performing students can be remedied by extra learning techniques. In the other hand, teachers can scaffold students with various methods to form abstraction in confronting with problems.

Abstract reasoning test can be accessible in selecting high ability students and diagnosing low ability students to remedy their deficiencies as one of the several measures in the aptitude, ability and achievement test (Bautista, 2013). Many research conducted for IQ gap in gender, age, and culture differences showed that differences in cognitive ability for decades. But recent research data on IQ test have shown that the gap in cognitive differences is not divergent. Reasoning, and especially inferential reasoning, has traditionally been placed at or near the center of what is meant by intelligence (Carroll, 1993). By using Rash model of IRT, Bautista (2013) reported that "the interaction between sex and grade level was not significant at the alpha of .05 level for assessing whether a participants' Abstract Reasoning (AR) score could be predicted from sex, grade level and their interaction" (p.29). On the other hand, the longitudinal study on gender differences in intelligence at ages 7, 11, and 16 years showed that "the same girls who obtained a higher IQ than boys at the age of 11 and 7 years, obtained a lower average than boys at the age of 16 years" (Lynn, & Kanazawa, 2011, p.323).

Abstract reasoning skills for problem solving ability is becoming more essential for students in 21st century. Moreover, any organizations screen the employees' reasoning skills before they employed them for their work. Cognitive ability is one of the most analysis finding as individual differences in many aspects of psychology. So, it needs to evaluate how people reason their own inferential process adequately. There is a few research in measuring the student's abstract reasoning skills in Myanmar. In this study, the researcher developed an abstract reasoning test by IRT and use this test to find out gender and grade differences of high school students general reasoning ability in Myanmar culture.

1.2 Objectives of the Study

The objectives of the study can be described as follows:

- 1. To assess abstract reasoning skills of high school students in Myanmar
- 2. To examine the difference in abstract reasoning skills by gender
- 3. To assess the invariance of abstract reasoning skills by grade

1.3 Definitions of Key Terms

General intelligence. A very general mental capability that, among other things, involves the ability to reason, plan, solve problems, think abstractly, comprehend complex ideas, learn quickly and learn from experience. It is not merely book learning, a narrow academic skill, or test-taking smarts (Smith, 2018).

Abstract reasoning. It refers to analytic intelligence, which is reasoning abilities and the skills for problem solving involving new facts, without relying broadly on the basic of declarative knowledge explicitly derived from both schooling and past experience (Carpenter, Just, & Shell, 1990).

2. REVIEW OF RELATED LITERATURE

The hierarchical model of intelligence for organization of cognitive abilities was designated by Carroll's (1993) massive analysis of more than 460 data, and some of which is based on the ideas of Spearman and Thrustone who originally built and analyzed. He then unified structural model of cognitive abilities. In the Figure 1, the lines connecting general intelligence (G) with the second-stratum factors are unequal in length; the line lengths correspond, approximately, to the degree of association between G and the second-stratum factors. G is most strongly associated with the factor known as fluid intelligence (abstract reasoning).



Figure 1. The Cattell-Horn-Carroll Model of Intelligence (Adapted from M. E. Martinez, 2000)

2.1 Importance of Abstract Reasoning Test

"Abstract items require students to solve problems by hypothesizing, identifying and applying patterns and relationships presented in diagrammatic form. Evaluation of evidence is an important element in problem solution" (ACER, 2011, p.5). Abstract reasoning tests are also called non-verbal tests and items are also useful in assessing candidates' reasoning ability independent of language skills.

Abstract reasoning test can assess one's ability to understand complex concepts and absorb new information regardless of past experiences. Newton (2009) indicated that measuring abstract reasoning can be "it is independent of educational and cultural background and can be used to provide an indication of intellectual potential" (p.1). He also argued that abstract reasoning can also be described as the best measure of general intellectual ability, for it can measure the ability to perceive the relationships and then work out with any co-relationship instead of requiring any language, mathematics, or knowledge.

Sanchez (2011) examined the relationship between of spatial and fluid intelligences and mathematical abilities for ninth and tenth grade high school students, and to assess which predictor variable, fluid or spatial intelligence, was the best predictor of mathematical abilities. In his study, The Revised Minnesota Paper Form Board Test (RMPFBT) was used to assess spatial intelligence, the Ravens Progressive Matrices (RPM) was used to assess fluid intelligence, and the Test of Mathematical Abilities. Second Edition (TOMA-2) was used to assess mathematical abilities. The result of his study is fluid intelligence is a better predictor than spatial intelligence of mathematical abilities. For descriptive statistics among the gender, male students are outperformed in three test than female. In terms of grade level, the mean score for ninth graders was lower than in RPM, and RMPFBT, than the mean score for tenth graders. But, ninth graders were higher than in TOMA-2.

In abstract reasoning test, the test items consist of diagrams, symbols, or shapes rather than words or numbers. The item formats involve identifying the underlying logic of a pattern and then determining the solution. Since abstract reasoning tests are close to assessing mathematical ability and are independent of language, they are considered to be an indicator of general ability test as well as "culturally fair tests".

3. METHOD AND PROCEDURE

In this section, a useful data for abstract reasoning skills can be collected by using survey descriptive method through questionnaires and how the data of the test was conducted for gender and grade analysis by SPSS version 23 will be expressed.

3.1 Sample of the Study

The test was administered to the sample of eight high schools from Yangon Region by using a stratified random sampling method as shown in Table 1. B.E.H.S (5) North-Okkalapa and B.E.H.S (2) South-Okkalapa for east district of Yangon Region, B.E.H.S (2) Mayangone and B.E.H.S (3) Kyimyintine for west district of Yangon, B.E.H.S (5) Mingalardon and B.E.H.S (2) Insein for north district of Yangon, and B.E.H.S (2) Thanlyin and B.E.H.S (1) Kyautan for south district of Yangon were chosen for the study.

According to the annual census of Department of Basic Education (DBE), school levels are classified as Grade A, B, and C. The researcher selected two Grade-B schools from each district by the records of DBE for sample representativeness. Since classes were heterogeneously organized, sample students were equally chosen from three classes who had Grade A, B, C and D in monthly achievement test for both ninth and tenth grade students. The gender and grade were also equally selected for these sample chosen.

In this study, a total of 1070 high school students were participated as 573 Grade 10 students and 497 Grade 11 students for 2019-2020 Academic Year. Out of 1070 high school students, 505 were male (47%) and 565 were female (53%) and their range of the ages was from 15 to 17 years. The sample was selected from four districts of Yangon Region according to the geographical data.

Table	Table 1. Number of Participants in the Study							
Districts	No. of	Grade 10		Grade 11		Grade 10 Grade 11 To		Total
01 Yangon	School	Μ	F	Μ	F			
East	2	76	74	65	61	276		
West	2	77	71	59	75	282		
North	2	54	73	63	65	255		
South	2	63	85	48	61	257		
Total	8	270	303	235	262	1070		

Table 1. Number of Participants in the Study

3.2 Instrumentation of an Abstract Reasoning Test

Some of the items was constructed by researcher and some were adapted from

- 1. Raven, et al. (1983)'s Advanced Progressive Matrices Test,
- 2. Suwanvichit (2003)'s Non-Verbal Test (Reasoning Ability),
- 3. Newton (2009)'s Abstract Reasoning Test,
- 4. Bautista (2013)'s Abstract Reasoning Scale and
- 5. Drager (2014)'s Abstract Reasoning Assessment

The first subscale for this test is figure sequence, which include 19 items. The second one is figure equivalent, the third one is figure odd one out and the last one is progressive matrices figure with 15, 18, and 13 items respectively. The items were arranged from easy to more difficult and the four distractors of multiple choice items were used for four sub-scales. To get the right answers, the students must find how the figures are related in rows or columns such as addition, subtraction, rotation.

Example items are described for figure progressive matrices sub-scale.

Question: Which figure complete the progressive series?



Explanation: Begin the comparing the figure, the addition and rotation rules are used alternatively in rows. So, the correct answer is B.

For validation of research instrument, expert review was conducted to the test items for face validity and content validity by six experts from Department of Educational Psychology in Yangon University of Education. The same questionnaires were used for all sample students. This test was administered to each district of two high schools with the permission of administrative personnel of respective schools within one week. The researcher administered the questionnaire with the help of assistant researcher to each school and gave guidelines how to answer the questionnaires.

4. DATA ANALYSIS AND FINDINGS

The abstract reasoning test is one of several measures in the aptitude, ability, and achievement tests. Many research conducted for IQ gap in gender, age, and culture differences showed that differences in cognitive ability for decades. But most recent research data on IQ test have shown that the gap in gender differences is not divergent and abstract reasoning skills can develop more in higher grade level. The researcher wanted to test whether or not the differences in IQ by gender, and grade of high school students in Myanmar culture.

In Table 2, high school students total reasoning skills are provided that the mean score for total reasoning skills as $\overline{X} = 24.95$ (SD=8.834). So, it can be assumed as high school students have average reasoning skills since theoretical mean score $\overline{X}=24.5$ and manifested as average reasoning skills in abstract reasoning. Myanmar high school students (2019-2020 Academic Year) might have normal reasoning skills.

Table 2. Descriptive Statistics for High School Student's Abstract Reasoning Ability in total reasoning skills

Abstract Reasoning	N	Mean	Std.	
skills		Score	Deviation	
Total Reasoning	1070	24.95	8.834	

In Table 3, high school student's reasoning in figure equivalent was the highest skill (\bar{X} =59.68%) and whose reasoning in figure odd one out was the lowest skill (\bar{X} =45.43%) among four sub-scales by mean percentage comparison. To be more clearly, it was displayed in Figure 2. This indicated that high school students are more efficient in comparing the same figures based on the relationships between elements, addition, subtraction, and rotation rules.

Table 3 Descriptive Statistics for High School Student's Abstract Reasoning Ability in each sub skills

Abstract Reasoning Skills	N	Mean%	Std. Deviation
Figure Sequence	1070	49.30%	22.23
Figure Equivalent	1070	59.68%	23.67
Figure Odd One Out	1070	45.43%	21.94
Figure Progressive Matrices	1070	50.92%	22.97



Figure 2. Mean Percentages Comparison for Abstract Reasoning Skills by Four Sub-Scales

4.1 Examining High School Student's Abstract Reasoning Skills by Gender

To compare male and female high school student's abstract reasoning skills for gender differences, independent sample t was calculated (see in Table 4). According to the result of independent sample t test, it was found that slightly differences in mean score of those reasoning skills. Male students were greater in "figure odd one out" than female students (p < 0.005 level). It can be concluded that the male has higher visuo-spatial ability in finding distinct figures. This finding is consistent with Colom & et al. (2004) findings in which the visuo-spatial format of the test could be advantage on male performance. Lemos et al. (2012) also suggested that male have small advantage on female in abstract reasoning, but there is no significant difference in gender biased. In this study, there are no statistically differences in abstract reasoning skills in total mean of male and female (p < 0.005 level). This finding is consistent with the Abstract Reasoning Test (ART) report. ART revealed that the abstract reasoning test is not biased on gender differences. To explore clearly, the mean comparison of the gender differences was graphed by bar chart (see in Figure 3).

Table 4. Independent Sample t-test Results of Abstract

Abstract Reasoning Skills	Gen- der	N	Mean	SD	T	р
Figure	М	505	6.0277	2.6494	1.2979	0.1946
Sequence	F	565	5.8160	2.6820		
Figure	М	505	6.5901	2.6488	0.3035	0.7616
Equivalent	F	565	6.5416	2.5655		
Figure Odd	Μ	505	6.6733	3.1882	3.1448*	0.0017
One Out	F	565	6.0814	2.9392		
Figure	М	505	6.1089	2.7914	-0.0153	0.9878
Progressive	F	565	6.1115	2.7276		
Matrices						
Total	М	505	25.40	9.1354	0.1179	0.1179
	F	565	24.55	8.5544		

Reasoning Skills by Gender

Note. M is Male, F is Female, and *the mean difference is significant at the 0.005 level.



Figure 3 Mean Comparisons of High School Students' Abstract Reasoning Skills by Gender

4.2 Examining High School Student's Abstract Reasoning Skills by Grade

To find out the abstract reasoning skills by grade for high school students, independent sample t test was used (see in Table 5). According to the result, it was found that significant differences in total mean score of those reasoning skills by grade. Thus, Grade 10 Students are quite higher in figure sequence, figure one odd one out and total reasoning skills (at p < 0.005 level). In this way, Grade 10 students have higher reasoning skills than Grade 11 students. Drager (2014) indicated that abstract reasoning ability is the most important among the variables studied in predicting success in high school algebra of mathematics. So, Grade 10 students may have higher mathematics abilities than Grade 11 students. This finding was consistent with Sanchez (2011) who found that ninth grade students were higher than tenth grade student in the Test of Mathematical Abilities, Second Edition (TOMA-2) as described in reviewed of related literature. But, contrast with Bautista (2013) who reported that grade level (9th, 10th, 11th, and 12th) in abstract reasoning skills was not significant at the alpha of .05 level. In Figure 4, mean comparison for abstract reasoning skills are illustrated.

Table 5 Independent Sample t-test Results of Abstract Reasoning Skills by Grade

Abstract Reasonin g Skills	G-r- a-de	N	Mean	SD	Т	р
Figure	10	573	6.1341	2.6509	2 0070*	0.0020
e	11	497	5.6633	2.6670	2.8878*	0.0039
Figure	10	573	6.7317	2.5625	2 2500	0.0240
Equivale nt	11	497	6.3710	2.6407	2.2590	
Figure	10	573	6.4861	2.9556	1 4270	0.1536
Odd One Out	11	497	6.2157	3.1985	1.4279	
Figure	10	573	6.3449	2.7741		
Ve Matrices	11	497	5.8387	2.7136	3.0117*	0.0027
Tatal	10	573	25.697	8.4866	2.0610*	0.0021
Total	11	497	24.089	9.1638	2.9019*	0.0031

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Note. *The mean difference is significant at the 0.005 level.



Figure 4. Mean Comparisons of High School Students' Abstract Reasoning Skills by Grade

5. CONCLUSIONS AND DISCUSSIONS

In the preface of International Trends in Educational Assessment, how well an educational progress is measured, evaluated, and assessed is mainly dependent on a nation's educational development. An effective education system needs robust quality control and monitoring mechanisms in place to efficiently evaluate the performance of the learning organizations. In educational settings, researchers have the responsibilities to analyze measurement and assessment data and to utilize them for educational improvement.

After developing abstract reasoning test by using item response theory (IRT), it would provide enough information for high school students with normal reasoning ability. Since schools were chosen same criteria from each district of Yangon to represent the population, abstract reasoning skills of high school students might be assumed that they have average reasoning skills since theoretical mean was 24.5.

For more detail about abstract reasoning skills of high school students, reasoning in figure equivalent was the highest skill (\overline{X} =59.68%) and whose reasoning in figure odd one out is the lowest skill (\overline{X} =45.43%) among four sub-skills. So, it can be said that high school students would be moreable to answer the figure equivalent than any other sub-scales in test. Figure odd one out was the lowest skills among four sub-scales. This indicated that high school students are more efficient in comparing the same figures based on the relationships between elements, addition, subtraction, and rotation rules. However, they need to fulfill the reasoning skills in figure odd one out to identify the patterns and relationships of the elements in figure. Thus, they need to have reasoning skills to novel situations with unfamiliar problems by using analytic reasoning skills. So, researcher believe that teacher can use abstract reasoning test to separate students' reasoning skills and their learning requirements before the lessons are to be taught.

To compare male and female high school student's abstract reasoning skills, independent sample t

was calculated. According to the result of independent sample *t* test, it was found that slightly differences in mean score of those reasoning skills. Male students were greater in figure odd one out than female students (p < 0.005 level). It can be concluded that the male has higher visuo-spatial ability in finding distinct figures. This finding is consistent with the present study, statistical analysis for gender differences on Abstract Reasoning Test (ART) indicated no significant difference in ART scores, it is suggesting that this test is not gender biased (ART Technical Manual, 2011). Moreover, by using Rash model of IRT, Bautista (2013) reported that "the interaction between sex and grade level was not significant at the alpha of .05 level. In comparison of gender difference in abstract reasoning skills for this study, independent sample t-test was calculated. Although male student was a little bit greater in each skill, there are no statistically differences in abstract reasoning skills. Based on this result, it can be assumed that there is no significant difference in gender for abstract reasoning test. This is an important point that the degree of abstract reasoning skills by gender may not be due to nature or genetic structure. It can be more concerned with social environment and their gaining knowledge by their formal education. Students' IQ can be affected by individual differences, but by not gender influences. Thus, researcher hope that learning situations can be created and fulfilled the requirements for student learning with gender equality.

To check out grade differences in abstract reasoning skills for this research, independent sample t-test was also conducted. It was found that significant differences in total mean score of those reasoning skills by grade. More specifically, Grade 10 students are quite higher in figure sequence and figure progressive matrices (at p < 0.005 level). According this result, it can be concluded that Grade 10 students have higher reasoning skills than Grade 11 students. Concerning with grade differences in this study, the longitudinal study on gender differences in intelligence at ages 7, 11, and 16 years (grade invariance) showed that "the same girls who obtained a higher IQ than boys at the age of 11 and 7 years, obtained a lower average than boys at the age of 16 years" (Lynn, & Kanazawa, 2011, p.323). This can be say that abstract reasoning skills by grade may not be concerned with age. This may be due to the reasoning skills associated with mathematics. Sanchez (2011) found that ninth grade students was higher than tenth grade student in the Test of Mathematical Abilities, Second Edition (TOMA-2). Drager (2014) indicated that abstract reasoning ability was the most important among the variables studied in predicting success in high school algebra of mathematics. So, Grade 10 students might have higher mathematics abilities than Grade11 students for 2019-2020 Academic Year. This indicated that abstract reasoning test might be a predictor of mathematical abilities.

5.1 Limitations of the study

Several limitations concerning with the sample and data in this research of the study. Firstly, the

participants of the sample were selected only from Yangon Region. To be more representative for this study, participants should be selected from different regions of Myanmar. Secondly, the test was measured by only paper format. Thirdly, the data findings were only examined with gender and grade differences. Some of the research done in abstract reasoning test was investigated in ethnicity and race. The fourth is that the researcher was conducted a cross-sectional study in this study rather than longitudinal study to carry out in time. Finally, the researcher conducted this test only for high school students than any other education levels.

5.2 Suggestions for Future Study

For analyzing psychological construct of students, such as personality, intelligence, ability, and so on, researchers cannot measure directly like physical measurements. Since construct are indirectly measured, researchers have to confirm how appropriately, and precisely we measure psychological constructs when it comes to research. By great utilizing psychometrics as a tool to reflect the unobserved construct, researchers can assess observable variable appropriately (Ishii, 2014). Since abstract reasoning is minimal reliance on prior knowledge and experience by schooling, gender and grade differences were conducted for abstract reasoning test in this study. Thus, differential item analysis for age, culture, race differences should be conducted for future studies.

In data findings of this study, there is no significant difference in gender of high school students. Lynn, Allik, and Irwing (2004) challenged gender differences on Raven's Standard Progressive Matrices (RSPM) test to a sample of 2735 12- to 18-year-olds in Estonia. The results showed that all four factors girls performed better than boys at the age of 12, there was no sex difference at age 14, while boys performed better than girls at the age of 17. Therefore, it should be developed the test of abstract reasoning skills for middle school students and university students in later research.

In Myanmar, education system has been reforming to new system in which critical thinking, creative thinking, analyzing skills, problem solving skills has been emphasized to upgrade in line with 21st century skills. Moreover, university will use many psychometric tests to screen and to know students' aptitude to ensure good transition in new higher education system. Abstract Reasoning tests have been recognized as one of the best aptitude tests by many researchers. So, future research should conduct longitudinal study in order to use this test in university and predict the future success throughout their university education.

In this research, Grade 10 students outperformed the test than Grade 11 students. By using Rash model of IRT, Bautista (2013) reported that "the interaction between sex and grade level was not significant at the alpha of .05 level." Grade 10 students outperformed in this study since they might have high mathematics achievement. So, in future study, the relationship between mathematics achievement and the abstract reasoning test should be conducted.

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References

- Australian Council for Educational Research (ACER). (2011). Abstract reasoning test. Retrieved July 1, 2019 from www.acer.edu.au.
- [2] Bautista, R. (2013). Rash modeling of abstract reasoning in project TALENT (Doctoral dissertation). Retrieved from ProQuest Dissertation and Theses database. (UMI No. 1546699)
- [3] Carpenter, P.A., Just, M.A., & Shell, P. (1990). What one intelligence test measures: A theoretical account of the processing in the Raven Progressive Matrices Test. *Psychological Review*, *97*(3), 404-443.
- [4] Carroll, J.B. (1993). Human cognitive abilities: A survey of factor-analytical studies. New York: Cambridge University Press. Colom, R., Escorial, S., & Rebollo, I. (2004). Sex differences on the Progressive Matrices are influenced by sex differences on spatial ability. *Personality and Individual Differences*, 37, 1289–1293. doi:10.1016/j.paid.2003.12.014.
- [5] Drager, K.W. (2014). The relationship between abstract reasoning and performance in high school algebra (Doctoral dissertation). Retrieved from ProQuest Dissertation and Theses database. (UMI No. 1563368)
- [6] Ishii, H. (2019). Essentials of statistical analysis and psychometrics. Tokyo: Japan UNI Agency, Inc.
- [7] Khin Zaw. (2001b). Cybernetic analysis of learning theories. Yangon Institute of Education, PhD Program, Yangon: YIOE.
- [8] Lemos, G. C., Abad, F. J., Alemida, L. S., & Colom, R. (2012). Sex differences on g and non-g intellectual performance reveal potential sources of STEM discrepancies. *Intelligence*, 41, 11-18.
- [9] Lynn, R., & Kanazawa, S. (2011). A longitudinal study of sex differences in intelligence at the ages 7, 11, and 16 years. *Personality and Individual Differences*, 51, 321-324.
- [10] Lynn, R., Allik, J., & Irwing. P. (2004). Sex differences on three factors identified in Raven's Standard Progressive Matrices. *Intelligence*, 32, 411–424. doi:10.1016/j.intell.2004.06.
- [11] Martinez, M. E. (2000). Education as the cultivation of intelligence. Mahwah, NJ: Lawrence Erlbaum Associates, Inc.

- [12] Newton, P. (2009). Psychometric success- abstract reasoning. Retrieved July 29, 2019 from www.psychometric-success.com.
- [13] Psytech International. (2006). Abstract reasoning test technical manual. Retrieved July, 20, 2019 from https://www.psytech.com/Resources/TechnicalManuals.
- [14] Sanchez, D. (2011). Using spatial and fluid intelligences to predict mathematical abilities in high school students (Doctoral dissertation). Retrieved from ProQuest Dissertation and Theses database. (UMI No. 3487012)
- [15] Shaw, A. (2015). Reasoning fast and slow: Investigating cognitive abilities, speed and effects of personality traits (Master's Thesis). Retrieved from ProQuest Dissertation and Theses database. (UMI No. 10674103)
- [16] Smith, M. A. (2018). Psychometric IQ argumentation (Tech.Rep. No. 1). Cambridge, United Kingdom: University of Cambridge, Department of Psychology, Health, Resilience & Performance (HRP) Lab.Walker, C. M. (2015). Learning by thinking and the development of abstract reasoning (Doctoral dissertation). Retrieved from ProQuest Dissertation and Theses database. (UMI No. 3733382)

Development of Numeracy Test for Adolescents

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ABSTRACT: Quantitative approach was applied to develop the numeracy test for adolescents and to find the differences in numeracy skill of middle school adolescents from Yangon Region using questionnaire survey method. In this study, the numeracy test was developed based on Trends in International Mathematics and Science Study (TIMSS) (2003) mathematics domain. Mathematics domains are comprised with five domains, number, measurement, geometry, data and algebra. In pilot test, the numeracy test had 100 items in total that was comprise with 25 items in each domain. The field test had total of 95 items. Finally, Numeracy Test for adolescents was developed by applying the two-parameter logistic IRT model. Alpha reliability for the field test for adolescents revealed at 0.951. As the field test, the ability range was -2.3 to +1.4 and the mean ability was -0.5. According to the difficulty (b) parameter and discrimination (a) parameter, items were deleted and the final optimal test had 63 items. The ability range of the final optimal test was -2.0 to +1.6. The mean ability of the final test was -0.3. So, the numeracy test in this research was relevant for the adolescents who had the ability -0.3.

Keywords: Numeracy; Adolescents; Mathematics; IRT;

1. INTRODUCTION

Neill (2001) defined that numeracy is the ability of a person to make effective use of appropriate mathematical competencies for successful participation in everyday life, including personal life, at school, at work and in the wider community. It involves understanding real-life contexts, applying appropriate mathematical competencies, communicating the results of these to others, and critically evaluating mathematically based statements and results. Coben (2002) suggested that an individual is numerate if they are able to judge confidently the type of mathematics to employ in a given situation, how accurate that mathematics should be and, especially, whether results obtained by using that mathematics are meaningful in that particular context.

Anthony Shomos and Matthew Forbes (2014) provided that people with higher levels of literacy and numeracy can understand information from dense texts and complex or abstract mathematical information. Advancing literacy and numeracy is to be expected to guide rises in constituents of human abilities and money, such as knowledge and higher order analytical thinking. Developing these other features of human capital is also central for occupation. Literacy and numeracy are not only the crucial foundation of education improvement and qualifications, but for entrance into and development in the labor market as well. It is predominantly remarkable that inadequate basic skills lower their status, alongside qualifications, in the expectation of idleness. It is also important that of the two fundamental proficiencies, weak numeracy skill appears to hold the greater disadvantage in the labor market consequence.

Geiger et al (2015) explained that the 21st century numeracy model was initially designed as a framework to mathematics curriculum designs and was later used in a range of research projects for related purposes. In particular, it has been assumed to direct the scheme of numeracy jobs for completion in texts beyond mathematics. Context (real world setting) is central to the model. Mathematical skill, equipment and characters surround the context - they are considerations in the numeracy design which is planned to develop respective nationality and/or real- life numeracy skills. These aspects capacity is rooted within a primary constructanalytical direction - a logical and critical command.

Christine DeMars (2010) explained that item response theory models show the relationship between the ability or trait (symbolized θ) measured by the instrument and an item response. The item response may be dichotomous (two categories), such as right or wrong, yes or no, agree or disagree. Or it may be polytomous (more than two categories), such as rating from a judge or scorer or a Likert-type response scale on a survey. The construct measured by the items may be an academic proficiency or aptitude, or it may be an attitude or belief.

Thorpe and Favia (2012) described item response theory (IRT) as a collection measurement model that try to explain the connection between the observed item responses on a scale and an underlying construct (as cited in Eleje & Esomonu, 2018). Hays et al. (2009) explained that IRT models are mathematical equations that specifically described the association between subjects' levels on a latent variable and the probability of a particular response to an item, using a non-linear monotonic function (as cited in Eleje & Esomonu, 2018).

From the importance of mathematics, this study provides directly a practical guide that detects the level of numerical ability, which is in turn helps to understand in-dept math. In addition to this, it introduces a test to determine the level in mathematics among the students. Although other countries notice that numeracy is very important for all people, Myanmar has a little knowledge about numeracy as a developing country. Adolescents need to attain skills in numeracy to reason well in adults. And then, adolescents have many dreams and aims for their lives and they have so many choices in careers in the respect of their interest. To choose any professions, they need to master the needed capability, especially numeracy skill to work. So, numeracy test is developed for adolescents among Myanmar people.

Developing tests take part an important function in the improvement of the learning activity, and when the test was planned and established in a standardized style, it will supply a great value of validity and reliability on the items in the test. In earlier years, item response theory models applied in developing items. Eleje and Esomonu (2018) described that IRT is now a famous and wellknown method that is commonly applied through a variety of assessment settings. This method provides a way to show the possibility of providing an acceptable response on an item based on the indispensable capacity of the examinee. So, IRT is utilized for an item analysis in this research.

For the purposes of this study a numeracy test for adolescents in Myanmar was constructed and the numerical skills of adolescents are examined.

1.1. Purpose of the Study

This study was conducted with the following purposes.

1. To construct a numeracy test for adolescents in Myanmar

2. To examine the numerical skills of adolescents

1.2. Definitions of Key Terms

Numeracy. Numeracy is defined as the capacity to make effective use of mathematics in contexts related to personal life, the workplace, and in exercising civil responsibilities (Geiger, Goos, & Dole, 2014).

Adolescence. Adolescence is a dynamically evolving theoretical construct informed through physiologic, psychosocial, temporal and cultural lenses (Steinberg, 2014). The World Health Organization (WHO) defines "adolescents" as individuals between 10 and 19 years, "youth" between 15 and 24years, and "young people" between 10 and 24 years (WHO, 2015).

2. REVIEW OF RELATED LITERATURE

Department of Education and Skills (2011) expressed that there is significance to increase numeracy abilities among children and adolescents in the education and community. People in schools must make an effort to enhance the numeracy capabilities that they will demand participation fully in the education organisation, to belong sufficient and pleasing days, to join as effective and educated people in nation. They recognized that it is essential that all children develop literacy and numeracy ability to their best and acknowledged that indications of falling standards commanded immediate and critical action by the country. Agents of trade, production and company directed to the growing needs for a great amount of numeracy skills in every occupation. They expressed the importance of raising standards to the levels achieved in the highest performing countries in order to carry on to increase native market and to invite high- merit businesses through inward stock.

Numeracy is not just the capabilities that apply addition, subtraction, multiplication and division. Numeracy comprises the capabilities to apply awareness in mathematics and proficiencies to settle difficulties and encounter every stress in complicated community and the world. To lead this capability, adolescents require being capable to judge and connect numerically, to have knowledge of statistics, to belong to a spatial knowledge, to realize shapes and structures, and to understand circumstances that needs mathematical thinking to clarify difficulties. They expressed that every adolescents and students require adequate numeracy skills. When they are not numerate, adolescents and adults cannot perform maximum involvement in many positions of living. For instance, they cannot record cost spent in shop or realize a receipt (Department of Education and Skills, 2011).

2.1. Relationship of Numeracy and School Mathematics

Marian Kemp and John Hogan (2000) stated that numeracy across the entire school curriculum should underpin planning for an emphasis on numeracy in the curriculum. Willis (1996) argued that a cross curricular approach to numeracy was needed in schools if numeracy was to be enhanced in students (as cited in Kemp & Hogan, 2000). It is simple to ascribe no transfer of mathematical abilities to other situations to an incomplete mathematics course and insufficient training, but the quite numerous argument about transmission of these abilities displays that even if mathematics were educated and studied sufficiently, people would not certainly utilize it to new conditions (as cited in Kemp & Hogan, 2000).

Boaler (1993) described that an emphasis on the crucial factors of mathematics is grounded on an approach for progressing numeracy in student which supposes that mathematics can be educated in school, inserted within any specific learning settings, and then brought mathematics beyond school to be utilized to any conditions in the authentic world (as cited in Kemp & Hogan, 2000). There is developing information on the transmission of knowledge and the data proposes that students do not spontaneously apply their mathematical understanding in other situations. Lave (1988) called that even experience in simulated shopping tasks in the classroom did not transfer to the supermarket (as cited in Kemp & Hogan, 2000). Alternatively, it seems that people utilize extremely efficient unofficially mathematical ability in particular circumstances.

A common response to this in primary and middle schools has been the adoption of integrated or interdisciplinary curriculum approaches which include the creation of authentic tasks through which a range of learning outcomes, including numeracy, are addressed as the need arises (as cited in Kemp & Hogan, 2000). Cummings (1994) expressed that in certain schools, the combination of main learning sections proposed by a wide variety of learning patterns seems to be performing well, while in another schools the addition does not look to be advanced and the results are based on subject (as cited in Kemp & Hogan, 2000).

3. Method

Quantitative perspective was used in this study. To be specific, the type of research for this study was survey research. Adolescents' numeracy was measured by questionnaire survey method. This study starts with a quantitative approach as a primary method, and then the following study was conducted to certain in interpreting the quantitative data. Numeracy for adolescents in this study was developed by five broad content domains; number, measurement, geometry, data and algebra.

3.1. Sample of the Study

The stratified sampling technique was used in this study. The schools were selected from Yangon Division as the sample of schools. One high school and one middle schools from east district were selected; one high school and one middle schools from west district; two high schools from south district; two high schools from north district. A total of 1133 middle school students from eight schools participated in this study. Out of 1133 Grade six, Grade seven, Grade eight and Grade nine students, 567 (50.04%) are boys and 566 (49.96%) were girls and their ages ranged from 10 to 15 years.

3.2. Instrumentation of Numeracy Test for Adolescents

The instrument in this study was developed according to the frameworks of Trends in International Mathematics and Science Study (TIMSS) (2003). The TIMSS (2003) framework consists of five broad content domains; number, algebra, geometry, data and measurement. Test was developed by the help of supervisor and teachers from educational test and measurement field and the junior assistant teachers from basic education schools and by using the Teacher Guide Books and middle schools Mathematics Text Books to be suitable for adolescents in Myanmar. A total of 100 items for five content domains were developed for numeracy test with 20 items for each domain.

3.3. Pilot Testing

A total of 118 middle students of B.E.H.S(3), North Okkalapa participated in pilot testing. The test was taken about one and half hours that most of students needed to complete the test. The pilot test data was administered. The internal consistency (Cronbach α) for numeracy test was 0.944. The internal consistency (Cronbach α) for number domain was 0.831. The internal consistency (Cronbach α) for measurement domain was 0.775. The internal consistency (Cronbach α) for geometry domain was 0.728. The internal consistency (Cronbach α) for data domain was 0.785. The internal consistency (Cronbach α) for algebra domain was 0.816.

Based on the result of the pilot test result, the test was revised. According to the internal consistency (Cronbach α) of the pilot data, the items that made reduced the internal consistency were removed. After pilot test was done, the field test was made. The field test had a total of 95 items. The students from selected in Yangon Division were participated to measure by the numeracy test.

4. DATA ANALYSIS AND FINDINGS

Firstly, data analysis for checking assumptions of unidimensionality, checking the conformity of model and test data, estimating item and ability parameters, tracing the test information function and developing the numeracy test for adolescents were described. The research questions addressed in this study were answered by using BILOG-MG 3, RStudio, SPSS programme.

4.1. Developing the Numeracy Test

4.1.1. Checking the Assumption of Unidimensionality and the Conformity of Model and Data

Assumption of unidimensionality of IRT model should be held to use IRT model. That is a set of items in a test that can measure a single ability. In order to investigate this assumption, a principal factor analysis was conducted by using SPSS software package. The values of eigenvalue 1, 2, 3, 4, 5, 6, 7 were 17.848, 2.842, 2.195, 1.751, 1.562, 1.530, 1.427 and so on, and thus eigenvalue was larger compared to the second and the second is not much larger than any of the others. Therefore, the test data satisfied the assumption of unidimensionality. Accordingly, it can be said that the test data satisfied the assumption of local independence.



Figure 1. Scree Plot of Eigenvalues for Numeracy Test Items

According to the Figure 2, test information functions used by 1-Parameter, 2-Parameter and 3-Parameter by using RStudio software can be showed. The evidence was obvious that the 2-Parameter distribution was similar with the normal distribution than the other distributions. Moreover, the mean ability of 2-Parameter test information function is nearly 0 or normal and it is said that the test developed by using 2-Parameter logistic model examined the adolescents with normal numeracy. Then, it designated that the observed data for the 2PL model was nearly identical with the expected data. Therefore, it was concluded that model-data fit was adequate enough to apply 2-Parameter IRT model for this test.



Figure 2. Comparison of Test Information Functions used by 1-Parameter, 2-Parameter and 3-Parameter

4.1.2. Item and Ability Parameters Estimation

The numeracy test was conducted by 2PL model in this study, so c or guessing parameter was neglected for the test items. Item discrimination (a) and item difficulty (b) for test items were estimated and the obtained parameter estimates of each item respectively. Actually, the acceptable range of an item is from 0 to 2 for discrimination (a) and from -2 to +2 for difficulty (b) (Hambleton, Swaminathan & Rogers, 1991). As item difficulty, easier items have lower (negative) difficulty values and harder items have higher (positive) difficulty values. According to this test analysis, b values varies from -2.195 to 5.234 and the mean is -0.155 (SD = 1.157). For item discrimination (a), higher values indicated that the item discriminates well between examinees with high and low ability. In this test, the discrimination values ranges from 0.122 to 1.380 and the mean is 0.697 (SD = 0.230).

4.1.3. Test Information Function

The test had smaller error across the ability scale from -2.3 to +1.4 and larger standard error had at the low and high ends of the scale. The maximum amount of information was I (θ) = 30.2 at θ = -0.5. That is that the test was suitable for the students who possess ability parameter θ equal to -0.5. Smaller standard error is associated with highly discriminating items for which the correct answer cannot be obtained by guessing (Hambleton, Swaminathan & Rogers, 1991). The estimation of the students' ability was more precise across from -2.3 to +1.4 than at the low and high ends of the scale. However, it cannot discriminate well for the adolescents who have higher ability levels (above θ = +1.4) and lower ability levels (less than $\theta = -2.3$). Therefore, it was judged that this test only can provide information well for adolescents with lower numeracy ability, but it may not provide enough information to assess adolescents with high and average numeracy skills. The reliability of 95-items numeracy test was 0.951.



Figure 3. Test Information Curve for the Numeracy Test with 95 Items

The following Table 1 showed table of number of items in each domain for 95-items numeracy test.

 Table 1. Table of Number of Items in Each Domain for 95-items Numeracy Test

No.	Name of Domain	Total No of Items
1.	Number	20
2.	Measurement	18
3.	Geometry	18
4.	Data	19
5.	Algebra	20
	Total	95

4.1.4. Developing an Optimal Numeracy Test

According to the above analyses, the test with 95 items was slightly easy. Therefore, it was recognized as an item pool and then an optimal numerical test was developed by selecting some experimental items from that item pool again. To produce a systematic test, a procedure to produce test items to fit any desired set of test specifications outlined by Lord (1977) was followed.

According to Lord (1977), the first step is to decide the desired target information function. So, as the target information, the standard errors of (approximately) lower than 1 would be acceptable in the ability range (-2.00, 2.00). Moreover, maximum amount of information would be stated at nearly $\theta = 0$.

Afterward, items from the pool with item information functions that will fill up hard-to-fill areas under the target information function were selected. After each item is added to the test, the test information function for the selected test items were calculated and graphed. Selecting and calculating the test items were continued again and again until the test information function approximates the target information function to a satisfactory degree. Therefore, among 95 items, 32 items were removed from all domains. The optimal test contained the items according to the following Table 1.

No.	Name of Domain	Total No of Items
1.	Number	11
2.	Measurement	13
3.	Geometry	12
4.	Data	12
5.	Algebra	15
	63	

Table 2. Table of Number of Items in Each Domainfor 63-items Numeracy Test

The test is discriminating well among examinees with the range of ability level from -2.0 to +1.6 in the test. The maximum amount of information was I (θ) = 23 at θ = -0.3. Moreover, its empirical reliability is 0.94. Therefore, it can be judged that this optimal test can provide information well for adolescents with normal numeracy.



Figure 4 Test Information Curve for the Optimal Numeracy Test with 63 Items

4.2. Descriptive Statistics for Adolescents' Numeracy Ability

Descriptive statistic was performed to examine the abilities of the adolescents. Table 3 showed mean and standard deviation of the whole numeracy optimal test with 63 items. In the numeracy test, the mean of the test was 33.44 and standard deviation was 14.23. Therefore, adolescents received above the mean score in the numeracy test.

Table 3. Descriptive Statistics for Adolescents' Numeracy Ability

	Ν	Mean	SD
Numeracy	1133	33.44	14.227

Table 4 confirmed that the mean percent of data domain of adolescents was the highest in the five domains of numeracy and that of geometry domain was the second highest. The mean percent of measurement domain of adolescents was the third highest and that of number domain was the fourth highest, and then that of algebra domain was the lowest on the whole numeracy test. So, it can be said that adolescents act the best in data domain than other components of numeracy. Moreover, the lowest performance of adolescents was in algebra domain.

So, students achieved the best result in data domain and the second higher result in geometry domain. And them adolescents' performance on measurement domain was the third highest among all domains. Adolescents' performance on number domain was the fourth highest and on algebra domain was the last.

Table 4. Descriptive Statistics for	Adolescents ²
Numeracy Ability	

	Ν	Mean Percentage	SD
Number	1133	53.01	27.5 5
Measureme nt	1133	53.11	26.7 4
Geometry	1133	55.35	26.6 9
Data	1133	57.48	24.94
Algebra	1133	47.77	26.16

5. CONCLUSION

The main objective of this study is to develop the adolescents' numeracy test. So, numeracy test was developed for Grade six, Grade seven, Grade eight and Grade nine students. The test was developed by using domains of Trends in International Mathematics, Science and Study (TIMSS) (2003). The summary of findings and discussions will be presented below.

Numeracy test for adolescents was developed with five domains including number measurement, geometry, data and algebra. To test whether the wording of test items had clarity or not and items were appropriate and relevant to adolescents, the pilot test was conducted. According to the pilot results, the final test had 95 items in total. The final test was administered to total 1133 students five domains including number, measurement, geometry, data and algebra.

Numeracy test was modified according to the pilot results and some items were removed. The final test had total 95 items. Classified sampling technique was used in this study. The final test was administered to total 1133 students.

Before conducting item response theory, the test was checked to hold the unidimensionality assumption of IRT by factor analysis. Unidimensionality means that a set of items in the test measures a single ability. And then, ability and parameter estimation were conducted by marginal maximum likelihood estimation method.

In the results of IRT item analysis, the range of discrimination (*a*) values of items was from 0.122 to 1.380. The mean of *a* values was 0.697. So, it can be said that the items could fairly discriminate higher ability students from lower ability students. The range of difficulty b parameter of items was from -2.195 to 5.234. The mean of *b* values was -0.155. Therefore, it can be confirmed that items were neither too easy nor too difficult. However, some items were too difficult or too easy and the test was suitable for the students who possess ability parameter θ equal to -0.5. The test was considered that it was slightly easy according to the test information curve. So, a new test information test was constructed according to Lord (1977).

Numeracy 95- items test was developed a new test by removing 32 items. Therefore, the final test had 63 items. The range of discrimination (*a*) values of items was from 0.342 to 1.128. The mean of *a* values was 0.704. So, it can be said that the items could better discriminate higher ability students from lower ability students. The range of difficulty *b* parameter of items was from -1.038 to 0.809. The mean of *b* values was -0.15. In the new test, the mean ability was -0.3. The ability range was -2.0 to +1.6. The same raw scores could not show the same ability because the ability scores of students were different based on their response pattern.

Numeracy test includes five domains such as number, measurement, geometry, data and algebra. Since the numbers of items in each domain were not equal, the mean percentages of items in each domain were used. The mean percent of data of adolescents was the highest in the five domains of numeracy and that of geometry was the second highest. The mean percent of measurement of adolescents was the third highest and that of number was the fourth highest, and then that of algebra was the lowest on the whole numeracy test. So, it can be said that adolescents act the best in data domain than other components of numeracy. Moreover, the lowest performance of adolescents was in algebra domain.

Students received the highest score in data domain because it can be said that they performed more concrete problems than abstract ones and data domain was more concrete. The lowest result in algebra domain was performed by the adolescents and it can reasonably be realized that it is because this domain was more abstract than other domains.

5.1. Suggestions and Recommendations

Numeracy has been interesting in other countries since it is the center of all jobs and daily life struggles. Numeracy is not only mastering mathematics but also utilizing mathematics in real life situation and professional jobs. But in Myanmar, most of the students are afraid of mathematics and they use rote learning in mathematics. They don't try to realize the concepts, rules and abstract. So, mathematics can't be understood by the students. Moreover, the students utilize mathematics in real life situations. To share students more information about numeracy importance, the standardized numeracy test was developed by using two-parameter IRT logistics model. The final numeracy test was developed with 63 items.

This study has shown that researcher should be aware of the importance of numeracy in adolescents. Teachers should take care of the fact that numeracy is the utilization of mathematics in real life situation. Teachers should take care of the fact that students must be fulfilled the understanding of the concepts, rules and abstract. The students should be aware of the importance of numeracy. Adolescents should realize that they will encounter job, difficult life in adult and numeracy can be used in their future struggles. It is recommended that this study will be very advantageous to students, teachers, curriculum developers and educators who would like to find means and ways to improve numeracy in adolescents' life. A lot of studies have suggested that numeracy is the most importance to encounter real life struggles in their future.

5.2. Limitations

The TIMSS 2003 framework is based on two main organizing dimensions, content domains and cognitive domains, as well as an overarching dimension of communicating mathematically. The four cognitive domains are such as knowing facts and procedures, using concepts, solving routine problems, and reasoning. However, this study focused only content domains of TIMSS (2003) and left to examine cognitive domains. And then, the research area is restricted only to Yangon Region. Therefore, the sample of the adolescents in this study was not enough to the population of adolescents. Moreover, two parameters logistic model was applied in this research. Multiple choice item type was used in this test and so, the students with low ability can choose the right answer by guessing.

5.3. Further Research

The most important investment in any nation is in its children. Children will be adult one day. Only when they fulfilled with the numeracy ability, they will encounter their life well. So, numeracy with their cognitive domain should be examined to adolescents. This study conducted in only Yangon Region, so in another regions, adolescents should be examined in numeracy ability. If so, adolescents have the opportunities to know the importance of numeracy. School location, gender and socioeconomic status can be factors that can affect the ability of numeracy since school facility are less efficient in rural than urban. Adolescents from lower socioeconomic status may be low in numeracy than those from high socioeconomic status, so this factor can affect the numeracy of adolescents. Hence, the further studies should be conducted with school location, gender and socioeconomic status. In this study, only two parameter logistic IRT model was used. So, it is recommended to apply three parameters logistic IRT model for test construction with larger sample size to reduce errors and to minimize the guessing.

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References

- [1] A. Schleicher, "Education for all", OECD Yearbook 2013, 2013, pp 42-57.
- [2] A. Shomos, & M. Forbes, "Literacy and Numeracy Skills and Labour Market Outcomes in Australia", Productivity Commission Staff working Paper, Canberra, 2014.
- [3] C. DeMars, "Item response theory: Understanding statistics measurement", Oxford University Press, Inc, New York, 2010.
- [4] D. Coben, "Use value and exchange value in discursive domains of adult numeracy teaching", Literacy & Numeracy Studies, 11(2), 2002, pp 25-35.
- [5] Department of Education and Skills. Literacy and numeracy for learning and life: The national strategy to improve literacy and numeracy among children and young people (2011-2020), Dublin: Schull Community College, (2011).
- [6] F. M. Lord, "Practical applications of item characteristics curve theory", Journal of Educational Measurement, 14, 1977, pp 117-138.
- [7] G. L. Thorpe, & A. Favia, "Data analysis using item response theory methodology: An introduction to selected programs and applications", Psychology Faculty Scholarship, 2012, pp 1-34.
- [8] L. I. Eleje, & N. P. M. Esomonu, "Achievement in quantitative economics for secondary schools: Construction and validation using item response theory", Asian Journal of Education and Training, 6(1), 2018, pp 18-28.
- [9] L. S. Gronmo, M. Lindquist, A. Aora, & V. S. Mullis, "TIMSS Mathematics Framework", TIMSS & PIRLS International Study Center: Lynch School of Education, Boston College, 2015.
- [10] M. Kemp, & J. Hogam, Planning for an emphasis on numeracy in the curriculum, The Commonwealth Department of Education, Training, and Youth Affairs.
- [11] O. Bulut, "Applying item response theory models to entrance examination for graduate studies: Practical issues and insights", Journal of Measurement and Evaluation in Education and Psychology, 6(2), 2015, pp 313-330.
- [12] R. K. Hambleton, H. Swaminathan, & H. J. Rogan, "Fundamentals of Item Response Theory", Newbury Park, CA: Sage Publications, Inc, 1991.
- [13] S. Thomson, K. Rowe, C. Underwood, & R. Peck, "Numeracy in the early years: Project good start", 2005.
- [14] V. Geiger, H. J. Forgasz, & M. Goos, "A critical orientation to numeracy across the curriculum", ZDM:

The International Journal on Mathematics Education, 47, 2015, pp 611-624.

- [15] V. Geiger, M. Goos, & S. Dole, "Students' perspectives on their numeracy development across the learning areas", In Y. Li, & G. Lappan (Eds.), Mathematics Curriculum in School Education, New York: Springer, 2014, pp 473-492.
- [16] W. A. Neill, 'The essentials of numeracy", New Zealand Council for Education Research, 2001, pp 7-24.
- [17] World Health Organization (WHO), "Adolescent health", 2015.

Student-Centered Approach is more Effective than Teacher-Centered Approach on Mathematics

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ABSTRACT: This paper intends to improve the home-room practices of educators in Myanmar to help creating understudy focused methodologies and the student who are happy to build up their reasoning cycle. The center is understudy focused instructing for first year understudies at the University of Computer Studies (Taungoo) and all of these first year understudies take-part in this investigation. Thinking idea is one of the primary aptitudes in science learning .This paper expects to advance the considering capacity understudies. Understudies with high numerical capacity have computational reasoning yet numerous understudies actually experience issues in intuition and taking care of capacities in numerical issues. Encouraging strategies from two semesters in 2018-19 scholastic years are analyzed. Understudies' exhibitions are determined and communicated by dominate. It is limited to five components for understudies' capacity. It likewise looks at four audits in two semesters. Understudies' capacities are appeared in bar graphs with rates for two semesters in 2018-19 scholastic years. Understudy focused showing have more innovative reasoning and are keen regarding the matter. The information was gathered by utilizing study structure with 100 understudies. Understudy focused educating is better for understudy by contrasting their deduction capacities on arithmetic.

Keywords: Teaching methods; Review; Teacher-centered approach; Students-centered approach; Excel

1. INTRODUCTION

Science turned into the main thrust for practically mechanical and logical advancement in nineteenth century. It has huge impact on our expert and social day by day life exercises. Since the obligation of instructor is to help thinking and learning, they should endeavor to inspire the understudies to master .Encouraging strategies are significant for educators. Every individual who doesn't have fundamental numerical aptitudes may confront numerous challenges in public activity [5]. The educators ought to have enough information about learning and instructing techniques. The author has been teaching computing of mathematics for first year at the University of Computer Studies (Taungoo) for two semesters in one year with two teaching methods. These are student-centered and teacher-centered teaching.

1.1. Research Motivation

The author has been teaching mathematic subject in one academic year. But the performance of the students of this subject is different in two semesters. In first semester, the performance of the students does not improve year after year. In second semester, the performances of the students improve year after year. Therefore, this research analyzes the significant differences between the effectiveness of difference teaching methods on students' academic performance [6].

1.2. Research Objective

The fundamental reason for this examination is to improve the understudies' intuition on issue in arithmetic of figuring subject. It analyzes one computing subject in Faculty of Computing for one academic year. Figuring arithmetic subject is analyzed by utilizing evaluation techniques and learning strategies to give information, critical thinking, basic reasoning, innovativeness, self-assurance. These strategies plan to cause understudy to go to classes consistently and accentuate on subjects. Thinking ability is a crucial element during a learning process to understand and acquire the new knowledge.

2. LITERATURE REVIEW

Learning is one of the significant features of current psychology [1]. Instructors have utilized diverse learning hypotheses and showing techniques in instructive framework everywhere on the world .Training strategies include the utilization of learning speculations and every hypothesis has various results in arithmetic.

To be effective in showing arithmetic, the educator ought to know about various instructing strategies. Students should be given enough confidence to discover their mathematics problems and think critically to solve them as well as their daily life problem.

Teacher-centered teaching is based on the behaviorism learning theorem. Behaviorist alludes to the learning hypotheses underscoring on change conduct which results from students' relationship of boost reaction. It states that learning is an adjustment in conduct because of experience [1].In mathematics class using teacher-centered method, the teacher teaches lower level problem solving followed by seat-work imitating the teacher's demonstration and then revises previous material and homework. Giving lecture is the dominant situation. [5]

Student-centered teaching is an understanding of the necessity of using knowledge and learning how to

learn by oneself and the attainment of the abilities required for independent learning. Critical thinking is the scholarly test of the understudies' capacity .The improvement of critical thinking can occur during a numerical exhibition task .The principles of numerical practices are adjusted to the numerical reasoning cycle. This strategy underlines that understudies should frame their own understanding of evidence [4].

Student-centered teaching method is a very convenient method. Students get the freedom. It develops the application using their own concept methods. It also develops their creativities as well as thinking power .Students emphasizes more on subject and learn more. Students are not bored in learning lesson. High numerical capacities had the option to break down the test question in subtleties including what was known and obscure in the inquiries. Also, they can solve the questions. Thinking capacity is an essential component during a learning cycle to comprehend and secure the new information .Believing is a characteristic cycle in an individual brain that can assist with taking care of different issues and improve the personal satisfaction. It includes a cycle of mental portraval that is shaped through the change of data with an intricate association of mental ascribes that are appraisal, deliberation, rationale, creative mind and critical thinking [3]. This technique has become a generally utilized strategy for instructing in instructive field. Thinking idea learning underscores learning exercises that are long haul, interdisciplinary and understudy focused. It additionally offers understudies the chance to investigate issue and difficulties that have genuine application expanding the chance of long haul maintenance of aptitudes and ideas.

3. RESEARCH DESIGN AND METHODOLOGY

In the University of Computer Studies (Taungoo), 100 students were selected from first year for two semesters in one academic year for this study. A lot of polls were put on the likert scale. The reactions were gathered and investigated. The two instructing techniques are contrasted concurring with reactions and interests on these.

Table 1. Comparison of two different methods from
two semesters in 2018/19 academic year

Teacher-Centered Teaching Method in first semester	Student-Centered Teaching Method in second semester		
• Explaining theorem and definition	• Teaching with power point		
• Solving example and different type of problem	• Saying about the usefulness of mathematics in computer science		
• Writing note down the formula and learn by heart	• Explaining the theorem, definition formula		

• Ordering to solve the similar problem as homework	• Explaining the link of mathematics theorem and computer field
• Testing the tutorial one time in one month	• Searching and collecting all questions from internet and asking these questions to the students
Recording the tutorial score	• Asking students the objective questions
• Answering the final exam with the standard question.	 Doing group discussion after lecture Doing group presentation Doing assignments once in two weeks Doing quiz two times in one week, Doing tutorial once in two months Doing the final exam with the standard question with many unseen problems [2]

4. DATA ANALYSIS AND RESULTS

Findings of the percentage on assessments of mathematics subjects from two semesters in one academic year are shown in Table 2.

According to Table 2 we can see that the students' performance abilities differ in two semesters. Teaching with the thinking methods help students to increase their creative abilities.

In two semesters, students are divided into three kinds, (1) poor students (2) normal students (3) excellent students. The poor students are those who are not interested in this subject. The normal students are those who are normally interested in this subject. The excellent students are those who are much interested in this subject. And then, for the tutorial test, the student who gets between 0 to 49 scores in the 100 given marks is defined the poor student, the student who gets between 50 to 79 scores in the 100 given marks is defined the normal student and the student who gets between 80 to 100 scores in the 100 given marks is defined the excellent student. In 2018-2019 academic years, there were the poor students (25%), the normal students (55%) and the excellent students (20%).

4.1. Students' Abilities on Two Teaching Methods

There are five abilities as assessments for the 100 students.



Review -1 Review -2 Review -3 Review -4 The review of student learning

Table 2. Comparison of the100 students' abilities of two different methods in one academic year

Abili- ties	Tea Teachii	Teacher-centered Feaching Method in first semester		Student-Centered Teaching Method in secon semester		ered in second
	Poor (25%)	Normal (55%)	Excellent (20%)	Poor (25%)	Normal (55%)	Excellent (20%)
Ability- 1	10%	40%	20%	20%	50%	20%
Ability- 2	0%	25%	10%	10%	40%	19%
Ability- 3	7%	30%	20%	20%	50%	20%
Ability- 4	10%	40%	20%	13%	50%	20%
Ability- 5	0%	2%	8%	1%	20%	18%

Now, we sketch Figure 1 from the data use of Table 2.

Figure 1 shows the comparison of assessment of computing subject for first year in two semesters. In this figure, when using the student-centered teaching method, poor students are more likely to attend classes and answer more unseen question, normal students become more active in learning and better creative thinking, and then almost excellent students improve in five abilities By analyzing, when using a teacher-centered teaching method, students are less likely to think creatively for fear of unseen questions.



Ability, 2

Ability, 3

Ability, 4



20%

Figure 1. Comparison of abilities of 100 students in two teaching methods

Table 3. Comparison of Mean for the 100 Students' Abilities on Two Teaching Methods

Kinds of student	Mean for first semester	Mean for second semester
Poor	5.4%	12.8%
Normal	27.4%	42%
Excellent	15.6%	19.4%

Comparison of mean for Student abilities



Figure 2. Comparison of mean for the 100 students' abilities

4.2. Review of Student Learning

Four steps are defined to assess the student learning in two semesters during 2018/19 academic year.

Review	1	- searching	the	links	associated	to	theorem
		using intern	et				

- Review 2 self-study condition
- Review 3 unseen test results in the exam
- Review 4 success level in the exam
- The survey form of the above four reviews is as follow
- (1)You can use internet to find links related to theorem.



- (2)You can study the lessons for yourself. Yes No
- (3)You can answer unseen questions well in exam.
 - No

Yes

(4)The level of success in exam is derived from student affairs of University Of Computer Studies (Taungoo). The percentage on assessments results is as shown in Table 4 [7].

Table 4. Comparison of review on 100 students' learning in two semesters

Reviews	Student's results in first semester	Student's results in second semester
Review -1	10%	50%
Review -2	20%	70%
Review -3	30%	80%
Review -4	90%	75%

According to Table 4,

- In review 1, only 10 out of 100 students use internet when teaching with traditional, and 50 learn when using thinking.
- In review 2, when teaching with traditional, only 20 out of 100 students are able to study on their own, and when teaching with thinking 70 students are able to study on their own.
- In review 3, when teaching with traditional, only 30 out of 100 students answer the unseen questions in the exams, and when teaching with thinking, 70 answer.
- In review 4, when teaching with traditional, 90 out of 100 students can pass the exams, and when teaching with thinking, only 70 can succeed.
- Figure 3 are constructed according to the results From Table 4.

The assessment of student learning in two semesters



Figure 3. Comparison of review on 100 students' learning in two semesters

Figure 3, shows the comparison on review of student learning in two semesters.

In the first semester of traditional teaching, 10 % of students are able to search links associated to theorem using internet. Then, 20% of students study themselves in this first semester of traditional teaching. Next, it also found that 30% of students are well-answered the unseen test in the exam and 90% of students pass the exam successfully.

In the second semester of thinking teaching, 50% of students are able to search links associated to theorem using internet. Then, 70% of students study themselves in this second semester of thinking teaching. Next, it also found that 80% of students are well-answered the unseen test in the exam and 75% of students pass the exam successfully.

By looking of graph, students learn to answer unseen questions more and more without afraid of unseen questions. They learn to search using internet and learn more on their own, but I see a drop in achievement.

In our opinion, when teaching with the studentcentered teaching methods, students' ability to think is improved and practice is weakened, resulting in a drop in pass rate due to the inability to complete the test on time. And then most students do not have the experience of thinking and teaching in elementary school, and the success rate may be due to the large number of students in a section.

5. THE EFFECTIVENESS OF STUDENT-CENTERED APPROACH

According to this analysis, students can get many experiences to solve the problem. Students gained valuable experience in the practical use of the mathematical principle and formula. They also acquired some advanced mathematical thinking from their problems solving method to create concepts. Students improve self-study and creative thinking by using student-centered teaching method. In the years to come, computing of mathematic should be taught this method.

6. CONCLUSIONS

This study was conducted to explore whether student-centered teaching method is more effective than teacher-centered teaching method. The data analysis and finding clearly proved that thinking concept learning improve the review of student learning and creative abilities. The finding will assist teachers and students to encourage the use of thinking learning in the class rooms. This study showed that students with different level of mathematical abilities tend to differ significantly according to different teaching method. The understudies had the option to break down and figure out what is known and obscure to settle the inquiries accurately. The finding demonstrated that it is curial to think about the degrees of understudies' numerical capacities. The students who do not have concept thinking abilities cannot solve unknown questions. The students' methods of thinking developed from the simple to the complex level. According to the graph, it is seen that students with student-centered teaching method are better in teachercentered teaching method.

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REFERENCES

- [1] Abdolreza Lessani, "Comparison of new mathematics teaching with traditional methods", people: International journal of social science, 2017.
- [2] Clinton, B.D., & Khlmeyer, J.M, "The effect of group quizzes on performance and motivation to learn", Two experiment in cooperative learning Journal, (2005).
- [3] Dimitirior Belias, "Traditional Teaching Methods vs. Teaching through Their Application of Information and Communication Technologies In the accounting Field", Quo Vadis, European scientific Journal, February 2013.
- [4] Menderes Unal, "Preference of Teaching Methods and Techniques in Mathematics with Reasons", Universal Journal of Educational Research5 (2); 194-202(2017).
- [5] Slobotka Aleksovska & Abduli Shemsedin, "The comparison of different teaching approaches related to the achievements of students' knowledge and skills", Macedonian Journal of Chemistry and Chemical Engineering 34(32), May 2015.
- [6] Paing Thwe Soe, Nilar Soe, Theint Theint, "Impact of Teaching Method on Academic Performance: An Experimental Research Study", Journal of Information Technology and Education Science, Volume-1, No-1 December, 2019.
- [7] Yi Yi Thant, "The Impact of Integrating Reading and Writing Skills at the Technological University's Students", Journal of Information Technology and Education Science, Volume-1, No-1 December, 2019.

Evaluating the Effect of Environmental Education and Awareness on Solid Waste Management within Elementary Students

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ABSTRACT: Myanmar has now faced a new challenge to managing the solid waste problem due to the low level of public knowledge and awareness in practicing the solid waste system, and changing consumption. To overcome these problems, environmental education is a primary action for people to promote their awareness of solid waste management. Since 2014, Mandalay City Development Committee (MCDC) had implemented the Environmental Education (EE) Program at some of the elementary schools in Mandalay to raise the knowledge on segregation of waste and reduce, reuse and recycle activities (3Rs) with the collaboration of IGES, Kitakyushu City and ASEAN ESC Model Cities Program. This program has promoted the knowledge of the students regarding the 3Rs by learning a particular subject about environmental education, and some practical activities. Therefore, this study intends to assess the effect of environmental education practices on students' awareness and knowledge in 3Rs activities. In the study 200 participant students were selected from 3rd grade, 5th grade, and 6th grade in the two model schools with a random sampling method and data which were collected using close-ended questions. However, 198 questionnaires (99%) were returned. Personal interviews were also conducted with 27 teachers from respective schools for examining how to change the students' attitude and behavior in building 3R practice after the implementation of the program. A descriptive method was used to analyze the data.

Keywords: Environmental education, Municipal solid waste, 3Rs, SDGs, Mandalay

1. INTRODUCTION

The amount of municipal solid waste generation is continuously increased at a growing rate worldwide. In this context, with the increasing population and high consumption patterns among urban cities, this problem is not easy to manage local as well as globally. People in urban cities discard their waste without care in open spaces neglect on the environment. As a consequence, Mandalay City in Myanmar has led to increased waste generation in recent times. The Cleansing Department of MCDC estimated that the current total garbage in the city is to be about 1020 to 1090 tons per day and the per capita generation is determined to be 0.73 kg per capita per day [6]. There is limited segregation of waste at the source before disposal. Wastes especially kitchen wastes are usually without sorting and together disposed into the final dumpsites. In this case, the life span of landfill sites in Mandalay is not more than 5 years of additional life due to the growing waste generation rate [11]. Moreover, waste separations at the source and 3R activities are very limited in Myanmar. Adeolu A.T and et al (2014) recommend that individual or group awareness and attitudes are important to respond to the challenges of waste generation and management [1]. Premakumara, D. and et al (2017) mentioned in their work that in Myanmar, City Development Committees of some cities have been implemented awareness-raising campaigns and environmental education programs for the public to promote 3R activities (reduce, reuse and recycle). MCDC has also carried out a good solid waste management system with integrating 3R practices (reduce, reuse and recycle) to promote waste reduction at source [9].

Zoë Lenkiewick (2016)provided that Sustainable Development Goals (SDGs) cannot be successful if the waste problem is not dealing with as a priority [15]. Premakumara, D. and et al (2016) discussed that as described in Goal 12, there is a global need to change the production and consumption patterns in goods and resources for achieving economic growth and sustainable development. Within Myanmar's Agenda 21, the 3Rs initiative has been launched by the government as an effective way of managing solid waste. It advocates environmental education programs in both formal and non-formal schools for making environmental awareness which in turn leads to changes in mindset and behavior among its citizens.

Solid waste management awareness is an environmental campaign to educate people on the consequence of creating and managing waste and consequently motivate them to do desirable practices for waste disposal at home, in school, and elsewhere [4]. Thus, since 2014, Mandalay City Development Committee (MCDC) has implemented the Environmental Education (EE) Program at some of the elementary schools in Mandalay to raise the students' awareness of waste separation and recycling together with the Department of Basic Education, the Institute for Global Environmental Strategies (IGES), Kitakyushu City and ASEAN ESC Model Cities Program. As a result, MCDC successfully has implemented an environmental learning program in 36 model schools in 2017-2018 [5]. This program has promoted the knowledge of the students regarding the 3Rs by learning a particular subject about environmental education and practicing in 3Rs activities.

In the study of Thu Thao Phan Hoang, and Takaaki Kato (2016), it is mainly focused on the eco- bags, plastic bags, and food waste system. They failed to assess the students' knowledge on separation of waste, and 3Rs practices. Premakumara, D. and et al (2017) discussed awareness-raising campaigns and environmental education programs for the public to promote 3R activities (reduce, reuse and recycle) in Myanmar. Therefore, there is a need to evaluate the awareness, and practices of students in Mandalay City concerning environmental education on solid waste management including reduction, reusing and recycling, and separation at the source.

1.1. Objectives of the Study

The objective of this study is to evaluate the environmental education program and its effect on 3Rs activities at two model schools in Mandalay City that improve the knowledge of elementary students. This study also assesses what extent the students aware of environmental protection and examines how to change the students' attitude and behavior towards sustainable lifestyles in building 3R practice after the implementation of the program.

1.2. Methodology

For the purpose of the study, descriptive research design was applied to evaluate the elementary students' knowledge and attitudes towards 3Rs activities, separation of waste, and participation in cleaning their school environment. This study is based on questionnaires survey and secondary data from internet sources, and open access. This study was restricted to Amarapura Township, Mandalay City. Primary data obtained directly from surveys that had been randomly selected students and personal interviews were conducted with 27 teachers from two model schools in Mandalav City. Basic Education High School No. 1 (School A) and Basic Education High School -Pa La Sa-2 (School B) in Amarapura Township were chosen. These two schools are of the model schools of MCDC implementing the environmental education program on solid waste management collaboration with the Department of Basic Education and other key stakeholders from 2016 to 2019. The questionnaire surveys were carried out in November 2019. In selecting the students, although elementary students are usually included in grades 1-8, this study selected randomly 100 elementary students from 3rd grade, 5th grade, and 6th grade (hereafter G-3, G-5, and G-6 respectively) in each school. A total of 200 questionnaires were distributed but 198 questionnaires (99%) were returned (Table 1). Personal interviews were made with 18 teachers from the above-mentioned grades in schools (B) and 9 teachers in school (A) for examining how to change the students' knowledge and behavior about solid waste management after the implementation of the program.

This study is focused on solid waste management education, especially the knowledge of 3Rs. Some of the questions were close-ended to prevent deviation and some had multiple options to broaden responses. Questions in this survey for students were contained about the types of waste and methods of disposal, separation of waste, 3Rs activities, and participation of solid waste management in their schools. Hence, the questionnaires were drawn from elementary school textbooks for Life Skill classes, and ecology note, IGES (2016) for environmental education learning program.

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Grade		(School A)	(School B)	Total
Grade	3	30	32	62
Grade	5	20	28	58
(Old)		50	20	
Grade	6	20	20	78
(New)		39	39	
Total		99	99	198

Table 1. Participant students from two model schools

Source: Author, 2019

This is a descriptive – qualitative analysis used in analyzing the collected information from the interviews and the questionnaires. The data obtained were analyzed using simple Microsoft excel to produce frequency tables and descriptive statistics for presentation.

2. RESULTS AND DISCUSSION

2.1. Biodata of Respondents

In analyzing the data collected, the majority of the respondents, 61% were females and 39% were males. Their age ranges are 39% for age 8-9 yrs, 57% for 10-11yrs and 4% for 12-13yrs. The study indicated that the majority of the respondents are between the ages of 10 and 11years which falls into the age group for reading comprehension questionnaires.

2.2. Knowledge for Types of Waste

It is important to know different types of waste for segregating and ensuring proper waste discard. According to the sites google.com, there are five different types of wastes such as liquid waste, solid waste, hazardous waste, organic waste, and recyclable waste [12]. Among them, this study focused on three types of waste as classified in the research article. Thu Thao Phan Hoang, and Takaaki Kato (2016) defined organic waste which is any material such as paper, cardboard, and food remains that is biodegradable and capable of being decomposed by bacteria or other living organisms. Inorganic waste can be subdivided as (1) inorganic waste and (2) recyclable or reusable waste. Inorganic waste is easy to decompose by microorganisms including glass, metal, old clothes, metal, tissue waste, plastic bags, toys, hazardous waste. Recyclable or reusable waste are cans, bottles, newspapers, and clothes, iron, metal, copper [13].

In implementing the environmental education program, the MCDC intends to give the basic knowledge and awareness of what is organic and inorganic waste, as well as recyclable or reusable waste, and how to separate them. The MCDC has also implemented a new awareness raising program to separate dry waste and wet waste before disposing. In this respect, the figure 1 shows the students' correct answer, organic waste (86%), inorganic waste (81%), recyclable or reusable waste (81%) from school A while organic waste (97%), inorganic waste (97%), recyclable or reusable waste (81%) from school B. The results of this study show that the level of knowledge of the students from school (B) is higher than that of the students from the school (A) regarding the types of waste.



Figure 1. Types of waste Source: Author. 2019

2.3. Awareness on the Protection of Environment

Students from both schools showed not only the correct answers that solid waste is considered a problem impacting on the environment and public health if not properly managed but also they have the sense of responsibility to preserve the environment. In this regard this study applies the questions for protecting the environment "which places should not be dumped your waste?" and why should you separate your waste?

Table 2 showed that 59% of the students have knowledge for separating of waste before disposal into dumpsite, 41% of the students answered that they do not throw garbage not only in open areas, but also into the river and the lake whereas 39% of the students knew not to dump waste into river and lake, and just 6% of the students care about the open areas or public spaces should not be disposed of.

Table 2. Awareness on the protection of environment

Awareness on the protection of environment by the students	Percentage
Should not dispose waste in the open	6%
spaces/ areas	
Not dumping waste into river, lake	39%
Do not throw garbage in the open areas, and into river, lake	41%
Separate waste	59%

Source: Author, 201	9)
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Separation of wastes at the source is a basic requirement of solid waste management and to promote effective disposal and encourage the 3Rs practices. Both schools have waste bins for disposing separately. This study revealed that the students' knowledge of how to separate their disposing waste.

Table 3 shows that there was no significant difference in students' knowledge of waste separation at the source. Many students (69% from school 1 and 74% from school 2) answered that they sorted different types of plastic, paper, bio gradable, and food waste. However, all the separated waste is dumped together at the school's dump yard and it is mixed up by garbage collectors and loaded to the same vehicle for transportation.

Table 3. Waste separation at source

School A	School B
(%)	(%)
69%	74%
23%	19%
3%	5 %
5%	2%
	School A (%) 69% 23% 3% 5%

Source: Author, 2019

As mentioned in Almasia, A., and et al (2019)'s article, many studies have been conducted on the knowledge, attitudes, and practices of people towards SWM. They also identified that the knowledge of individuals is an important and influential factor in practices for easily affecting the implementation of recycling programs and ensuring their success [2]. In this context, there is a series of participatory learning workshops in Mandalay city since 2014 to set up a 3R community [8]. Two model schools in this study have started the Environmental Education (EE) Program to raise the students' awareness of waste separation and recycling with the cooperation of MCDC under the ASEAN ESC Model Cities Program in 2016 (Interview with teachers in November 2019). Including two model schools, some of the Basic Education High Schools in Amarapura Township has implemented the "No Plastic Bag Day" campaign in every Friday [7]. Figure 2 shows a comparison between school A and school B regarding the awareness of transforming the behavior from a throwaway society to a 3R society. However, the results of this study did not show significant differences between the two model schools. The results were pooled together between the students from both schools.

The results showed in figure 2, 22% of students did not know the term of 3Rs. However, thanks to the environmental education program, students' knowledge of 3Rs (Reduce, reuse, recycle) increased in both schools. This study asked the question "Do you know do and don't to follow 3Rs activities?" Of all the students (198), 89% answered for using own reusable bags or baskets, 87% knew for not using plastic bags in shopping, 78% denied for unnecessary packaging in shopping, 65% repaired or



reused old clothes and toys, and 97% gave old clothing and toys to others instead of throwing away these.

Figure 2. Awareness on 3Rs (Reduce, Reuse, Recycle) Source: Author, 2019

The majority of the students (86%) from both schools knew which items are recyclable. Based on the findings, students possessed high awareness of and knowledge about building a 3R society. However, this result is consistent with the answers from the teachers who said that most of the students have good knowledge of 3Rs but they do not practice it properly. Nevertheless, to some extent, the students' knowledge and attitudes in this study can contribute to reduce the volume of municipal solid waste in near future.

This study also revealed the students' knowledge about food waste. Figure 3 indicated that 65% of the students are feeding their residual waste to animals and 29% of students choose for producing fertilizer. In this regard, among 27 teachers, only 5 (19%) teachers taught practically how to do composting whereas 56% taught composting with the general principles. Therefore, this is relevant to the answer to students. Most of the students don't know composting.

Waste management is a serious problem for Mandalay to become a clean, green, and smart city. In this respect, most of the students need to understand that waste collection is an essential component of solid waste management. That's why this study assessed the attitudes towards solid waste collection among the students in their classrooms and schools. Of the 198 students, 91% of the students answered that they have the responsibility to collect their waste by themselves. This result is consistent with the practice of participation in keeping their school premises and garbage collection campaigns at schools. Astalin (2011) recommended that the social duty of students is to be more aware of environmental awareness [3]. In line with this suggestion, in this study, a significant finding is that 92% of the students knew to pick up and put garbage in a near bin when they see garbage in the public space.

Figure 4 revealed that 11 % of students from school 1 who often participated in sweeping and garbage collection at their schools and 87% took part in it weekly while 22% of students from school 2 often engaged in it and 70% of students involved in this campaign. Students' practice about trash collection in their respective schools is positive. Findings indicated that the students have possessed good habits and practices for keeping the clean their environment.



Figure 3. Awareness of residual food waste Source: Author, 2019



Figure 4. Practice of garbage collection at Schools Source: Author, 2019

3. CONCLUSION AND RECOMMENDATION

In this study, the purpose was to evaluate the environmental education program and its effect on the present situation of elementary student's awareness in 3Rs activities in Mandalay city. According to the results, most of the students have a sense of responsibility to preserve the environment. This study agreed the recommendation of Thu Thao Phan Hoang, and Takaaki Kato (2016) that environmental education increased environmental knowledge in elementary schools. In consistent with their findings, the results of this study indicated that the students answered correctly the types of waste what are organic wastes, inorganic wastes, and recyclable and reusable wastes. After the environmental education program, they had a relatively high knowledge of solid waste disposal. But, their knowledge did not influence them to practise waste segregation. In this regard Mandalay City Development Committee needs to

attract the students for practicing the separation of waste at their school by setting up two kinds of bin for the collection of organic and inorganic wastes. To some extent, the students' knowledge and attitudes in this study will contribute to reduce the volume of municipal solid waste in near future.

Rodi'c and Wilson (2017) described in their study, out of 17 SDG Goals, solid waste management (SWM) is directly connected with Goal 12 [10]. Of the SDG Goals, this study is mainly focused on the SDGs goal 12.5 and 12.3. According to the SDGs 12.5, waste generation can be substantially reduced by 2030 through 3Rs. In this regard, MCDC has being implemented to set up a 3Rs community as a better way of managing solid waste. Thus, this study showed that the extent of the general concept of 3Rs among the students of the study areas was somewhat satisfactory except the weaken practice of compositing. Fortunately, this study revealed that at the same time the majority of the students said that they knew to use their reusable bags or baskets in shopping (89%) and deny unnecessary packaging (78%). The level of reuse/ repair of some items (65%) is satisfactory to some extent in Mandalay. Most of the people acknowledged that they have items they use before they think of disposal. But some of the people do not deliberately reuse items to reduce the solid waste volume. There was a common behavior among the respondents to build a 3Rs society as a part, they donated or gave their some of reusable or recyclable items such as old clothes and toys to other (97%) instead of throwingaway. The majority of the students (86%) from both schools knew which items are recyclable.

By SDGs goal 12.3, this study revealed the behavior and habits of students about food waste treatment that 65% of the students are feeding their residual waste to animals and 29% of students choose for producing fertilizer while only 6% of students dispose their food waste in the dump yard. Goal 12.3 is a significant part to Goal 2 for achieving food security and improving nutrition, and promoting sustainable agriculture. This study identified that the effectiveness of environmental education programs are to some extent provided the motivation skills to the students to participate in keeping their surrounding environments and 3Rs activities. The students' behavior and practices spread into their families by which affecting a large area or community indirectly.

In the evaluation of the effects of environmental education and students' awareness in two model schools, there is need to increase the number of environmental education practices for improving environmental awareness among students. There is also necessary to do the research with more students for a longer period along with an associated budget.

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REFERENCES

- [1] Adeolu A.T, et al.,"Assessment of Secondary School Students' Knowledge, Attitude and Practice towards Waste Management in Ibadan, Oyo State, Nigeria", Journal of Research in Environmental Science and Toxicology Vol.3 (5), pp-66-73, September 2014, http:// www. interesjournal. org? JREST, and see also https://www.researchgate.net/publication/296607808_acce ssed 23 September 2019.
- [2] Almasia, A., and et al., "Assessing the knowledge, attitude and practice of the kermanshahi women towards reducing, recycling and reusing of municipal solid waste", Journal of Resources, Conservation & Recycling, Elsevier, 141 (2019), pp-329–338, https://www.sciencedirect.com/ science/article/abs/pii/S0921344918303823, and see also https://www.researchgate.net/publication/329090542, accessed 23 September 2019.
- [3] Astalin, P.K., "Environmental Awareness in Relation to Awareness towards Social Duty and Some Educational Factors affecting it among Higher Secondary Students", Journal of Education and Practice, 2(3), International Institute for Science, technology, and Education, New York, 2011, pp-54-62, http://academicinforma.com/.
- [4] Madrigal, D.V. and Oracion, E.G., "Solid Waste Management Awareness, Attitude, and Practices in a Philippine Catholic Higher Education Institution", August 2018, pp-43-57, https://www.researchgate.net/publication /327177428, accessed on 23 June 2019.
- [5] MCDC, Project of Environmental Education and Practice of Waste Separation at Source in Mandalay City, Cooperation of ASEAN ESC Model Cities, Cleansing Department, Mandalay City Development Committee, 2017.
- [6] Min Aung Phyoe, U., Staff Officer from Cleansing Departments of Mandalay City Development Committee (MCDC), Mandalay, Interview on 6 November 2017.
- [7] Netherlands Enterprise Agency, Myanmar Waste Scoping Mission Report, Netherland: Ministry of Foreign Affair, 2017.
- [8] Premakumara, D. and el at., Development of Environmental Learning Programme for Establishing a Sustainable Solid Waste Management System in Mandalay, Myanmar, Presented at the HDCA 2016 Conference, Hitotsubashi University, Tokyo, 1-3 September, http://www.enviroscope.iges.or.jp
- [9] Premakumara, D. and el. at., Waste Management in Myanmar: Current Status, Key Challenges and Recommendations for National and City Waste Management Strategies, Policy Report, IGES, Japan, 2017, http://www.enviroscope.iges.or.jp

- [10] Rodi´c, L. & Wilson, D.C., "Resolving Governance Issues to Achieve Priority Sustainable Development Goals Related to Solid Waste Management in Developing Countries", Journal of Sustainability, 9, 404;doi:10.3390/ su9030404, pp-1-18, 2017, www.mdpi.com/ journal/ sustainability, MDPI, Basel, Switzerland, also Available, https://www.researchgate.net/publication/314481905.
- [11] San Myint Yi, (2017). "A Study of Municipal Solid Waste Management in Mandalay City", Presented at the 2017 AMI Conference on Progress towards Myanmar's Sustainable Development Goals, 27-30 November, 2017, University of Yangon, Myanmar.
- [12] Types of Waste", https://sites.google.com/a/mtholyoke-.edu/ waste/waste/types-of-waste
- [13] Thu Thao Phan Hoang, Takaaki Kato., "Measuring the effect of environmental education for sustainable development at elementary schools: A case study in Da Nang city, Vietnam", Sustainable Environment Research, 26, Issue 6, pp-274-286, Elsevier B.V., Taiwan, November 2016, http://doi.org/10.1016/j.serj.2016.08.005.
- [14] United Nations (UN), "Goal 12: Ensure sustainable consumption and production patterns", http://www.un.org> sustainable- consumption and....the United Nations, accessed 20 January, 2020.
- [15] Zoë Lenkiewick (2016), "Waste and the Sustainable Development Goals", http://www.wasteaid.org>wastesustainable- development-goals, accessed 1 January, 2020.

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