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Notes from the Editor

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In its latest effort, the Department of Education, in the Philippines, launched *SulongEdukalidad,* to shift focus on quality delivery of education. *Edukalidad* focuses on four major actions (acronym KITE) to address quality in basic education:

- K to 12 curriculum review and update
- Improving learning environment
- Teachers' upskilling and reskilling
- Engagement of stakeholders

While all four actions are crucial for the achievement of expectations, the focus on teachers and how they are viewed as main agents to effect lasting change in education, will prove to be the most important aspect of *Edukalidad.*

Locally, challenges are met in many areas of teacher upskilling and reskilling. There is also the much-desired concrete link between the pre-service and in-service system in developing quality teachers to handle basic education.

This latest volume of EMER adds to the growing literature on links between motivation and classroom focus. In particular, the article of Ocampo and Magno underscores the potentials of pre-service teachers with emphasis on assessing their passion for teaching. The article supports paradigms in reviewing passion using specific data analysis. While the article is not exhaustive in terms of what the driving passion/s is/are for the pre-service teachers, it allows us a to see critical areas to help in providing data which may assist in upskilling teachers.

Further, the article by Lucasan and Ballada draws good initial mapping of what values are taught by basic education teachers. Their conclusions drive us to take a look at what seemingly is lacking in most basic education schools:

teaching of values as both classroom and school decisions. For the most part, the article emphasized that the teaching of values is successful only when those who teach it (all school personnel) also embody them.

Finally, Bongala and David provided much needed pedagogical practices that may support students understanding of algebraic patterns. While the article is not exhaustive in showcasing additional lens for teachers, it provides an analysis of the challenges students face so that teachers' practices maybe strengthened or refined.

All three articles provide additional focus DepEd's efforts in the further reskilling and upskilling of our teachers. It is PEMEA's support to education quality in the country through educational measurement and evaluation.

Assessing Preservice Teachers Passion for Teaching

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Abstract

The present study analyzed the Passion for Teaching Scale using a Partial Credit Rasch Model. The passion scale was anchored on the framework by Vallerand et al. (2003) with dimensions harmonious and obsessive passion. The model was contextualized for teaching and items were written pertaining to preservice teachers' passion for teaching. The scale was administered to 137 preservice teachers taking a course in education in a private university in Manila. The results of the Partial Credit Model showed that the scale calibration for both the harmonious and obsessive passion were monotonic. The scale categories are ordered appropriately based on the responses of preservice teachers. There are equal probabilities along the categories measured by each scale. The scales also shows measurement precision based on the Test Information Function.

Keywords: Obsessive Passion, Harmonious Passion, Teaching Potential, Rasch Analysis

Introduction

Passion has been studied in variety of context such as sports and the arts. Passion can also be explored in an academic setting such as students' inclination towards their course such as a course in education. There is a need to study passion in other context such as teaching in order to test the generalizability of the variable across different situations. Preservice teachers can be passionate about their teaching. Passion is a strong inclination toward an activity (such as teaching) that people like, they find important, and which

they invest time and energy is termed as passion (Vallerand et al., 2003, 2008, 2010). Passion in teaching occurs when the activity defines the identity of the individual ("I am a teacher," "I am an educator," "I am a trainer"). Some teachers who teach controls the appropriate situation when to engage in it (autonomous internalization of the activity) while some individuals are overpowered by the activity because of their extreme engagement (controlled internalization of the activity). Given this scenario, Vallerand (2003) distinguished two kinds of passion: Harmonious passion (HP) and obsessive passion (OP). Vallerand et al. (2003, p. 7575) defined harmonious passion as:

> Harmonious passion results from an internalization of the activity into the person's identity. An autonomous internalization occurs when individuals have freely accepted the activity as important for them without any contingencies attached to it… Individuals are not compelled to do the activity but rather they freely choose to do so. With this type of passion the activity occupies a significant but not overpowering space in the person's identity and is in harmony with other aspects of the person's life.

On the other hand, obsessive passion is defined as (Vallerand et al., 2003, p. 757):

> Obsessive passion (OP)… results from a controlled internalization of the activity into one's identity. Such internalization originates from intrapersonal and/or interpersonal pressure either because certain contingencies are attached to the activity such as feelings of social acceptance or self-esteem, or because the sense of excitement derived from activity engagement becomes uncontrollable. Thus, although individuals like the activity, they feel compelled to engage in it because of these internal contingencies that come to control them. They cannot help but to engage in the passionate activity. The passion must run in its course as it controls the person. Because activity engagement is out of the person's control, it eventually takes disproportionate space in the person's identity and causes conflict with other activities in the person's life.

Harmonious passion is demonstrated by a teacher who will stop teaching when they are tired and needs to eat lunch. However, a teacher that is obsessively passionate with teaching will continue to teach and will skip eating to continue teaching.

The distinction between harmonious and obsessive passion was theoretically tested by Vallerand et al. (2003) by first devising a pool of items that reflects the definition of the two constructs. An exploratory factor analysis was conducted and the hypothesized items that loaded to two factors that explain 54.7% of the total variance. The items loaded appropriately under harmonious and obsessive passion as hypothesized. The two latent variables were further tested using a Confirmatory Factor Analysis (CFA) where the items under each factor served as indicators. The results of the EFA showed all items loaded significantly under their respective factor and the model showed to have adequate fit.

The model of passion by Vallerand has been contextualized in task such as sports, arts, gambling, and leisurely activities but not in teaching. The present study will adapt the two models of passion by Vallerand by contextualizing it on preservice teachers passion for teaching.

Since the conception of the dualistic model of passion and the creation of the passion scale (Vallerand et al., 2003), researches have been widespread to look into the applicability of passion across many different fields, occupations, and activities (see Vallerand, 2010 for a review). For example, a validation of the passion scale among Spanish workers employed in different entrepreneurial companies showed that the two-factor structure of passion can be observed in the workplace, and that harmonious passion was seen to have a robust correlation to job satisfaction (Ramos, Ales, & Gonclves, 2014). In sports, a study validated the applicability of the passion scale among individuals who frequently (e. g., 8 times a week) visits the fitness centers to fulfill their exercise regimen. The results showed that the passion scale was a valid instrument to measure passion. It was given to exercising participants who confirmed the dualistic model of passion (Parastatidou, Doganis, Theodorakis, & Vlachopoulos, 2012). In relationships, couples who were seen to have obsessive passion experience problems (i. e. fights) in their relationship, and couples exhibiting obsessive passion experience otherwise (Levesque, Lyne, Lalibertea, Pelletier, Blanchar, & Vallerand, 2006).

The studies used the passion scale to measure obsessive and harmonious passion for different life activities. Previously, the passion scale was used and construed with the similar findings through different activities (Schellenberg, Gunnell, Mosewich, & Bailis, 2014). However, since the researches in passion spawned to different occupations and life activities, it is argued that the use and interpretation of the passion scale across different occupations and life activities needs to be tested in other context. Each activity

and occupation is distinct from the other considering the complexity and the diverse demands of each activity.

The present study addresses the need to construct a perspective of passion in a specific occupations and academic activity, specifically teaching. The present study constructed a passion for teaching scale using the theoretical framework of the dualistic model of passion conceptualized by Vallerand and colleagues (2003). Aside from contextualizing passion for teaching, an Item Response theory was used to analyze the items. More specifically, a Partial Credit Rasch model was applied. Majority of the analysis conducted for the passion scale only made use of Classical Test Theory like the principal components analysis to look at the sources of the variations among the items. For example, Vallerand et al. (2003) extracted the two-factor model using a maximum likelihood approach with an oblimin solution. The exploratory factor analysis showed that the two-factor solution had 5.62 and 2.05 eigenvalues which explains 54% of the total variance. In the same study, the two factor solution was tested using Confirmatory Factor Analysis, the model attained a good fit with RMSEA=.073, CFI=.93, and NNFI=.91. External validity was also conducted for the passion scale with other measures such as the Positive and Negative Affect Schedule (PANAS) (r= -.03 for HP and r=.49 for OP), flow (r=.38, r=.16, r=.24 for harmonious passion). Divergent validity was also established between harmonious and obsessive passion when contextualized in sports (.49). The analysis conducted for the passion scale was mostly based on the classical test theory approach. The Item Response Theory approach can provide further support about the accuracy of the scale. In a Partial Credit Rasch Model, detection of the uniformity of the distribution of response frequencies for the four point scale is made possible. In addition, the Partial Credit Model can test the step calibration in a monotonic fashion, and the fit of the items to the model is assessed.

Method

Participants

A total of 137 undergraduate students enrolled in different preservice education programs in a university in Manila participated in the study. Among these subjects, 95 (69.3%) were females and 42 (30.7%) were males. Participants' ages ranged from 18 to 22, with an average age of 18.8 (SD= .85). All the participants are majoring in secondary education with a focus on social science teaching and English teaching.

Instrument

The present research utilized the 60-item Passion for Teaching Scale (PTS) developed by Magno and Mamauag (2013). The PTS assesses a preservice teacher's harmonious passion towards teaching (i. e., I will surely gain a sense of fulfillment when I start teaching; α=.86) and obsessive passion towards teaching (i. e., I cannot sleep thinking about my class the next day; α=.70). Participants rated the items using a 4-point Likert scale from 1= Strongly Agree to 4=Strongly Disagree. The internal reliability of the scale was α=.76.

Procedure

A graduate student served as an examiner in the in the administration of the scale among the participants. The examiner briefed the participants about the purpose of the study, the voluntary nature of their participation, the confidentiality of their responses, and the general instructions in answering the instrument. The participants took approximately 30 minutes to complete the questionnaire. After the data collection phase of the research, the responses of the participants were encoded for data analysis.

Data Analysis

The Rasch model is used to determine the items that are highly and less endorsed, items that are easy and difficult, and items that fit the Partial Credit Rasch model. The primary output of Rasch analysis is a set of item difficulty and person ability values placed along a single interval scale. Items with higher difficulty scores are less likely to be endorsed, and items with lower scores are more likely to be endorsed, and those with lower ability are less likely to posses the characteristic (Magno & Ouano, 2009). Rasch analysis (a) estimates the difficulty of polytomous items as the natural logarithm of the odds of answering each item correctly (a log odds, or logit score), (b) typically scales these estimates to mean = 0, then (c) estimates person ability scores on the same scale. In the analysis of polytomous items, item difficulty and person ability are defined such that when they are equal, there is 50% chance of high response, as person ability exceeds item difficulty, the chance of a high response increases as a logistic ogive function, and as item difficulty exceeds

person ability , the chance of success decreases. The formal relationship among response probability, person ability, and item difficulty is given in the mathematical equation by Bond and Fox (2001, p 201). A graphic plot of this relationship, known as item characteristic curve (ICC), is given for three items of different difficulty levels.

Results

The 60 items of the passion of teaching scale was initially tested as a two-factor model using a Confirmatory Factor Analysis (CFA). The two-factor model in the CFA did not attain a good fit with indicators RMSEA=.13, PGI=.46, GFI=.39. Another CFA was tested where the items that were not significant in the initial CFA were removed resulting to 17 items of harmonious passion and 15 items of obsessive passion. The residuals of the 17 items of harmonious passion were correlated and the same procedure was done among the items of the obsessive passion. This procedure assumes that the commonalities among the items for each factor accounts for explaining the latent variable (Cole, Ciesla, & Steiger, 2007). In the second CFA, the fit of the two-factor model of passion for teaching attained fit with RMSEA=.06, PGI=.94, GFI=.96. The comparative fit index also improved from the initial model to the modified model. The fit indices for the first model areAIC=33.34, SBC=35.93, BCC=34.78 and the values for the modified model are AIC=7.81, SBC=7.34, and BCC=9.24. The Cronbach's alpha is .87 for harmonious passion and .64 for obsessive passion. Convergent validity was obtained for the two factors with a correlation of r=.74, p<.01.

The Partial Credit Rasch Model was used each for the harmonious passion and obsessive passion scale. The point measure correlation of the items for harmonious range from .34 to .75 and for obsessive passion the values range from .26 to .63 which suggest that the items are dependent on each other. This also indicates that the items for the harmonious and obsessive passion contribute to define a common construct. The measurement error ranged from 0.1 to 0.12 and 0.1 to 0.11 respectively for harmonious and obsessive passion which indicates dependence among the data. Separate reliabilities are obtained for the Rasch model for persons and items. The person reliability for the harmonious passion is .85 and the item reliability is .96. For obsessive passion, person reliability is .56 and the item reliability is .95. The high values indicate consistency of responses per items and consistency of

person responses in the scale. The infit indices for the items of harmonious and obsessive passion were determined.

Majority of the items for the harmonious and obsessive passion showed to fit the Rasch model with expected infit values of 0.5 to 1.5. The items showed an indication of the absence of redundancy and the presence of homogeneity. Both harmonious and obsessive passion scales also show unidimensionality of the data that tends to support the contribution of items in defining a central construct for the internal structure of the scale.

Table 1
Item Calibration for the Harmonious Passion Scale

Items	MEASURE	IN.MSQ	IN.ZSTD	OUT.MSQ	OUT.ZSTD	PTMA
61. Becoming a teacher drives me to do equally interesting activities.	-0.61	0.86	-1.31	0.84	-1.28	0.64
62. I can see myself as a teacher as I move to higher levels of education.	0.29	1.03	0.36	0.98	-0.15	0.75
63. I gain memorable experiences as I go through my teacher education subjects.	-0.24	0.96	-0.31	0.91	-0.81	0.74
65. My family wants to see me become a successful teacher someday.	-0.69	1.17	1.49	1.34	2.46	0.34
66. My teachers look forward to my pursuit of a teaching career.	0.06	0.69	-3.31	0.70	-2.95	0.57
68. I love teaching as I can do other things simultaneously.	0.61	1.33	2.79	1.26	2.06	0.60
70. My talents will be of good use when I eventually teach.	0.08	0.71	-3.04	0.70	-2.95	0.57
74. While studying in college, I am able to balance fun and studies.	-0.71	1.14	1.19	1.08	0.62	0.54
96. I think I will enjoy teaching.	0.29	1.17	1.53	1.11	1.02	0.62
97. I will gain a sense of fulfillment when I start teaching.	0.13	0.92	-0.78	0.88	-1.08	0.70
98. I believe that passionate teachers are good teachers.	-0.64	1.50	4.03	1.43	3.11	0.44
99. I believe I can be a source of inspiration to others.	-0.23	0.68	-3.34	0.64	-3.63	0.58
100. I believe teaching is like organizing a show.	-0.54	0.69	-3.10	0.72	-2.51	0.61
101. I believe that teachers must put their students as the focus of learning.	0.59	1.50	4.06	1.41	3.11	0.56
117. I make sure that whatever happens, I come to class on time.	0.09	0.98	-0.20	1.04	0.43	0.38
118. My schooling in college will be meaningless if I will not become a teacher.	0.2	0.64	-3.91	0.71	-2.92	0.45
120. I CANNOT imagine myself doing an	1.35	1.18	1.38	1.17	1.10	0.39

administrative job.

Table 2
Item Calibration for the Obsessive Passion Scale

ENTRY	MEASURE	IN.MSQ	IN.ZSTD	OUT.MSQ	OUT.ZSTD	PTMA
76. I believe that teachers exist to serve their students.	-0.33	0.59	-4.80	0.58	-4.77	0.63
78. I feel very elated when I start imitating my favorite teacher.	0.41	1.14	1.33	1.09	0.93	0.51
79. I have a strong urge to become a good teacher someday.	0.09	0.68	-3.70	0.68	-3.65	0.62
82. I am engrossed with the idea of people listening to me when I talk.	-0.22	1.32	3.00	1.28	2.60	0.51
83. I will feel incomplete if I think I can never become a teacher.	0.85	0.95	-0.40	1.01	0.14	0.43
85. I like extending help to my classmates even when it is late.	-0.89	0.53	-4.96	0.52	-4.58	0.47
89. I am too exacting in my schoolwork.	0.24	0.71	-3.24	0.71	-3.20	0.39
91. As I grow in the teaching profession, I will commit to my own teaching motto.	-0.53	0.85	-1.47	0.83	-1.60	0.61
92. I am NOT very excited about becoming a teacher.	-0.14	1.37	3.46	1.49	4.34	0.19
93. I attend enthusiastically to all my classes.	0.03	0.68	-3.74	0.66	-3.90	0.46
94. A teacher works hard to be a good example to the students.	-0.52	0.72	-3.03	0.73	-2.67	0.43
112. I will not leave the teaching profession as long as I have a choice.	0.22	1.46	9.90	2.68	9.90	-0.33
113. I get upset when I miss a class.	0.5	0.80	-2.02	0.78	-2.23	0.47
115. I believe that teaching ends after class hours.	0.28	0.90	-1.04	0.89	-1.09	0.26

The validity of the two scales was also assessed using the Partial Credit Rasch model. More specifically, the categories of the response scale were assessed based on the criteria provided by Linacre (2002). The functionality of the scale categories needs to have the following: (a) uniform distribution of the response frequencies throughout the different categories with a minimum of 10 observations in each; (b) monotonic progression of the mean measure observed and step calibration throughout the response categories; and (c) an outfit mean square (MNSQ), which is more sensitive than the infitfor unexpected responses, of the response categories of less than 2.0.For the harmonious passion scale, the response frequency ranges from 496 to 669

which are above the requirement of 10. The mean measure observed are .69, 1.34, 1.91, and 2.40 and the step calibration values are -4.67, .49, 1.53, and 2.65which both show monotonic progression in their values. The outfit mean square values are .96, .91, .99, and 1.08which are all below the requirement value of 2.0. Substantial validity is supported for the functioning of the response categories of the harmonious passion scale. As for the obsessive passion scale, the same pattern is observed corresponding to the three criteria. The response frequencies range from 280 to 609 which are more than the requirement of 10. The mean measures observed are .99, 1.15, 1.65, and 1.85 and the step calibration values are -3.73, .31, 1.45, and 1.97 which indicates monotonic progression. The outfit mean square values are also less than 2.0 with values 1.09, .71, 71, and 1.13. The response categories of the obsessive passion scale also showed evidence of substantial validity.

For the harmonious passion scale, the mean of the person infit is .99 and the standard deviation is .37 while the person outfit is 1.00 and the standard deviation is .43. The scale based on person fit statistics assumes good model fit because the number of people with infit and/or outfitabove 1.5 is low. The estimates are also precise for most of the people given the person separation reliability value of .87. This means that there is only a small amount of proportion of people variance that is not explained by measurement error. The same pattern is observed for the obsessive passion scale with values of 1.01 and .37 respectively for the mean person infit and standard deviation, and 1.00 and .37 respectively for the mean person outfit and standard deviation. The values provide evidence of good fit because the number of people with infit and/or outfit above 1.5 is low. Given the value of .87 for person separation reliability, a small amount of proportion of people variance is not explained by the measurement.

Table 3
Response Category Statistics of the Harmonious and Obsessive Passion Scale

	Harmonious Passion				Obsessive Passion			
Category	Observed Frequency	Observed Mean Measure	OUTFIT MNSQ	Step Calibration	Observed Frequency	Observed Mean Measure	OUTFIT MNSQ	Step Calibration
1	496	.69	.96	-4.67	280	.99	1.09	-3.37
2	601	1.34	.91	.84	609	1.15	.71	.31
3	669	1.91	.99	1.49	575	1.65	.71	1.45
4	560	2.40	1.08	2.34	451	1.85	1.13	1.97

The Test Information Function (TIF) of the harmonious and obsessive passion scales was also analyzed. The amount of precision at different levels of passion varies to some degree between the scales. Greatest precision for the harmonious passion scale is within 5SD below the mean and 1SD above the mean while for obsessive passion precision is 4SD below the mean and 1SD above the mean. The harmonious passion has greater precision than the obsessive passion scale.
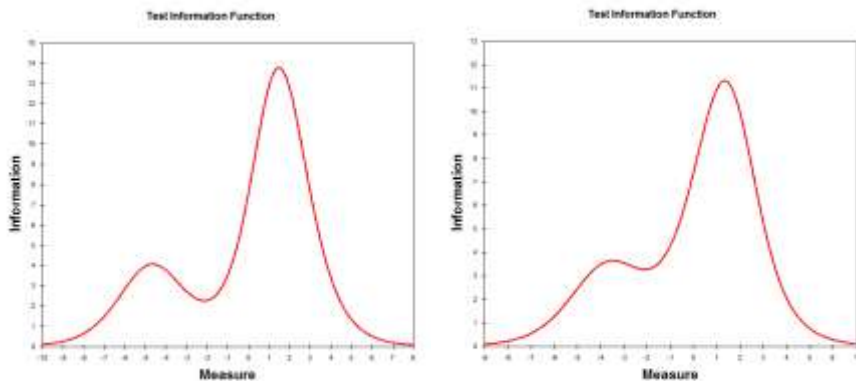
TIF for Harmonious Passion   TIF for Obsessive Passion

Figure 1. TIF for Harmonious and Obsessive Passion

Discussion

The purpose of the study is to provide further evidence on the validity and reliability of the passion for teaching scale using the Partial Credit Rasch Model. The analysis was conducted each for the harmonious and obsessive passion of the scales. Previous studies has shown the factor structure and internal consistency of the items based on a Classical Test Theory approach. The present study provided further evidence for the scales by analyzing the contribution of the items in a common construct, dependency of the items,

separate estimates for person and item reliability, homogeneity of the items, the functionality of the scale categories, and precision of the measurement of the scale.

First, both the harmonious and obsessive passion showed that the items contributed to define a common construct of passion. This was evidenced by moderate to high values of point measure correlations. This was also supported by small standard error of measurement attained for the model. The small standard errors for each item indicates small amount of noise in the distribution. Validity is defined when items share a common construct or consistent behavior of items (Messick, 1995). The parameters obtained in the items' point measure correlation and standard errors support the validity of the items measuring a single construct of passion.

Second, the reliability of the passion for teaching scale was also adequate for both persons and items. The reliabilities show consistency on the responses of the items and the consistencies of the persons' responses. This is similar in the concept of internal consistency reliability in the case of Classical Test Theory. However, separate estimates of reliability are obtained in the Rasch Model.

Third, the homogeneity of the items to have few redundancies though the estimates of item infit and outfit. This result also supports the unidimensionality of the harmonious scale. The same result was obtained for the obsessive passion scale which indicates unidimensionality. The infit estimates are within the boundaries required in the model which shows that the difficult items are highly endorsed by respondents who have characteristics of passion (ability). Difficult items are those items with positive logit measures and easy items are those with negative logit measures. The most difficult item with a logit measure of 1.35 indicates assuming oneself doing an administrative job. This item is not highly endorsed because the students still see themselves as teachers and not yet as administrators. They are presently mastery the science of teaching and they have not yet progressed in managing other teachers. On the other hand, the easiest item is balancing fun and studying while in college. Balance between fun and study is highly endorsed as explained by the developmental level of the teachers. Most of the respondents are within 17 to 19 years old and the characteristic is typical of this age group.

Fourth, is the functionality of the scale categories are strongly supported. The evidence of the appropriateness of the scale categories fulfilled the criteria set by Linacre (2002). There were more than enough respondents distributed within the four categories of the scale. When these quantities were transformed into logit measures, the four categories showed to have

monotonic increase indicating fit of the categories in the model. The Partial Credit Model assumes that for a scale to be substantially valid, the parameters should be interpreted with difficulties within the steps. The more the participant agrees to the items, the higher is the logit attained showing that the categories are well ordered.

Lastly, the scale showed to be a precise measure of passion as indicated by the Test Information Function (TIF). The harmonious passion scalescovered about 6 SD of the curve and the obsessive passion scale covered about 5 SD of the curve. The large coverage within the curve means that the items also have high degree of precision contributing to the high precision of the entire scale.

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Assessing the Teaching of Values in Elementary Grades

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Abstract

The values education framework of the Philippines' Department of Education (DepEd) emphasizes the teaching of core values (i.e., truth, justice, freedom, love, equality, and peace), as well as 21st century skills and critical thinking. The DepEd also expects subject teachers to integrate values in their lessons. Whether these essential components are actually taught in the classroom or not needs to be determined. This study sought to assess the teaching of values in a public elementary school in one city in the National Capital Region. Using questionnaires, teachers and their students were asked to identify the values that are being taught in the classroom, and how these values are taught. Results show that teachers teach a variety of values, and that the importance they give to these values differs from that of their students. Different teaching strategies were also mentioned in the teaching and integration of values in other subjects. Recommendations for the teaching of values and its integration in various subjects are forwarded.

Keywords: Teaching values, values integration, elementary students

Introduction

Values education is an important but often neglected learning area in basic education. It leads to many beneficial effects for learners, such as the development of better sociomoral cognition, prosocial behaviors and attitudes, problem-solving skills, reduced drug use, reduced violence/aggression, school behavior, knowledge and attitudes about risk, emotional competency, academic

achievement, attachment to school, and decreased general misbehavior (Berkowitz & Bier, 2007). Well-implemented character education programs also lead to higher academic achievement (Benninga, Berkowitz, Kuehn &, Smith, 2003; Snyder et al., 2009).

In the Philippines, the importance of values education is emphasized in the Department of Education (DepEd) Order No. 6, s. 1988. It defines values education as "the process by which values are formed in the learner, under the guidance of the teacher, and as he interacts with his environment" (DepEd, 1988). The DepEd Values Education Framework aims to "provide and promote values education to all for the development of the human person committed to the building of a 'just and humane society and an independent and democratic nation" (DepEd, 1988).

The DepEd Values Education Framework is anchored on the 1987 Philippine Constitution, which identified in its Preamble, the core values on "truth, justice, freedom, love, equality, and peace." Thus, the core and related values included in the Values Education Framework include those that are aimed at supporting and preserving human dignity.

In 2003, the DepEd released Order No. 41, which emphasized values education in the restructured Basic Education Curriculum. In this memorandum, DepEd stressed that every teacher, regardless of discipline, is a values education teacher, and thus, values development must be meaningfully integrated in every subject in basic education. More recently, the DepEd K to 12 Curriculum Guide for the subject *Edukasyon sa Pagpapakatao* (ESP or Values Education) specifies the inclusion of twenty-first century skills aside from the core values that were identified in the original 1988 Values Education Framework (DepEd, 2013). ESP is considered as one of the major subjects and is given the same weight as English, Math, Science, Filipino and *Araling Panlipunuan* (Social Studies) when calculating for a student's general average, as specified in the Policy Guidelines on Classroom Assessment for the K to 12 Basic Education Program (DepEd, 2015). Figure 1 shows the current conceptual framework for values education (DepEd, 2013).
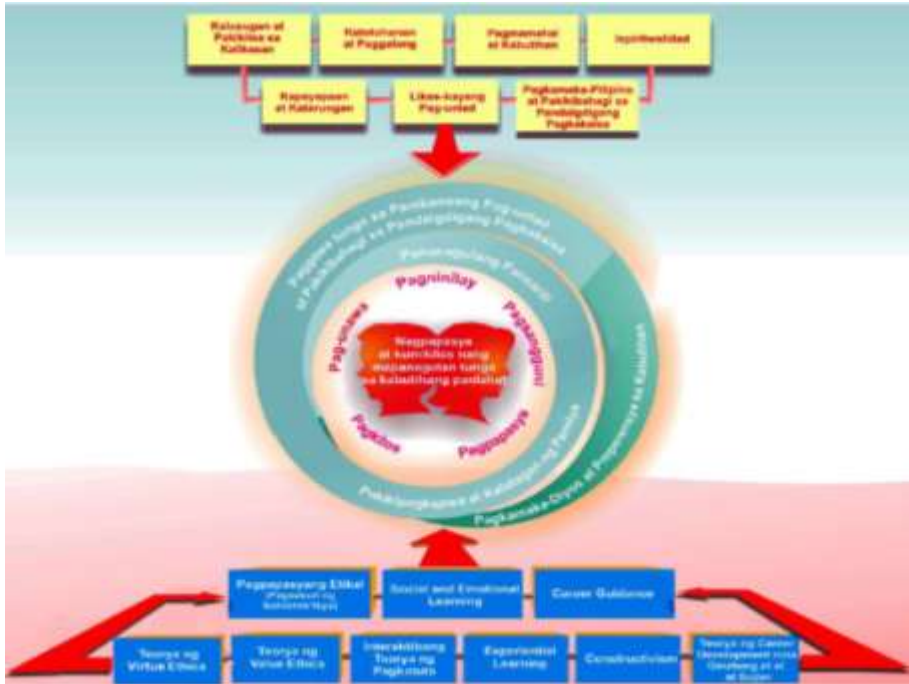
Figure 1. DepEd Conceptual Framework for Values Education

In this framework, the core outcome of values education is the total human development of the student, especially in terms of the 21st century skills. Thus, values education aims to develop students who are able to decide and act responsibly for the common good. To do this, students will be guided in discovering the significance or meaning of their lives and their role in Philippine society so that they can effectively contribute to the building of a community that upholds truth, freedom, justice, and love (DepEd, 2016). Thus, students must be able to demonstrate the macro skills of understanding, reflecting, seeking guidance or advice, making decisions, and acting according to moral standards.

According to DepEd (2016), values education in the Philippines is anchored on the philosophy of personalism and on the concept of virtue ethics. Personalism is a paradigm that gives importance to the uniqueness, significance, and inviolability of the person, and the person's relational or social dimension (Williams & Bengston, 2018). Personalism recognizes the unique, infinite dignity of human persons and one's personhood is made whole only in communion with other persons (Brooks, 2018). Virtue ethics, on the other

hand, posits that a good person is one who lives virtuously, that is, what makes a person good is possessing and living out the virtues (DepEd, 2016).

The curriculum guide for ESP also names other theories used to explain how students ought to learn values education. These include Bandura's Social Learning Theory, Kolb's Experiential Learning, Constructivism, and Theory of Career Development (DepEd, 2016). The curriculum guide briefly describes each theory, but there is no elaboration how these theories play out in the actual teaching-learning process.

Strategies for Teaching Values

Halstead and Taylor (2000) identified several methods of teaching values, which are directly related to values education theories. Character education (Lickona, Schaps, & Lewis, 2007) approaches the teaching of values through direct instruction. This involves identifying the values that ought to be imbibed by students and providing opportunities for studying these values directly through formal instruction, problem solving, cooperative learning, experience-based projects, and discussions of ways to practice virtues (Halstead & Taylor, 2000). Values education that adheres to the theory of moral reasoning (Kohlberg, 1987) prefer the use of dilemma discussion strategies, which have been found effective in advancing moral reasoning in students (Cummings, Maddux, Cladianos, & Richmond, 2010). Another approach to teaching values is circle time, which is a popular method for promoting confidence, self-knowledge, and self-esteem, usually among primary students (Halstead & Taylor, 2000). Circle time involves having students and the teacher sit in a circle on the same level to talk about a topic or theme and/or to share ideas or feelings (Mary, 2014). This approach has been shown to facilitate prosocial behaviors, develop social and personal skills, and improve confidence and self-esteem among students (Cefai, Ferrario, Cavioni, Carter & Grech, 2014; Collins, 2013; Miller & Moran, 2007).

Aside from explicit instruction in a specific subject like ESP, values may be integrated in the teaching of other academic subjects. Veugelers (2000) proposed that teachers often use four strategies in teaching value-laden topics. In the first strategy, teachers trying not to express their own values. The second strategy involves teachers explicitly stating those values that they find important. For the third strategy, teachers stress the differences among values, without expresses the values they find important. Finally, the fourth strategy involves the teacher indicating differences in values, but also expressing the values they find important. Veugelers (2000) also noted that teachers usually

follow a pattern in teaching values. They start off by not expressing their values, and then they stress the differences in values, without stating their own, to allow students to form their own opinions. Eventually, though, teachers end by indicating the values that they find important.

The Curriculum Guide for ESP identifies three strategies for teaching values (DepEd, 2016). These are ethical decision making through analysis of issues or problems, Social-Emotional Learning (SEL), and career decision-making. According to the Curriculum Guide, students should be taught how to choose actions with a preference for the common good. Specifically, the process of decision making should include identifying details related to the issue or problem and careful consideration of the moral values that impact that situation and the impact of one's actions on others. The Curriculum Guide also identifies the SEL skills that ought to be developed in students. These skills include self-awareness, self-management, social awareness, responsible decision-making, and relationship skills (CASEL, 2019). There is no discussion, however, how these skills may be facilitated inside the classroom. Finally, the ESP Curriculum Guide specifies that career decision-making should be included as a strategy in teaching values, but there is no discussion to explain how this will be articulated in the teaching-learning process.

The Present Study

The present study aimed to assess the practice of teaching values in a public elementary school. Specifically, it sought to determine what values are being taught, how these are integrated in other subjects, and the strategies that teachers use in teaching these values. Furthermore, it sought to identify if teachers and their students differ in terms of the importance they give to the values being taught in school.

Method
Research Design

This study made use of a cross-sectional, descriptive research design (Johnson, 2001). This design was used because the purpose of the study was to describe the current state of practice in the teaching of values in the elementary grades.

Participants

The main participants of the study were elementary teachers (n = 35, age range = 28 to 40 years, M age = 39.07 years, SD = 6.89) in a public school in Makati City, Metro Manila. Table 1 shows the distribution of the participants according to selected demographic variables.

Table 1. *Distribution of Study Participants*

Variable/Levels	Frequency	Percent
Gender		
Male	4	11.43
Female	27	77.14
No response	4	11.43
Highest Educational Attainment		
Bachelor's	20	57.14
Master's	6	17.14
No response	9	25.71
Years of Teaching Experiences		
5 to 9 years	5	14.29
10 to 14 years	12	34.29
15 to 19 years	8	22.86
20 or more years	6	17.14
No response	4	11.43
$M = 14.61$, $sd = 5.96$		
Grade Level Taught		
Grade 1	5	14.29
Grade 2	4	11.43
Grade 3	7	20.00
Grade 4	6	17.14
Grade 5	7	20.00
Grade 6	6	17.14
Subjects Taught		
Araling Panlipunan (Social Studies)	11	31.43

Variable/Levels	Frequency	Percent
English	13	37.14
Edukasyong Pantahanan at Pangkabuhayan (Technology and Livelihood Education)	4	11.43
Edukasyon sa Pagpapakatao(Values Education)	23	65.71
Filipino		
Health	15	42.86
Music, Arts, Physical Education and Health	1	2.86
Math	10	28.57
Mother Tongue	13	37.14
Science	7	20.00
	5	14.29

Grade Six students were asked to validate the responses of their teachers. A total of 189 students (47% boys) responded to a questionnaire that asked them to identify the values being taught by their teachers.

Instruments

Teachers responded to a questionnaire that generated information about the values they think should be taught and why, the top five values which should be taught, and the teaching strategies used and in which subjects these were used.

Students also answered a questionnaire that sought to validate the top five values that were identified by teachers. Only Grade 6 students were selected to participate in this validation phase because younger students might not be able to accomplish a self-report instrument.

Procedure

The researchers first sought permission from the school principal and informed consent from the teachers and the parents of the Grade Six pupils. Once permission had been given, the teachers and their students were asked to respond to the instrument. A follow-up interview was conducted with one teacher to verify the responses obtained from the questionnaire.

Data Analysis

Teachers were asked to identify all the values that they teach to students. They were then asked to rank the top five values in order of importance. Students were also asked to rank the top five values that they believe their teachers emphasize during class. The Mann-Whitney U Test was then conducted to determine whether there was a significant difference in the mean ranks of these values as rated by teachers and their students.

Results and Discussion

Values Taught

Teachers and students were asked to identify the values that are being taught in their school. These may be values taught either in ESP or integrated in other subjects. Table 2 shows these values in alphabetical order.

Table 2. *Values Taught in Grades 1 to 6*

1. commitment	11. generosity	21. patience
2. cooperation	12. Godly devotion	22. perseverance
3. courtesy	13. grit	23. resourcefulness
4. creativity	14. hard work	24. respect
5. devotion	15. honesty	25. responsibility
6. diligence	16. initiative	26. sacrifice
7. discipline	17. judgment	27. self-discipline
8. entrepreneurial spirit	18. love	28. self-respect
9. faith in God	19. love of country	29. self-worth
10. faithfulness	20. obedience	

From the list above, teachers were asked to identify the top five most important values to teach. These values, in alphabetical order, are faith in God, honesty, kindness, love, and respect. Grade Six students were then asked to validate whether or not these are the values they have learned from their teachers. The Mann-Whitney U Test was used to test the hypothesis that the mean ranks assigned by teachers and students would not be significantly different, indicating that the values considered by teachers to be important are also the same values that students feel they are learning. Table 3 shows results of the Mann-Whitney U Test.

Table 3.*Comparing Mean Ranks using the Mann-Whitney U Test*

	Group	Mean Rank	Mann-Whitney U	*p*-value
Respect	Students	121.42	2930.5	.107
	Teachers	101.73		
Honesty	Students	121.64	2886.0	.084
	Teachers	100.46		
Faith in God	Students	126.83	1843.5	.000
	Teachers	70.67		
Love	Students	120.48	3120.0	.147
	Teachers	107.14		
Kindness	Students	124.24	2364.0	.001
	Teachers	85.54		

Note. Smaller mean ranks indicate greater importance of the value

The results showed that these five values are perceived by teachers to be more important compared to their students. While students ranked these values as equally important (mean ranks range from 120.48 to 124.24), teachers place more importance to certain values than others (mean ranks range from 70.67 to 107.14). In particular, the Mann-Whitney U tests showed that *Faith in God* ($U = 1,843.50$, $p = 0.000$) and *Kindness*($U = 2,364.00$, $p = 0.001$) have mean ranks rated by teachers that are significantly different from the mean ranks rated by students. This means that teachers consider these two as the more important values they teach in class, but students perceive these values to be given the same importance as other values.

It should also be noted that although there are a variety of values that teachers focus on, these values are still anchored on the DepEd Values Education framework, as shown in Table 4.

Table 4. *DepEd Core Values and Values Taught by Teachers*

DepEd Core Values	Values Identified by Teachers
Kalusugan at Pakikiisa sa Kalikasan (Health and Concern for the Environment)	self-discipline self-respect self-worth
Katotohanan at Paggalang (Truth and Respect)	honesty kindness respect
Pagmamahal at Kabutihan (Love and Kindness)	courtesy devotion generosity kindness love obedience patience sacrifice
Ispiritwalidad (Spirituality)	faith in God faithfulness godly devotion
Kapayapaan at Katarungan (Peace and Justice)	judgement patience
Likas-kayang Pag-unlad (Personal Development)	commitment cooperation creativity devotion entrepreneurial spirit grit hard work initiative perseverance resourcefulness responsibility sacrifice self-discipline

DepEd Core Values	Values Identified by Teachers
Pagkamaka-Pilipino at Pakikibahagi sa Pandaigdigang Pagkakaisa (Nationalism and Global Citizenship)	cooperation love of country responsibility

An interview conducted with one teacher clarified why teachers identified different values. This teacher noted that the choice of which values to teach is incidental and usually based on the content to be discussed. For example, when the topic is about water and land resources, the teacher also takes the opportunity to teach the value of caring for the environment. Schuitema et al. (2008) noted that this strategy entails using topics with a moral dimension as a jump off point for discussing specific values. This implies, however, that teachers could focus on as many values as there are topics in a particular subject area. Moreover, the finding that teachers do not have a consensus in terms of the values that they teach suggests that they have no common understanding of the DepEd values education framework.

Lickona (2002) noted that effective character education calls for schools to explicitly state the values they stand for, define these values in terms of observable behaviors, disseminate these values to all members of the school community, and hold all school members accountable to a standard of conduct consistent with such values. In the current study, it was found that teachers and students held different beliefs in terms of what values are important. This incongruence may be due to the fact that the values held important by the school are not explicitly stated and communicated with all school members, including the teachers and students. This is a cause for concern, because the identification and definition of values to be taught are essential for character education (McKay, 2002).

Teaching Strategies Used

Table 5 shows the strategies teachers use to teach values. Teachers use a variety of strategies, some of which are applied in both ESP (i.e., values education) and in integrating values in other academic subjects. The use of different approaches is not surprising considering that the DepEd (2016) Curriculum Guide for ESP does not clearly or sufficiently explain how values should be taught in the classroom.

Table 5. *Strategies Used to Teach Values* (n = 35)

Strategies	Used in ESP		Used in Integrating Values in other Subjects	
	f	%	f	%
Analysis of everyday situations	1	2.86	-	-
Behavior management	3	8.57	-	-
Direct instruction/Lecture	9	25.71	9	25.71
Experiments	-	-	1	2.86
Games	-	-	4	11.43
Group activity	1	2.86	2	5.71
Modeling	-	-	2	5.71
Role playing	3	8.57	3	8.57
Setting standards	-	-	5	14.29
Use of stories	1	2.86	7	20.00
Use of video clips	8	22.86	1	2.86
Visualization	2	5.71	-	-

The results show that teachers frequently use direct instruction or lecture, video clips, stories, role play, group activities, and games in teaching values. Among these strategies, the use of stories has been found to be an effective method for teaching values. For example, Leming (2000) found that a literature-based character education program was effective in improving students' ethical conduct. Using stories also helps students build social skills and decrease negative social behaviors (DeRosier & Mercer, 2007). While the teachers in the study identified the use of stories to teach values, there was no opportunity for them to explain how they practice this in the classroom.

Other effective approaches of teaching values include cooperative learning and group work where students are given the opportunity to discuss and solve problems (Schuitema, Dam, & Veugelers, 2008). In a review of character education programs, Berkowitz and Bier (2005) noted that peer interaction is a powerful means of promoting character development among students. Based on the response of the teachers, it can be seen that they do provide opportunities for students to interact and work together through group activities, role playing, games and experiments.

Note, however, that direct instruction is still the favored teaching strategy identified in this study. This suggests that teachers may need more training or professional development in the teaching of values, either as a

subject in itself or integrated with another academic discipline. Previous research in Western countries has shown that teachers often receive very little training in the teaching of values (Milson & Mehlig, 2002), which may explain why they lack professional knowledge (i. e., a common formal ethical language and knowledge based on educational theories and research) in the field of values education (Thornberg, 2008). This is also likely to be true among Filipino teachers. A cursory examination of the Teacher Education curriculum (CHED, 2017a; CHED, 2017b) shows that the teaching of values is given emphasis only in the Bachelor of Secondary Education, major in Values Education program. The Bachelor of Elementary Education program has one course on Good Manners and Right Conduct, while the other specializations (i. e., English, Mathematics, Science, Social Studies, and Filipino) in the Bachelor of Secondary Education program do not include a course on the teaching of values.

Conclusions and Recommendations

This study identified the values that elementary school teachers deem important to impart to students and the strategies they employ in teaching those values. Teachers named a variety of values, but the top five most important values they teach students are faith in God, kindness, honesty, respect, and love. Students ranked the values they think have been taught to them, and their rankings were found to be different from that of their teachers. This lack of consensus suggests that the values being given importance in the school are not explicitly and publicly stated. Teachers also identified various strategies of teaching values, but the most common method is direct instruction, either in ESP or in other academic subjects. This indicates that teachers may need additional training in the teaching of values, and especially in integrating values in other academic subjects.

In order to make the teaching of values more effective, schools should clearly identify and define the values that will be taught and emphasized across grade levels and subjects (McKay, 2002). All adult members of the school, including non-teaching staff, should consistently practice these values so that they can be effective role models for students (McKay, 2002). Teachers should employ strategies that have been found effective in values education, such as the use of stories (Leming, 2000), having moral dilemma discussions (Schuitema et al., 2008), and collaborative learning (Berkowitz & Bier, 2005). Finally, schools should provide opportunities for community participation

whenever possible so that students are able to see these values being practiced in real life (McKay, 2002).

We recognize that the current study is limited in terms of its sample size and methodology. Future research may consider a larger sample across different schools and levels. A deeper examination of the teaching strategies in values education may also be considered through a mixed-methods research design. In particular, a qualitative phase that utilizes both interview and observation data will give a clearer picture of how values are being taught in Philippine classrooms.

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Factors Affecting Students' Performance in Generalizing Algebraic Patterns

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Abstract

Pattern generalization is indispensable to the development of algebraic thinking; however, students in early and even in late middle school are struggling in generalizing patterns. This study identifies the students' perceived factors that affect their performance in generalizing algebraic patterns and describes how each factor affects their process of generalization. This study used the qualitative descriptive design. The students were given open-ended problems which require them to generalize patterns. Results show that the factor which greatly influences the students' performance was associated to the structure of the task such as the size of the values and problem presentation. The ability to derive algebraic symbol influences students' thinking of getting better result while lacking this ability despite their complete and accurate solution leaves them the feeling of arriving at incorrect answer. With these results, teachers should help students to structure and organize their informal methods rather than focus on how to use mathematical formulas. Teachers should expose them to pattern-based problem solving with considerations to the elements that influences their performance.

Keywords: factors, performance, algebraic pattern, generalization

Introduction

Patterns are regarded as important focus in the early stages of the development of algebraic thinking. Algebraic thinking begins as soon as the students notice consistent change and seek to describe it (QSA, 2005). In early

and middle school students, pattern activities contribute to the development of functional thinking (Souviney, 1994; Van De Walle, 2004; Warren & Cooper, 2006), in seeing relationships and making connections (Cathcart et al., 2003) and improved competency in problem solving (Bassarear, 2008, Cathcart *et al.*, 2003).

Pattern is considered as the heart and soul of mathematics because Algebra, and indeed all of mathematics, is about generalizing patterns (Liljedahl, 2004; Lee, 1996). According to Schoenfeld (1992), mathematics is conceptualized as the "science of patterns", an empirical discipline analogous to the sciences due to its emphasis on pattern-seeking from the empirical evidence. That is, studying patterns is closely related to many mathematical content areas such as numbers, geometry, measurement and data (Fox, 2005). One example in geometry involving measurement is to identify the largest possible area that can be constructed given a perimeter. This can be discovered by examining the pattern that comes from a series of constructions and measurements. The pattern that clearly emerges is that as the number of sides of the polygon increases, the polygon becomes "circular" and the area increases. Eventually, it will lead to a conclusion that a circle yields the largest area given a certain perimeter. Students are able to explore and widen their thinking towards new ideas. This may stir up their curiosity to seek for more patterns which no one had ever noticed. Acknowledging the role of pattern generalization in improving functional and algebraic thinking, teachers may incorporate pattern exercises in their algebra lessons with considerations to the elements or factors that influence or contributes to the performance.

With the new educational reform adopted by the Philippines such as the K-12, Patterns and Algebra is taught across grade levels starting from grade 1 to 10. This brought a greater emphasis on the importance of the content. However, in a study on the analysis of secondary school students' algebraic thinking ability, it was found out that students struggle in generalizing patterns (Nurhayati et al., 2017) which according to the same study the students get poor result in the aspect of function and mathematical modeling. Students can see patterns but they have problem in perceiving an algebraically useful pattern (Lee, 1996). With this, teachers play significant role to direct students' attention to useful patterns underlying the wide variety of mathematical topics.

To address this issue, the following questions were addressed: (a) what are the perceived factors affecting students' performance in generalizing algebraic patterns? and (b) how does each factor affect their process of generalization? Understanding the factors that affects discovering patterns will help teachers understand pupils' work. Also, this will provide information on

the possible ways to improve students' generalizing performance and their process of generalization. This study will guide teachers on how they will be able to address the factors that lead students in recognizing meaningful patterns.

Algebraic Patterns

There are two predominant types of algebraic patterns: repeating and growing patterns. These two types of pattern are used to find generalizations within the elements such as identifying the next term or filling up the missing part.

Repeating pattern has a discernible unit of repetition that is a cyclical structure generated by repeated smaller portion of the pattern called as the "unit of repeat" (QSA, 2005; Threlfall, 1999). For example, ABABAB… can be observed as repeating pattern with a unit of repeat of 2 which is "AB". AB continues and repeats in such order as the pattern expands. Repeating pattern can also be in a form of but not limited to number pattern such as 122122122… or in terms of pictorial or geometric shapes such as ▼●▼●▼●. Varying some attributes of elements (such as size, color, orientation, etc.) while keeping other attributes constant add complexity to a repeating pattern (Threlfall, 1999). An example is ABCabABCabABCab. It has a unit of repeat of 5 with varying attributes. These attributes add complexity to repeating pattern which encourages keen observation and reasoning skills. Repeating pattern observes regularity and sequencing. Young children can succeed in generating or continuing repeating patterns using a procedural or rhythmic approach (Zazkis & Liljedahl, 2002).

Although most patterning experiences for young learners will focus on repeating patterns, they can also begin to visualize and talk about growing patterns in early grades. Growing pattern on the other hand have discernible units commonly called "terms" and each term in the pattern depends on the previous term and its position in the pattern. When exploring growing pattern, pupils have the opportunity to find relationship between elements of the pattern and their position. For example ABCDBCDACDAB, the four letters ABCD are continuously used, however the order of the letters changes depending on the number of iteration. Number pattern like the sequence 3, 7, 11, 15 has a common difference of four and the succeeding number depends on the previous number. Example of geometric or pictorial growing pattern is shown below where the "L" becomes larger as the number of beads increases.

Generalizing Patterns

Mason (1996) describes "expressing generality" as one of the roots of, and routes into, algebra. Generalization as described by Kaput involves describing the relationships and examining the varying quantities that exist in a particular situation. As students' understandings develop, and they analyze and interpret repeating and growing patterns, the focus shifts towards higher-order thinking activities (QSA, 2005). One way is to give students the task to think beyond what is seen in the patterns. This type of activity is regarded as "reading across the grain" and in mathematical pattern it is associated with generalizing patterns where students extend thinking and reasoning about the pattern based on the linked elements or terms with their position. That is, generalization is both "an object and a means of thinking and communicating" (Dörfler, 1991).

Research Methods

This study used the qualitative descriptive research design. The goal of qualitative descriptive study is to give a comprehensive summarization of experienced events (Lambert & Lambert, 2012). This type of design provides deep descriptive content from the participants' perspective (Sandelowski, 2010). Therefore, this approach is suitable to identify the perceived factors affecting students' performance and describe how these factors affect their process of generalization,

Five-item open ended problems were used in the study. Three of which were already used in the study of Liljedahl (2004) and Nurhayati, Herman, & Suhendra (2017), one from an internet source, and the other problem was made by the researcher. In choosing and constructing the problems, one must fit as either repeating or growing pattern. The problems undergone pilot testing to Grade 10 students and showed acceptable result in the item analyses. Thus, the same questions were used in the actual test except for the last question with some revision. The pilot test was conducted to Grade 10 while the final test was administered to Grades 11 and 12. It is because it is more likely that Grades 11 and 12 can answer the problems given that the Grade 10 was able to.

A total of eighteen senior high students from STEM classes served as the participants. Convenient sampling technique was used to look for the participants. The participants were asked to write their solutions and were given 30 minutes to complete the test. After the test, two questions were asked intended for each student to reflect on the answer(s) they feel sure is/are correct or not and why he/she feels so. This was followed by a 10-minute interview. The account as to how they express themselves were not limited to English language. Some preferred English, others opted for Filipino and few resorted to Bikol dialect. The interviews conducted were all audio recorded.

The answers and solutions for each question were compared. For question 1a, the students' papers were grouped into three: correct, incorrect and blank. The solutions and interviews of the group of students who got correct answer in 1a were reviewed and coded. This guided the researcher to identify the factors that yield to correct answer. Likewise, students who got incorrect or no answer provided reasons for not successfully obtaining the correct process and answer in 1a. The same process was done with the rest of the questions.

Aside from grouping the students based on their performance in each questions, their performance to the types of questions were also compared.

Results and Discussion

The answers were marked as correct, incorrect or blank. Based form the answers and reflections of the participants, the test seemed to be a power test. All of them were able to get the first item correctly while only few get the correct answer for the last item. Some of the items have sub-questions yielding 7 as the highest possible correct answers. The table below shows the result of their performance in each item categorized as correct, incorrect or blank.

Table 1. *Result of Students' Performance per Item*

Item	Correct	Incorrect	Blank
1a	18	0	0
1b	16	2	0
2	15	2	1
3a	14	2	2
3b	12	3	3
4	15	3	0
5	4	13	1

The table implies that as the item number progresses, the performance gets low. The first item seemed to be the easiest question obtaining 18 out of 18 correct answers. Question 3b got the highest number of blank answer and solution. In the last item (5), only four got the correct answer while 13 of them were incorrect and only one participant with no written answer and solution.

The following discussions focus on the factors affecting the students' performance in the test items.

Near and Extreme Generalization

Question 1a and 1b have the same pattern principle. However, it can be seen from the table that from 18 participants getting the correct answer in 1a, two of them fell out in 1b.

Problem 1:

"A bank has three lanes being served and customers are called alternately. The lanes are called in sequence as ordinary transaction, senior citizen and account opening. (a) Which lane would be served on the 11th call? (b) Which lane would be served on the 110th call? How do you know?"

Almost all of them used counting strategy and some used division with remainder. All of them considered 1a easy but were challenged in the next question.

Two who got incorrect answers were able to identify the unit of repeat and the process of identifying which lane would be called given the number. Moreover, both of them recognized that a number divisible by 3 is on the account opening or 3rd lane; however, they committed error in identifying a multiple of 3 nearest to 110. One of them considered 109 divisible by 3, thus in his answer, 110th is ordinary transaction. The other participant considered 112 as a multiple of 3, thus he counted backwards to locate 110 and found it as ordinary transaction too. This indicates that they have not mastered divisibility rules, a lesson given as early as in primary schooling, and this is quite alarming knowing that they are already in their senior secondary years.

While most of them arrived at the correct answer, they experienced difficulty in question 1b because the number is quite large for them.

"Kaya ko po masagutan and mahanap yung answer, ang problema lang yung solution po. So narealize ko na pagbigger numbers baka hindi na masagutan."

Q1a is an example of near generalization where only smaller value is involved while extreme generalization involves larger number or terms in the sequence like in Q1b. This type of generalization is time consuming for the participants. On the other hand, posing a larger number extends their thinking and exercises more their generalizing skills and this is what the students missed.
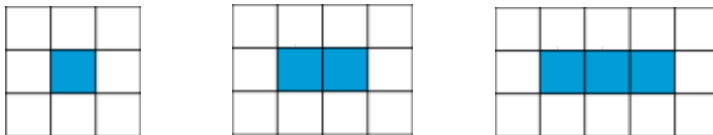
Problem 2:

"Consider the sequence 1, 5, 9 … Will 63 be in the sequence? Why or why not?"

The problem is a type of an arithmetic sequence with a common difference of four. The participants immediately noticed this common attribute. Some used the method of additive counting while others recall the arithmetic sequence formula and incorporate in solving the problem. Most of them considered the problem as a near generalization since they resorted to recursive method.

Discrete and Arbitrary Number

Third problem:

Gardens (shaded region) are framed single row of tiles as illustrated below.

a) *How many border tiles are required for a garden of length 18?*
b) *How many border tiles are required for a garden of length "n"?*

In question number 3, the problem asked for the number of boarder tiles given a certain garden length. Some was able to identify the constant number of tiles on the left and right side of the garden and the variable on the upper and lower side, thus generated a formula in 3a and 3b. Some made tables and visual extensions of the given images.
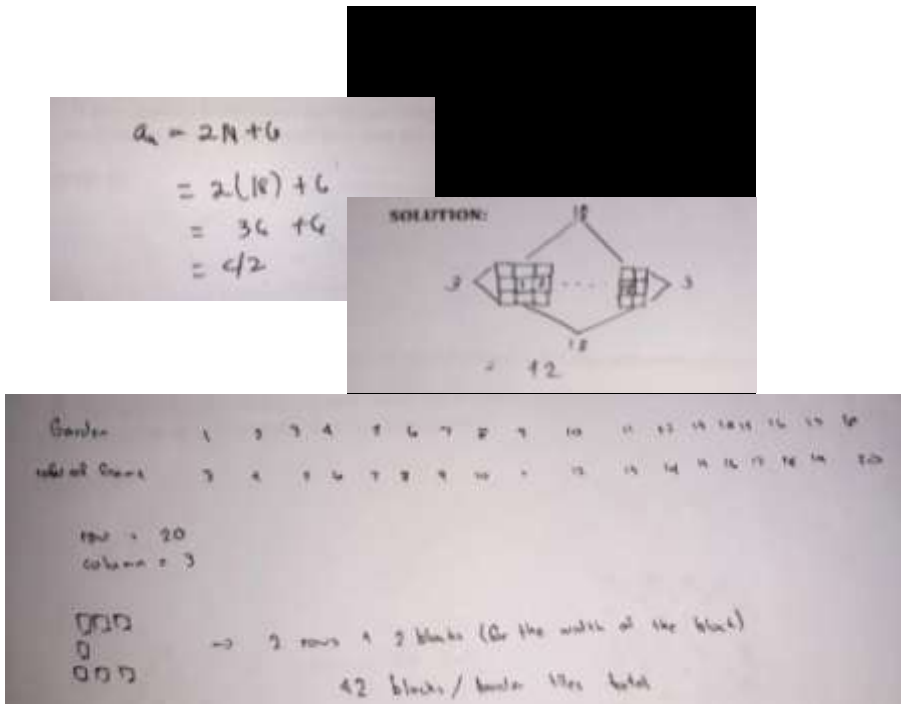
Figure 1. Some solutions in Q3a

More students were able to answer Q3a given the length of 18. This adds direction to their solution as to when will the tiles extend. Question 3b looks for the number of boarder tiles for arbitrary length *"n"*. The student who draws the extension had difficulty in expressing the number of boarder tiles in terms of *"n"* and was left with no answer and solution. The one who made tables was able to come up with an algebraic notation by considering the rows at the top and bottom and the constant blocks on left and right sides.
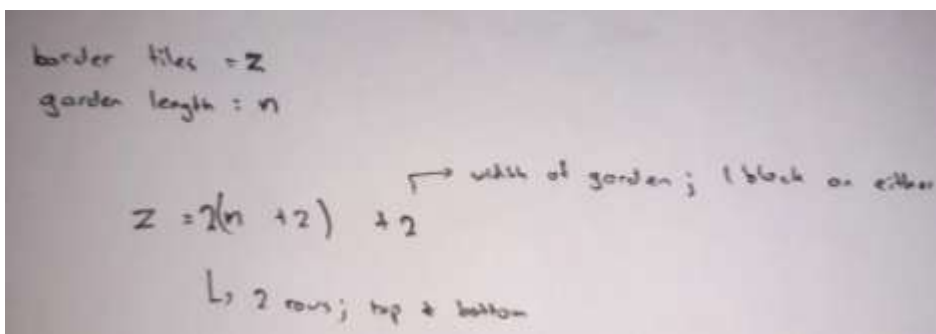

Figure 2. Student's solution in Q3a

Text Description and Visual Image

In a study of the difficulties in mathematical problem solving, students have difficulty in reading and comprehension (Phonapichat, Wongwanich, & Sujiva, 2013). Comprehension involves students' showing an understanding of specific terms and express the questions in their own words (Newman, 1983b). According to Sepeng & Madzorera (2014), comprehension is associated with insufficient grasp of vocabulary knowledge. If students failed in comprehending a problem, more so in visualizing it.

Problem 5 posed several confusions to comprehension and visualization. The problem was given as: *"If you build a four-sided pyramid using basketballs and do not count the bottom as a side, how many balls will there be in a pyramid that has three layers?"*

The confusions were seen when the participants committed misconceptions on the following terms or phrases:

- pyramid
- layers versus sides
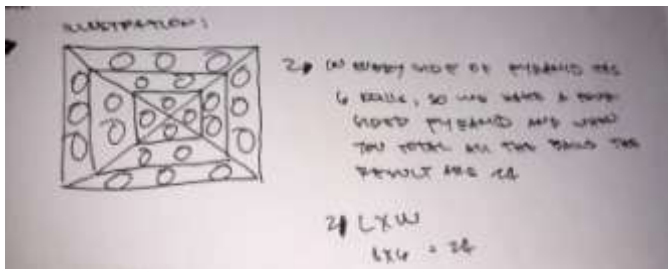- "do not count the bottom as a side"

Figure 3. Student's illustrations of the four-sided pyramid

The figure above shows the illustration from one of the participants. Considering the sides (for each triangle), it has three layers with increasing number of balls going to the base, that is: one, two and three balls. However, the balls at the edge were not combined to form an actual pyramid.

The participant fails to consider the three-dimensional attribute of a pyramid and focused on the side-view of the pyramid.
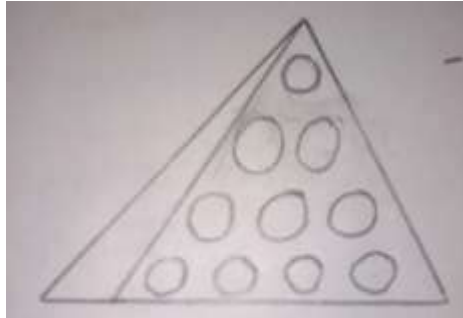
Figure 4. Illustration of the Pyramid's Layer

One student explained his solution this way: *"Since it is a four-sided pyramid and the bottom is not counted, the answer would be $24 - 1 = 23$, where 1 is consider as the top."*

The pyramid in Figure 4 has four layers instead of three. He was confused with the statement "do not count the bottom as a side". He thought that when the bottom is excluded, the statement will be satisfied. Nonetheless, his goal was not reached by omitting the bottom side because the balls at the bottom were not actually subtracted. To his explanation, it was the top that he omitted. Subtracting the top ball will result to a truncated pyramid, different from the given problem. The non-included side in the problem was the base of the pyramid which most of them did not realize.

Only three got the correct answer in the 5th problem. In their solution, they considered each layer and make sure that the edge would have four sides then add the balls. This strategy worked. They were able to come up with a formula to determine the number of balls in each layer.
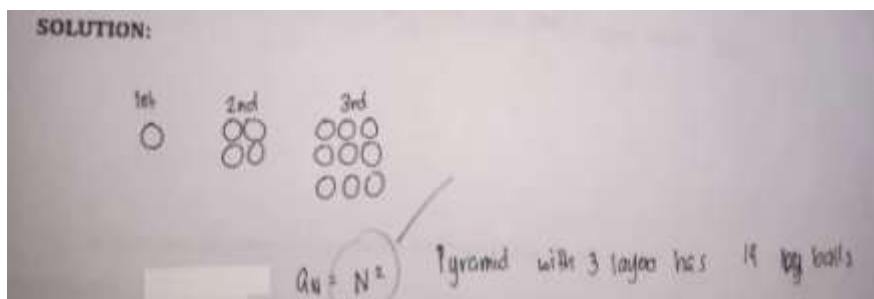
SOLUTION:

1st   2nd   3rd

$a_n = N^2$ Pyramid with 3 layers has 14 big balls

Figure 5. Layered Illustration of the pyramid

While the 5th problem required the participants to visualize, the 3rd problem provided an image of the problem with least words to describe it. Comparing the result, students performed better in the third problem. One student noticed the illustration.

> *"It was easy creating the formula with pictures to explain it."*
> *"Number 5 is hard for me to interpret."*
> *"I'm not sure with number 5 because I did not understand the problem and I don't know how to solve it."*
> *"Number 3 and 5 are hard for me to comprehend."*

Tension between Algebraic Thinking and Algebraic Notation

Students who were able to recall the formula of arithmetic sequence were able to easily solve the problem. One participant transforms the words and images into numerical form and opted to solve using algebraic notation. He has unique solutions for problems 1a, 1b, 4 and 5. According to him he attends Saturday Math class and this helped him familiarize algebraic problems. When asked why he chose to solve using algebraic notation:

> *"Madali lang naman magcount pero sa MGT (Mathematics Teachers Guild) kailangan saamin may proper solution… kasi kahit madali lang dapat ang solution maayos parin."*

Unable to recognize the formula and resort to other ways of getting the pattern made some participants doubt.

> *"Hindi ko po alam ang formula, nakalimutan ko po. Alam ko po kung paano sagutan kaso di ko po masyado maexplain, baka po mali."*

These types of behaviors are evidences of the tension between algebraic thinking and algebraic symbolism. In a study of generalization of patterns of pre-service teachers (Zazkis & Liljedahl, 2002), solutions that are complete and accurate but did not involve algebraic symbolism are perceived

as inadequate, worse wrong. This has been the reason for the continuous criticism in algebra due to the "rushing from words to single letter symbols" (Mason, 1996). According to the conclusion of Radford (2000), students are already thinking algebraically when they were dealing with the production of a written message even though they are not using the standard algorithm symbol. Therefore, neither the presence of algebraic notation should be taken as an indicator of algebraic thinking, nor the lack of algebraic notation should be judged as an inability to think algebraically. The second student has lost his chance of expressing his generalization and thus affected his performance in the item. Like most of the students, he did not answer the last item. This might or has been happening in a math classroom. This kind of tension has clearly affected one's performance.

Conclusion

The performance of the students varies in each pattern-based problem and perceived factors emerged affecting their performance in generalizing patterns. These are near and extreme generalization; discrete and arbitrary number; text description and visual image; and tension between algebraic thinking and algebraic notation. Students performed well when given small range of pattern extension and experienced difficulty with extreme values. The task of generalizing a pattern for arbitrary number has likewise posed challenges to them. Illustrations and visual representations are more helpful than text descriptions of the pattern due to the complex task of comprehending and visualizing. Lastly, students who were not able to express their thoughts symbolically leaves them with a feeling of inadequacy at not meeting the expectation then opted not to answer some of the problems, thereby negatively affect his performance.

Implication

Students have different levels of perceptual and generalizing ability, thus these emerging factors are hoped to turn teachers' pedagogy and teaching strategies in teaching algebraic patterns such as exposure in applying the rules to larger values, provide exercises in visualizing pattern problems and introduce strategies to translate their solutions into mathematical symbols. Teachers should help students to structure and organize their informal methods rather than focus on memorizing and applying the formulas.The study does not imply of resorting to practices that makes generalization easy

for learners, but to give new ways to new researches and classroom practices to strengthen their weak spots. Also, in the early stage of algebraic thinking, this study suggests the use of facilitating tasks such as smaller scale of repetition, use of visual images and encourages the possibility of mindless symbol manipulation to focus on pattern structure rather than computational manipulation.

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APPENDIX 1

The Instrument

This problem set consists of five-item pattern-based problem solving questions intended to determine the factors affecting your performance in generalizing algebraic patterns. Your scores will not be graded nor put into public. Moreover, your identity and responses will be kept strictly confidential and will be used for research purposes only. Enjoy answering!

Name (optional): _____

Grade Level & Strand: _____

School: _____ Time started: _____ Time finished: _____

Instruction: Kindly **ENCIRCLE** your final answer and write your solution for each item.

1. A bank has three lanes being served and customers are called alternately. The lanes are called in sequence as ordinary transactions, senior citizens and account opening.

    a) Which lane would be served on the 11th call?
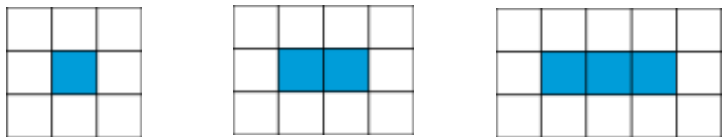
SOLUTION:

    b) Which lane would be served on the 110th call? How do you know?

SOLUTION:

2. Consider the sequence 1, 5, 9 … Will 63 be in the sequence? Why or why not?

SOLUTION:

3. Gardens are framed single row of tiles as illustrated below.

Problems	Type of Pattern	Source

c) How many border tiles are required for a garden of length 18?

SOLUTION:

d) How many border tiles are required for a garden of length "*n*"?

SOLUTION:

4. A toy train has 100 cars. The first car is red, the second is blue, the third is yellow, the fourth is red, the fifth is blue, the sixth is yellow, and so on. What is the number of the last blue car?

SOLUTION:

5. If you build a four-sided pyramid using basketballs and do not count the bottom as a side, how many balls will there be in a pyramid that has three layers?

SOLUTION:

---Thank You! ☺ ---

1. A bank has three lanes being served and customers are called alternately. The lanes are called in sequence as ordinary transactions, senior citizens and account opening. c) Which lane would be served on the 11th call? d) Which lane would be served on the 110th call? How do you know?	a) Repeating Pattern b) Growing Pattern	Researcher-made
2. Consider the sequence 1, 5, 9 … Will 63 be in the sequence? Why or why not?	Growing Pattern	*Peter Liljedahl (2004)*
3. Gardens (shaded region) are framed single row of tiles as illustrated below. e) How many border tiles are required for a garden of length 18? f) How many border tiles are required for a garden of length "*n*"? a) Repeating Pattern b) Growing Pattern		Nurhayati D. M., Herman T., & Suhendra S. (2017).
4. A toy train has 100 cars. The first car is red, the second is blue, the third is yellow, the fourth is red, the fifth is	Growing Pattern	

blue, the sixth is yellow, and so on. What is the number of the last blue car?		*Peter Liljedahl (2004)*
5. If you build a four-sided pyramid using basketballs and don't count the bottom as a side, how many balls will there be in a pyramid that has three layers?	Growing Pattern	from internet source