Exploring Factors on the Learning Engagement in Mathematics of the Outcome-Based Teacher Education Curriculum (OBTEC) Students

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Abstract- The study explores factors on the learning engagement in mathematics of the OBTEC students. To determine the learning engagement, the researcher utilized the correlation-predictive method of research using the modified Mathematics Classroom Engagement Scale developed by Qi-Ping Kong, Ngai-Ying Wong, Chi-Chung Lam administered to the 162 OBTEC students. Statistical tools such as the mean, standard deviations, and stepwise multiple regression were used to answer problems of the study. Results show that the level of behavioral and cognitive engagement in mathematics is high while the affective engagement is average. However, when grouped according to personal factors, the level of the behavioral and cognitive engagement is high but low in affective engagement. Results also reflected that attitude towards mathematics and instructors/professors teaching competence are predictors of OBTEC students learning engagement. This means that OBTEC students were engaged behaviorally and cognitively in their mathematics class. On the other hand, students' attitude toward mathematics and instructors teaching competences predicts students' learning engagement.

Index Terms- Factors, Learning Engagement, Mathematics, First Year College Students

I. Introduction

Mathematics has always been regarded as one of the most difficult subject not only in the elementary and secondary curriculum but also in the tertiary education. Results of tests and examination local and abroad show a dismal failure on the part of the mathematics teachers and the school system in general because the data show that mathematics was among the subject area which obtained the lowest mean percentage score. However, according to the Australian Academy of Science (2006) mathematical sciences are fundamental to the well-being of all nations. They drive the data analysis, forecasting, modeling, decision-making, management, design and technological principles that underpin every sector of modern enterprise. Mathematics is the foremost enabling science which underpins research, development and innovation in every aspect of society, from business and science through health and national security. The importance of a supply of capable mathematicians in an increasingly technological society cannot be over emphasized; yet international trends indicate that, while the demand for Science, Technology, Engineering and Mathematics (STEM) skills is increasing, however, in many countries student participation and engagement in mathematics is steadily declining (OECD, 2006).

This is most likely true in the Philippines. Mathematics teachers commonly observed that students are mathematically capable, yet disinterested and disengaged from the subject, perceiving it to be boring, irrelevant and difficult. Lack of ability is not the reason students are not participating in mathematics as a subject. According to several national and international studies, students appear to be capable and performing relatively well in knowledge and skills areas (ACER, 2008; Thompson & Fleming, 2004; OECD, 2006). However, they do not engage themselves well in mathematics.

Along this line, Yair (2000) argues that a multitude of factors all combine to impact on students' overall engagement in mathematics. However, in this research, personal factors such as gender, age, type of secondary schools, and status of schooling as well as other related factors like physical learning environment of the classroom, attitude towards mathematics, and other related factors are considered to influence OBTEC students learning engagement in mathematics.

II. Statement of the Problem

The main purpose of this study was to explore factors on the learning engagement in mathematics of the OBTEC students of Philippine Normal University Visayas. Specifically, the study aims to determine (1) the level of the learning engagement in mathematics when grouped according to personal and other related factors; (2) correlation between first year college students level of learning engagement in mathematics and personal and other related factors; and (3) predictors on the learning engagement in mathematics of the OBTEC students.

III. Conceptual Framework

This study is anchored on the concepts related to students' learning engagement in mathematics and the factors influencing it.

According to Fredricks, Blumenfeld, and Paris (2004) student engagement has an extensive research base and is shown to be a highly complex and multi-faceted construct. Researchers, psychologists and educators differ in opinions of what constitutes engagement, how the construct can be measured and what factors combine to result in engagement. However, in this study, the researcher acknowledges the concept proposed by researchers on engagement which identifies three common dimensions namely

behavioral engagement, affective engagement, and cognitive engagement.

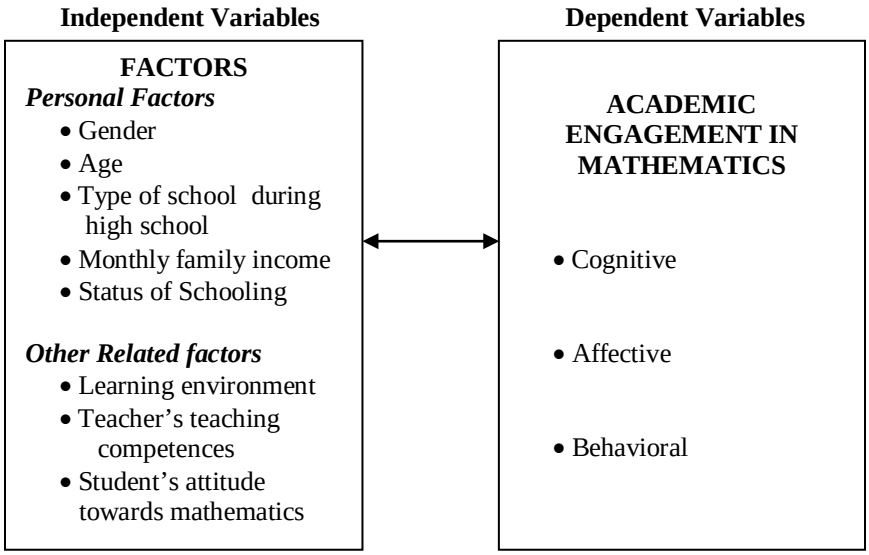
Behavioral Engagement is involvement in academic and social or extra-curricular activities (Hughes, Luo, Kwok, & Loyd, 2008). Under this are three components: (1) Behavior related to learning which is "effort persistence, concentration, attention, asking questions, and contributing to class discussions", (2) Compliance, which is shown in abiding by school rules and regulations, as well as misbehavior i.e. cutting class, frequent absences etc. (3) Participation in extracurricular activities.

Affective Engagement on the other hand involves positive and negative reactions to people and activities at school (Hughes, Luo, Kwok and Loyd, 2008). In other words, it is also the student's feelings about school and to the degree to which they care about their school; belongingness, safety, comfort and pride in the institution; relationships with teachers and peers".

Cognitive Engagement is associated with how much the student invests in his education and how much he motivates himself. This also includes the significance of academics to the student as well as getting good grades and the ability to finish tasks while going beyond what is expected. The three dimensions helps in the complete understanding "student's relationships to their school" (Sciarra & Seirup, 2008).

Likewise factors that may influence learning engagement in mathematics of the OBTEC students are determined. These are personal factors such as gender, age, type of school, and status of schooling and other related factors such as the learning environment, mathematics teachers teaching competence, and students' attitude towards mathematics.

Figure 1on the next page shows the conceptual framework of the study.



IV. Methods

Correlation-predictive method of research was utilized in this study. The participants of the study were the 162 OBTEC students of Philippine Normal University, Visayas enrolled during the academic year 2014-2015. To gather data on the level of the learning engagement in mathematics, the researcher utilized four sets of questionnaires. The three sets were personally developed and were subjected to validity and reliability testing by the researcher. These are: (1) the physical learning environment scale, (2) attitude scale for mathematics, and (3) instructors/professors teaching competences scale. The fourth set was a mathematics classroom engagement scale developed by Qi-Ping Kong, Ngai-Ying Wong, Chi-Chung Lam and was modified by the researcher to suit to the present purpose of the study. Each of the three developed questionnaires consisted of 10 items while the mathematics classroom engagement scale consisted of 56 items from which 20 items composed the first domain (behavioral engagement), 22 items composed the second domain (emotional engagement), and 14 items composed the third domain (cognitive engagement). To answer questions posed in this study, descriptive and inferential statistics such as frequency, percent, mean, Pearson Product Moment of Correlation Coefficient, stepwise multiple regression were used.

V. Results and Discussion

Learning Engagement in Mathematics in Terms of Personal Factors

Table 1 reflects that the level of the learning engagement in mathematics of the OBTEC students is high *(M = 2.21, SD = 0.19).* They also have high behavioral *(M = 2.23, SD = 0.23)* and cognitive *(M = 2.22, SD = 0.34)* engagement but average in affective engagement *(M = 2.18, SD = 0.20).* Responses of the students disclosed that they are engaged in mathematics behaviorally and cognitively. However, they are not engaged affectively compared to their engagement behaviorally and cognitively. According to Marks (2000) engagement in mathematics is crucial in the classroom. Students who are

engaged with school are more likely to learn, find the experience rewarding and to continue with higher education. Engagement in the classroom also contributes to students' social and cognitive development as well as academic achievement (Finn, 1993). Disengagement in mathematics leads to reducing the range of higher education courses available to students in addition to limiting their capacity to understand life experiences through a mathematical perspective (Sullivan, Mousley, & Zevenbergen, 2005).

Table 1
Level of Engagement in Mathematics of the OBTEC Students

Engagement	Mean	SD	Interpretation
Behavioral	2.23	0.23	High
Affective	2.18	0.20	Average
Cognitive	2.22	0.34	High
Overall Mean	2.21	0.19	High

Grouping OBTEC students as to gender, Table 2 indicates that the level of engagement in mathematics of the female students is high *(M = 2.22, SD = 0.18)* while the males were only average *(M = 2.19, SD = 0.24)*. However, when dimensions were considered individually, females have better behavioral engagement than males but they have almost the same level of engagement in affective and cognitive domains. However, considering obtained means, results reveal that females' obtained means were slightly higher than the males. Although the difference is slight, however result can be taken to mean that females are more attentive and more engaged in the different mathematics activities than males. However, their responses can also be interpreted to mean that they are more engaged than males may be because they need to strive more in this subject because they find the subject more difficult. On the other hand, male students of today as observed are carefree and are involved in activities outside of the classroom. These are activities such as sports, computer games, and many others which lead them not to pay attention to their studies (Montinola, 2009).

Table 2
Level of Engagement in Mathematics of the OBTEC Students when Grouped According to Gender

Engagement	Male			Female		
	M	*SD*	*Interpretation*	*M*	*SD*	*Interpretation*
Behavioral	2.19	0.29	Average	2.24	0.21	High
Affective	2.14	0.22	Average	2.19	0.19	Average
Cognitive	2.22	0.37	High	2.22	0.34	High
As a Whole	2.19	0.24	Average	2.22	0.18	High

When grouped according to age, table 3 shows that the level of engagement in mathematics of the students whose age is on the age bracket of 17 and below is high *(M = 2.23, SD = 0.17)* while those whose age is on the age bracket of 18 and above is average *(M = 2.19, SD = 0.21)*. Furthermore, the level of behavioral and cognitive engagement of the students whose age belong to the age bracket of 17 and below is high while average in terms of affective engagement. On the other hand, the level of behavioral engagement in mathematics of the first year college whose age is on the age bracket of 18 and above is high while average in terms of affective and cognitive engagement.

Although responses demonstrate that younger students are more engage in their mathematics subject, however, considering their obtained means, slight difference was observed. These differences can be interpreted to mean that younger generations are more receptive to changes. They are dynamic and are susceptible to the demand of the time. In relation to their engagement in mathematics, they are more interested to learn and more engaged academically in the subject than those who are older than them.

Table 3
Level of Engagement in Mathematics of the OBTEC Students when Grouped According to Age

Engagement	17 and below			18 and above		
	M	*SD*	*Interpretation*	*M*	*SD*	*Interpretation*
Behavioral	2.24	0.21	High	2.22	0.21	High
Affective	2.19	0.16	Average	2.17	0.19	Average
Cognitive	2.25	0.35	High	2.19	0.34	Average
As a Whole	2.23	0.17	High	2.19	0.18	Average

When type of secondary school they graduated from graduated were considered, Table 4 reveals that the level of engagement in mathematics of the students who are graduates of public high schools is high *(M = 2.23, SD = 0.17)* while those who are graduates of private high schools is average *(M = 2.19, SD = 0.21)*. Likewise, it can be gleaned from this table that the level of behavioral and cognitive engagement in mathematics of the students who were graduates of public high schools is high while average in affective engagement. On the other hand, the level of behavioral and cognitive engagement in mathematics of those who are graduates of private high schools is average while high in in affective engagement.

Responses of the respondents in this regard can be taken to mean that majority of the students in public high schools belong to the average and poor family. Their status in life is their motivating factors why they should strive and put more interest towards schooling. They should have positive outlook toward schooling, thus they are motivated to engage more in the different subject areas.

Table 4
Level of Engagement in Mathematics of the OBTEC Students when Grouped According to the Type of School

Engagement	Public			Private		
	M	*SD*	*Interpretation*	*M*	*SD*	*Interpretation*
Behavioral	2.24	0.22	High	2.14	0.32	Average
Affective	2.17	0.20	Average	2.22	0.20	High
Cognitive	2.22	0.33	High	2.15	0.48	Average
As a Whole	2.21	0.19	High	2.17	0.25	Average

Table 5 indicates that the level of the learning engagement in mathematics of the students who are working students is average *(M = 2.20, SD = 0.19)* while those who are not working students is high *(M = 2.21, SD = 0.19)*. Likewise, results reveal that both groups have high level of behavioral engagement while average in affective engagement. On the other hand in terms of cognitive engagement, the level of engagement in mathematics of those who are working is average while high for those who are not working students.

It can be gleaned from the results that students who are not working while studying have better learning engagement in mathematics than those who are working. Responses are typical of the fact that doing activities simultaneously is a difficult task. Line of duties is divided, thus causing them to engage moderately in learning mathematics.

Table 5
Level of Engagement in Mathematics of the OBTEC Students when Grouped According to Status of Schooling

Engagement	Working			Non working		
	M	*SD*	*Interpretation*	*M*	*SD*	*Interpretation*
Behavioral	2.33	0.13	High	2.23	0.23	High
Affective	2.08	0.27	Average	2.18	0.20	Average
Cognitive	2.19	0.53	Average	2.22	0.34	High
As a Whole	2.20	0.19	Average	2.21	0.19	High

Learning Engagement in Mathematics in Terms of Other Related Factors

Considering the physical environment of the mathematics classroom, the level of the learning engagement in mathematics of the students who perceived that their mathematics classroom is conducive is high *(M = 2.21, SD = 0.19)* while average *(M = 2.20, SD = 0.19)* by those who perceived that their mathematics classroom is fairly conducive. Furthermore, results reveal that the level behavioral engagement of the students who perceived that their mathematics classroom is conducive is high while average for those who perceived it as fairly conducive. However, in terms of affective engagement, the level of engagement in mathematics of both groups is average. On the other hand, in terms of cognitive engagement, the level of engagement of those who perceived that their mathematics classroom is conducive is high while average by those who perceived that their mathematics classroom is fairly conducive.

Results presented in this table reflected that the more conducive the classroom is, the higher is the level of students' engagement in mathematics. In other words engagement of the students can follow how classroom are organize, the ventilation of the classroom, the lighting of the classroom, and generally the physical condition of the classroom. Arranging the physical environment of the classroom is one way to improve the learning environment and to prevent problem behaviors before they occur. Research on the classroom environment has shown that the physical arrangement can affect the behavior of both students and teachers (Savage, 1999; Stewart & Evans, 1997; Weinstein, 1992), and that a well-structured classroom tends to improve student academic and behavioral outcomes (MacAulay, 1990; Walker, Colvin, & Ramsey, 1995; Walker & Walker, 1991). In addition, the classroom environment acts as a symbol to students and others regarding what teachers' value in behavior and learning (Savage, 1999; Weinstein, 1992). If a classroom is not properly organized to support the type of schedule and activities a teacher has planned, it can impede the functioning of the day as well as limit what and how students learn and engage towards learning. However, a well-arranged classroom environment is one way to more effectively manage instruction because it triggers fewer behavior problems and establishes a climate conducive to learning.

Table 6
Level of Engagement in Mathematics of the OBTEC Students who Rated their Mathematics Classroom in Terms of the Physical Environment

Engagement	Fairly Conducive			Conducive		
	M	*SD*	*Interpretation*	*M*	*SD*	*Interpretation*
Behavioral	2.26	0.22	High	2.12	0.23	Average
Affective	2.08	0.27	Average	2.18	0.20	Average
Cognitive	2.19	0.53	Average	2.22	0.34	High
As a Whole	2.20	0.19	Average	2.21	0.19	High

Table 7 reflects that the level of the learning engagement in mathematics of the students who have positive attitude towards mathematics is high *(M = 2.22, SD = 0.19)* while those with moderately positive attitude is average *(M = 2.07, SD = 0.13)*. Furthermore, results reveal that the level of behavioral and cognitive engagement of the students with positive attitude towards mathematics is high while those with moderate attitude are average. However, the level of affective engagement of those with positive attitude towards mathematics is average while those with moderate attitude are high.

Results presented in this table disclosed that student's attitude towards the subject influences his or her level of engagement towards the subject. Along this line, a genuine interest in school subjects is important as well. Students with an interest in a subject like mathematics are likely to be more motivated to manage their own learning and develop the requisite skills to become effective learners of that subject. Hence, interest in mathematics is relevant when considering the development of effective learning strategies for mathematics. In contrast, anxiety about learning mathematics can act as a barrier to effective learning. Students who feel anxious about their ability to cope in mathematics learning situations may avoid them and thus lose important career and life opportunities (OECD 2004 Learning for Tomorrow's World – First Results from PISA 2003).

Table 7
Level of Engagement in Mathematics of the OBTEC Students when Grouped According to their Attitude towards Mathematics

Engagement	Positive			Moderately Positive		
	M	*SD*	*Interpretation*	*M*	*SD*	*Interpretation*
Behavioral	2.24	0.23	High	2.11	0.21	Average
Affective	2.17	0.20	Average	2.24	0.18	High
Cognitive	2.24	0.33	High	1.86	0.31	Average
As a Whole	2.22	0.19	High	2.07	0.13	Average

Table 8 shows that the level of the learning engagement in mathematics of the students who rated their mathematics instructor/professor as outstanding is high *(M = 2.25, SD = 0.17)* while those who rated their mathematics instructor/professor very satisfactory, satisfactory, and fairly satisfactory is average with the obtained means ranging from 2.03 to 2.20 at standard deviations ranging from 0.17 to 0.26. On the other hand, when dimensions were considered individually, the level of the behavioral engagement in mathematics of the students who rated their instructor/professor as outstanding, very satisfactory, and fairly satisfactory is high while average for those who rated their mathematics instructor/professor as satisfactory. In terms of affective engagement, the level of engagement of the students who rated their mathematics instructor/professor as outstanding, very satisfactory, satisfactory, and fairly satisfactory is average. In the cognitive domain, the level of their engagement in mathematics is average except for those who rated their instructor/professor as outstanding.

According to Lardizabal as cited by Dioneza (2014) the teaching skills of the teacher is manifested in his mastery of subject matter and ability to identify needs, interests, and capacities of the learners and adequately providing for them. The teacher has teaching skills if he or she utilizes varied teaching aids suited to particular topics and teaching techniques that can most effectively be used. Skills in guidance should be seen in the teachers' interest and concern for the students. This can elicit positive and active involvement in the class. Management skills are exhibited by their adequate preparation for the days' learning and activities and performance of routine duties such as correcting of test papers and of the attainment of daily teaching objectives. These reflections are reasons why students are engaged in their mathematics class. They believed that teachers' teaching competencies can elicit students to engaged meaning fully in their classes.

Table 8
Level of Engagement in Mathematics of the OBTEC Students when Grouped According to their Perceptions of the Teaching Competence of their Mathematics Teacher

Engagement	Outstanding			Very Satisfactory			Satisfactory			Fairly satisfactory		
	M	*SD*	*VI*	*M*	*SD*	*VI*	*M*	*SD*	*VI*	*M*	*SD*	*VI*
Behavioral	2.27	0.22	High	2.23	0.21	High	2.05	0.29	Average	2.21	0.22	High
Affective	2.19	0.21	Average	2.17	0.18	Average	2.14	0.18	Average	2.19	0.30	Average
Cognitive	2.31	0.33	High	2.19	0.28	Average	1.90	0.37	Average	1.95	0.44	Average
As a Whole	2.25	0.17	High	2.20	0.17	Average	2.03	0.26	Average	2.11	0.22	Average

Predictors of Learning Engagement in Mathematics

Table 9 indicates that none of the personal factors predicts the behavioral, affective, and cognitive engagement in mathematics of the students. However, other related factors such as instructor/professor teaching competencies (β = -0.30, $t(160)$ = -3.98, $p < 0.01$) predicts students learning engagement in mathematics as a whole and in terms of behavioral engagement (β = -0.19, $t(160)$ = -2.38, $p < 0.02$). Instructor/professor teaching competencies explained a significant proportion of variance in the learning engagement in mathematics ($R^2 = 0.09$, $F(1, 160) = 15.84$, $p < 0.01$). On the other hand, attitude towards mathematics (β = -0.17, $t(160)$ = -2.06, $p < 0.04$) and instructor/professor teaching competencies (β = -0.28, $t(160)$ = -3.51, $p < 0.01$) predict students' cognitive engagement. Attitude towards mathematics explained a significant proportion of variance in the cognitive engagement in mathematics ($R^2 = 0.15$, $F(1, 160) = 13.56$, $p < 0.01$) while instructor/professor teaching competencies explained a significant proportion of variance Instructor/professor teaching competencies explained a significant proportion of variance in the learning engagement in mathematics ($R^2 = 0.12$, $F(1, 160) = 22.42$, $p < 0.01$).

Results in this regard reflect that competencies of instructor/professor handling mathematics can significantly predict how well the students engage in their mathematics class. Likewise student attitude towards mathematics can significantly predict students' cognitive engagement.

Table 9
Summary of Multiple Regression Analysis on Factor Associated to the Learning Engagement in Mathematics of the First Year College Students

Predictor Variable	Beta	SE(B)	β	t	ρ
Behavioral Engagement					
Instructor/professor teaching competencies	-0.05	0.02	-0.19	-2.38	0.02
$R^2 = 0.03$					
Cognitive Engagement					
Instructor/professor teaching competencies	-0.12	0.03	-0.28	-3.51	0.01
$R^2 = 0.12$					
Attitude towards mathematics	-0.23	0.11	-0.17	-2.06	0.04
$R^2 = 0.15$					
As a Whole					
Instructor/professor teaching competencies	-0.07	0.02	-0.30	-3.98	0.01
$R^2 = 0.09$					

VI. Conclusions and Recommendations

The level of the learning engagement in mathematics of the OBTEC students is high. This concludes that they are engage in mathematics. Likewise, they are engage behaviorally and cognitively. OBTEC students in this regard are showing positive conduct; they followed rules and showed compliant behavior. Likewise they show persistence, concentration, attention, questioning, and communicating. Furthermore, since OBTEC students are engaged in the cognitive aspect, this means that they desire to go beyond basic requirement and the desire for the challenges. However, they are not much engaged affectively. In this regard, they are less interested on the subject and they have some anxieties in mathematics.

Finally the study concludes that student attitude towards mathematics and mathematics instructor/professor teaching competencies can significantly predict learning engagement in mathematics. This means that how they develop interest and how they behave in their mathematics class is a reflection of their engagement toward the subject. Likewise, the teaching competencies of mathematics instructors/professors handling mathematics class motivate students to engage meaningfully in their mathematics classes, thus improving their academic performance in mathematics.

In this regard, mathematics instructors/professors are encouraged to develop competencies in the subjects taught. As much as possible, they should have mastery of the subject matter ahead of their students. Likewise, they should use appropriate teaching strategies that would motivate and stimulate students to be more engage in mathematics.

Similarly, students should develop positive attitude towards mathematics. Several studies show that attitude towards mathematics can influence students academic engagement and performance as well.

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