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Outcomes-based Teaching and Learning: A Constructive Alignment of a Mathematics Course for College Students

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OUTCOMES – BASED TEACHING AND LEARNING: A CONSTRUCTIVE ALIGNMENT OF A MATHEMATICS COURSE FOR COLLEGE STUDENTS

A Special Project

Presented to the

College of Graduate Studies and Teacher Education Research

Philippine Normal University

National Center for Teacher Education

Taft Avenue Manila

In Partial Fulfillment of the Requirements for the Degree

Master of Education with Specialization

in Mathematics

By

IRISH MAE G. MAGTAGÑOB

March 2014

APPROVAL SHEET

This special project entitled **"OUTCOMES – BASED TEACHING AND LEARNING: A CONSTRUCTIVE ALIGNMENT OF A MATHEMATICS COURSE FOR COLLEGE STUDENTS"** prepared and submitted by **IRISH MAE G. MAGTAGÑOB** in partial fulfillment of the requirements for the degree of **Master Education with specialization in Mathematics**, is hereby recommended for approval and acceptance.

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A C K N O W L E D G E M E N T

The researcher wishes to express her sincere gratitude, and indebtedness to the following persons who in their special ways, have contributed to the realization of this study:

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Above all, to God Almighty, for his guidance, love, strength, protection and gift of wisdom.

IMGM

I dedicate this paper to the best teachers I have ever known,

Tatay and Nanay, this is for you.

ABSTRACT

Name: Irish Mae G. Magtagñob

Title: Outcomes – Based Teaching and Learning: A Constructive Alignment of a Mathematics Course for College Students

Key Concepts: Outcomes – Based Education (OBE), Outcomes – Based Teaching and Learning (OBTL), Constructive Alignment, Intended Learning Outcomes, Learning Plan, Assessment Task

Degree: Master of Education

Specialization: Mathematics

Adviser: GLADYS C. NIVERA, Ph. D.

The main objective of this study is to evaluate the curriculum alignment and students' learning experience of a mathematics course under Outcomes – Based Teaching and Learning (OBTL). There were 76 respondents in this study. A learning plan for Math 015: Mathematics of Investment was developed and implemented to two sections. The learning activities and assessment tasks were evaluated through self – constructed evaluation tools. A survey form was used to identify the students' perception of the whole learning experience under Outcomes – Based Teaching and Learning. To support the students' perception of their learning experience, an examination was used to assess the learning of the students.

Statistical analysis utilized mean, frequency and percentage. The learning plan and assessment tasks were evaluated as excellent; there is alignment of intended learning outcomes, teaching and learning activities and assessment tasks. The findings revealed that the three components of Outcomes – Based Teaching and Learning (OBTL) were perceived by the students as most influential in their learning. As to the hindrances that affect their learning, two items were identified by the students; first, the phasing of the lesson was too fast and second, the time frame was too short. After the whole experience the students claimed that learning took place, and this was supported by the result of the examination.

It is recommended that further studies should be done that look into the effectiveness of Outcomes – Based Teaching and Learning (OBTL).

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CHAPTER I

THE PROBLEM AND ITS BACKGROUND

Background of the Study

Gone are the days when simple lecture and tutorial in a class work well enough. The drastic change in the educational system is felt worldwide in both basic and tertiary education. Schools and universities are now faced with a challenge on how to cope to this fast changing system.

The change in the system of tertiary education is brought about by two aspects: financial and managerial concerns. The decrease of public funding caused students to pay higher fees which made education a personal benefit. In return, the students are demanding for quality teaching which they believe they have paid for. Just like any corporation, the universities' agenda now is to sell education and to provide for market needs. Thus, the demand now is a new modularized credit-based curriculum, accountability and assurance. This demand calls for benchmarking which will standardize the outcomes of education. Hence, a degree commenced in one university can be completed in another. The outcomes – based system was adopted by universities in many countries to promote education renewal and to answer the demand for quality teaching and increasing call for accountability (Biggs and Tang, 2007).

The Commission on Higher Education is trying to think of ways in order to improve the educational system. In a research made by Riguer (2012) entitled ASEAN 2015: Implications of People Mobility and Services, it is recommended to pursue complementary policies to leverage Filipino human capital for development and global competitiveness to safeguard equity and to enhance institutional efficiency; such competitiveness measures to be improved are quality education and skills upgrading and bridging. According to CHED Memorandum Order (CMO) No. 37 series of 2012, "Quality education today is measured not only by effectiveness, efficiency, sustainability, but also by relevance. Relevance in education would mean addressing the needs of the students and the employers of today and providing the future graduates a curriculum of global comparability."

In preparation for ASEAN 2015 there is a shift in the purpose of education which is to enable individuals to cope with the drastic changes by developing the needed competencies. The ASEAN Economic Community qualifications and QA frameworks are based on learning outcomes. There is a mutual recognition of degrees and diplomas based on learning outcomes in the era of student and labor mobility. In terms of economic development and global competitiveness, the Philippines has lagged behind its neighbors; same thing with the higher education as presented in the 2012 – 2013 Economic World Forum. In the Philippine Education Sector Assessment Project (July 2011), Rizal Buendia shared the 2009 World Bank Philippines Skills report which reveals the very poor employer perceptions of Filipino graduates. According to Buendia's article, graduates of higher education lack basic skills. University graduates

have serious gaps in foundational skills such as problem solving, critical thinking, initiative and creativity. And to a lesser extent, there are also gaps in job – specific technical skills.

In fact, in the 2012 – 2013 Economic World Forum Global Competitiveness Report (Schwab, 2012), Philippines ranked far behind and even farther than the other Asian countries. Given the innovation indicators; 1 being the highest and 144 as the lowest, Philippines ranked 64in the innovation and sophistication factors, 80 for basic requirements and 61 for efficiency enhances where higher education training and technological readiness are the pillars and we ranked 61 and 72 respectively. Philippines ranked 65 in general compared to other Asian countries like Singapore who ranked 2nd, Hong Kong ranked 9th, Japan ranked 10th, Taiwan ranked 13th, Malaysia ranked 25th, China ranked 29th and Thailand on the 38th.

Though we ranked far behind the other Asian countries, Philippines great improvement must be recognized as well. In 2008 – 2009 report, we ranked 85 in basic requirements, 68 in efficiency enhancers, 67 in the innovation and sophistication and an overall rank of 71. But when it comes to scientific output from 2003 – 2011, the Philippines ranked at the bottom compared to other Asian countries which indicates a very minimal growth for 8 years.

These Asian countries who surpassed Philippines in terms of economic growth established a good educational system that is able to stand amidst the changes and effects of globalization, experimenting with new forms of instructional delivery and

recognizing the importance of education in economic and in social development (Higher Education Across Asia: An Overview of Issues and Strategies, 2011). In order to prepare the next generation of Filipinos who will face the more daunting challenges of a world that will change much faster than that in our lifetime, there is a need for renewal and reorganization of our educational system.

The key to success is education. Buendia (2011) recommended that we should have sustained program in building capacities of leaders; that the most important in the education reform agenda is leadership. Educational leaders must confront the educational problems and educational stakeholders must recognize the need for improved sector – wide planning to address key deficiencies across the education sector.

The Commission on Higher Education (CHED) started the move of improving our educational system by setting up guidelines in the establishment of Outcomes – based Education (OBE) system in higher education. In this paper, the researcher intends to evaluate the curriculum alignment and the student's learning experience on a mathematics course under Outcomes – Based Teaching and Learning (OBTL).

Theoretical Bases

A student centered model of teaching is based on two main theories: phenomenography and constructivism (Biggs and Tang, 2007). Phenomenography was

originally used by Sonnemann (1954) in clinical psychology. In the student learning context, it refers to the idea that the learner's perspective determines what is learned, not necessarily what the teacher intends should be. Phenomenography was a term resurrected by Marton (1981) to refer to the theory that grew out of his studies about the surface and deep approaches to learning. Their study explored students' approaches to learning a particular task. Students were given a text to read and were told that they will be asked questions afterwards and they responded in two different ways. The first group learned in anticipation of the questions, concentrating anxiously on the facts and details that might be asked. The students were not able to comprehend the point that the author was making; instead, only a list of disjoint facts was remembered.

On the other hand, the second group went below the surface of the text to understand the meaning of what the author was trying to say. They were able to see the bigger picture and how the facts and details made the author's case. As what Marton and Saljo (1976a, 1976b) put it, the first group used a surface approach to learning while the second used a deep approach to learning. All studies related to this had a common focus and entails the idea that teaching is a matter of changing the learner's perspective, the way a learner sees the world and how learners represent knowledge (Prosser and Tigwell, 1998).

Constructivism on the other hand has a long history in cognitive psychology (Piaget,1950). At present, it takes on several forms: individual, social, cognitive and postmodern (Steffe and Gale,1995). The emphasis of this theory is that the learners

construct knowledge with their own activities and building on what they already know. Teaching in this sense is not a matter of transmitting but of engaging students into active learning and constructing their own knowledge in terms of what they already understand. In hermeneutic constructivism, meaning is defined as hermeneutically informed understanding which is based on how learners make sense of their experiences (Champlin – Scharff, 2010).

Both of these theories agree that effective learning changes the way we see the world and that education is about conceptual change, not just the acquisition of information. Conceptual change takes place when it is clear to both teachers and students what the intended learning outcomes are. Second, when the students experience the felt need to get there. Third, when students feel free to focus on the task. Fourth, when students work collaboratively and in dialogue with others. Furthermore, interactions in the collaborative activities lead students to creating knowledge. When knowledge is communicated, the learning becomes deeper (Biggs and Tang, 2007). This leads to another theory which is sociocultural or collaborative learning theory.

In conceptualizing outcomes-based teaching and learning, phenomenography and constructivism work well. That is the reason why intended learning outcomes should be stated as clearly as possible and their attainment monitored through teaching and learning activities that leads to active learning. Outcomes-based Education (OBE) has been widely used worldwide by different universities; each has their own version,

understanding and implementation which brought immense confusion and conflict. Basically, OBE has three versions (Biggs and Tang, 2007). The first version is by William Spady which is known as the Spady model (Spady, 1994). He proposed an individualized programme for disadvantaged school students that he called “outcome-based education”. In his version, he set up a target for each student to reach so that all could achieve some sort of success instead of teaching the standard disciplines. His targets included a values component of a general humanistic kind which later on was opposed by some Christian fundamentalists believing that it is not the school’s responsibility. This version was picked up and adopted by many but eliminating some of the values outcomes. Aside from that, some made a mistake of designing cross-disciplinary targets without “basics” and using some sort of postmodern management-speak that were not understood by most parents and teachers.

The second version of OBE comes from the accountability movement in the USA (Ewell 1984; Miller and Ewell, 2005). In this version, outcomes are at the institutional level. These outcomes statements were constructed with the aid of an ‘enormous’ template comprising four dimensions and 12 sub-dimensions: knowledge outcomes, skills outcomes, attitude / value outcomes and relationships with society and particular constituency outcomes.

The third version of OBE is the outcomes-based teaching and learning (OBTL), which had its seeds in the Dearing Report (1997), where outcomes are defined specifically to enhance teaching and assessment. Its essential features are that, first;

the intended learning outcomes of teaching a particular course or programme are stated. Second, teaching should be done in such a way to increase the likelihood of most students in achieving those outcomes. Third, it is using an assessment task that requires the student to perform the intended outcome itself. The three essential features of OBTL is also known as constructive alignment which is the means of enhancing teaching and learning.

Conceptual Framework / Paradigm

In consonance with the never ending search for an effective teaching strategy, educators came up with different methods that will develop essential understanding. Outcomes based teaching and learning is perceived by most educators as the answer to the challenges faced by our educational system.

Commission on Higher Education (CHED) started the move by directing universities, colleges and institutions to implement OBE. Constructive alignment is the realization of Outcomes - Based Teaching and Learning (OBTL). In the constructive alignment, learning objectives are clearly stated and the exam measures precisely those learning objectives. After which, the teacher must choose the appropriate teaching and learning activities to develop those skills and competencies during the course. This theory of constructive alignment developed by John Biggs, as illustrated in

figure 1, explains the essential features of OBTL (Biggs, 2007). This conceptual paradigm was adopted and enhanced by the researcher.

Outcomes – Based Teaching and Learning (OBTL), as defined in CHED's Memorandum Order #37 series of 2012, is the constructive alignment of intended learning outcomes with appropriate outcome – based assessment methods and teaching and learning activities. Figure 1illustrates the alignment of the basic features of OBTL.

The figure focuses on the intended learning outcomes (ILO) which is anchored to teaching and learning activities (TLA) and assessment task (AT). The connection among those essential elements is the so called constructive alignment developed by John Biggs.

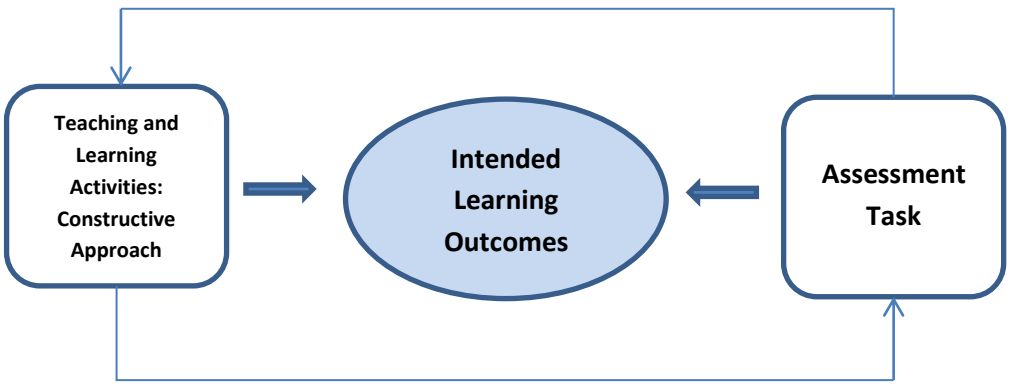

Figure 1. The Constructive Alignment

Biggs and Tang (2007) discussed the meaning of constructive alignment in two different aspects: in terms of student's role and teacher's role. In terms of the student's role, alignment is about getting students to take responsibility for their own learning and establishing trust between student and teacher. On the other hand, the teacher's role in the alignment is to create an environment which is encouraging and supportive of students engaging in the appropriate and necessary mental activity.

There are two parts of constructive alignment; the students construct meaning from what they do to learn and the teacher align the planned learning activities with the learning outcomes. The first figure is the basis of the following three figures. The next figures are different situations and adaptations of curriculum alignment. Figures 2 and 3 will illustrate how two classroom situations differ in terms of the alignment of the activities with the objectives and assessment while figure 4 is the framework of the concept, methods and procedures of this research.

The following diagrams describe two situations happening in a classroom at a particular course. These two diagrams are adoptions of how John Biggs (Biggs and Tang, 2007) described an unaligned curriculum and an aligned curriculum. Figure 2 is the unaligned curriculum which is called the "dealing with the test" situation. Notice that in the diagram, the teacher's intentions differ from the exam's assessment and student's activity. For example, the teacher's intentions were to develop a particular set of skills then the exam measures something else; as a result, the student will focus on the skills

required for the test disregarding the teacher's intention. The next diagram is an example of unaligned course.

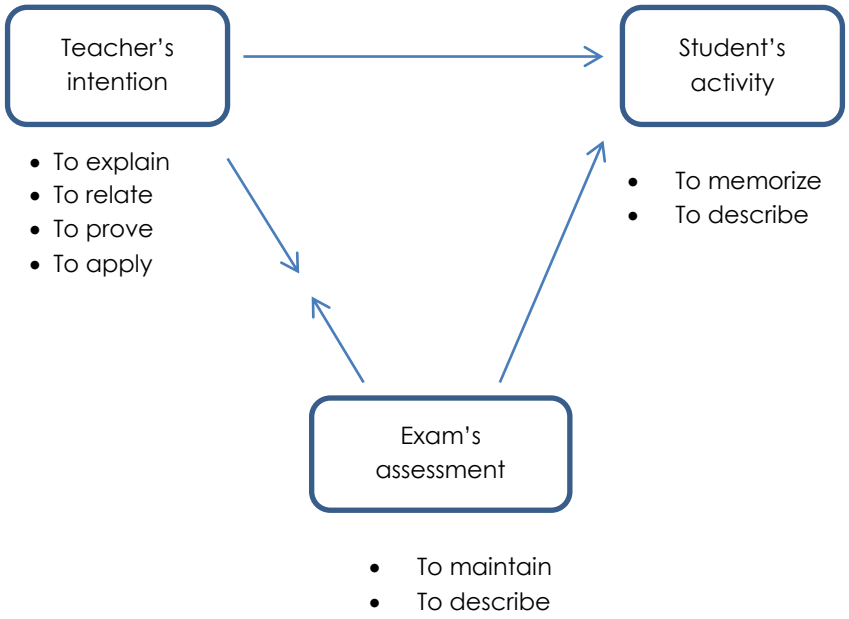

Figure 2. The "Dealing with the Test" Curriculum

Figure 3 illustrates how a particular course is properly aligned. The exam explicitly conforms to the teacher's intentions. In this curriculum, the teacher has carefully aligned the exam with the learning objectives and student activities. As a result, the students will end up learning what the teacher has intended. This figure describes the constructive alignment of a learning plan.

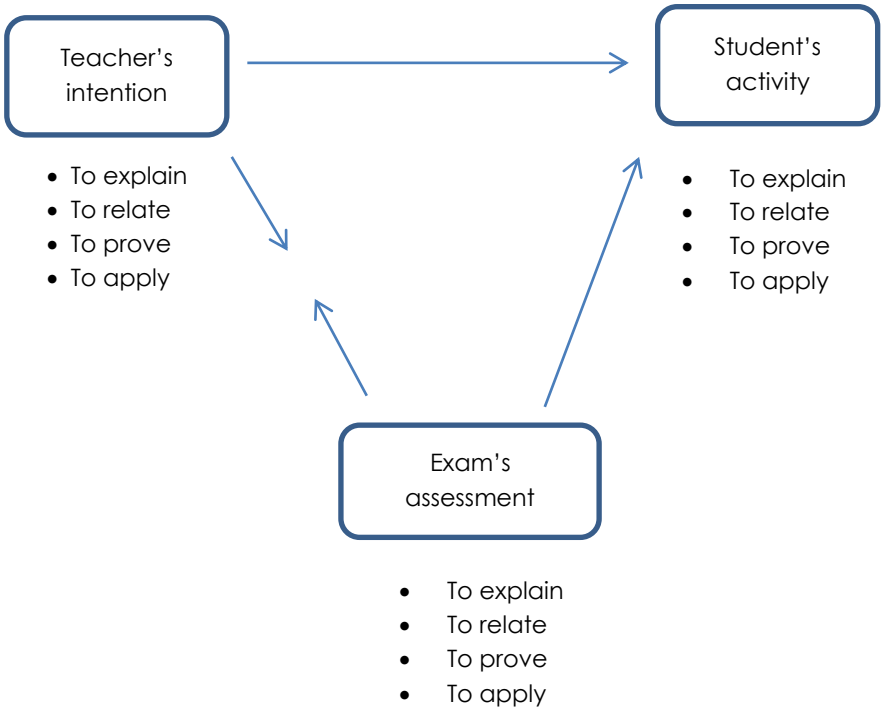

Figure 3. The Aligned Curriculum

This is how John Biggs (2007) illustrated constructive alignment. Notice that the objectives of the three basic components of OBTL are exactly the same. There is an alignment of the teacher's intention, the teaching and learning activities and the assessment.

With all of these, the researcher decided to focus her study on the students' perception of Outcomes – Based Teaching and Learning (OBTL) and the evaluation of the learning plan she created. Figure 4 illustrates the conceptual framework of this study.

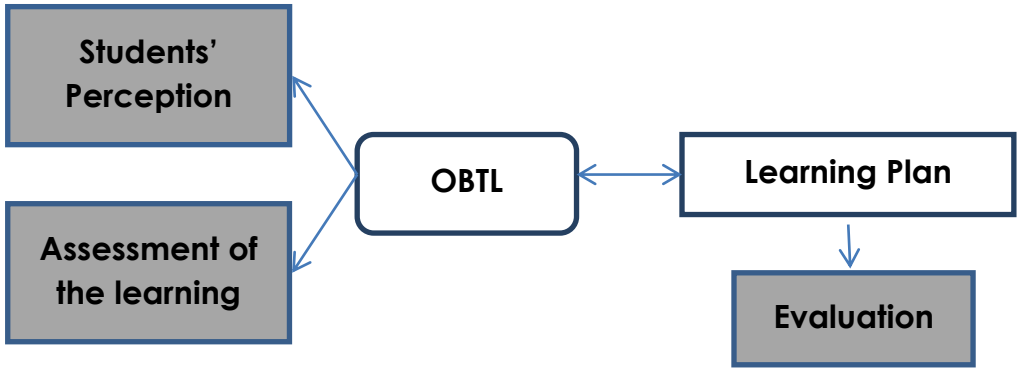

Figure 4. The Conceptual Framework

Figure 4 explains the objectives and procedures of this study. The learning plan was created based on the features of OBTL which will be evaluated and implemented. After the implementation, students' perceptions of the whole learning experience under OBTL will be gathered and will be assessed through survey and examination.

An arrow connecting OBTL and learning plan indicates oneness of the concept (OBTL) and the output (learning plan). The arrows pointing to evaluation, students' perception and assessment of the learning indicates the procedures and data to be collected in this study.

Statement of the Problem

This study aims to evaluate the curriculum alignment and the student's learning experience on a mathematics course under Outcomes – Based Teaching and Learning (OBTL). This paper seeks to answer the following questions:

1.) What are the students' perspectives of the whole learning experience?
    a. What are the factors that helped them understand the lessons?
    b. What are the factors that hindered them in understanding the lesson?
    c. What is their assessment of the learning that they have experienced?
2.) What is the assessment of the students' performance after the whole learning experience?
3.) Were the assessment tasks in line with the intended learning outcomes and teaching learning activities?

Setting of the Study

The respondents of this study are students of Malayan Colleges Laguna (MCL), one of the emerging colleges in the south that is starting to make a name with its ratings in the licensure examinations for the past two years. The respondents of this research are students enrolled in the following programs: Accountancy,

Entrepreneurship, Information Technology (IT), Tourism Management (TM) and Multimedia Arts (MMA), taking a basic math course which is Mathematics of Investment (Math 015). The said course was taken during the second term of the school year 2013 – 2014. Two sections, heterogeneous in nature, were chosen by convenience and were handled by the researcher and a partner instructor.

Scope and Delimitation

This descriptive research aims to evaluate the curriculum alignment and the student's learning experience on a mathematics course under Outcomes – Based Teaching and Learning (OBTL). The study started with the development of a learning plan (see Appendix A) based on the existing syllabus (see Appendix K). The teaching and learning activities and assessment tasks in the learning plan were aligned to the intended learning outcomes written in the syllabus. After evaluation, the learning plan was implemented. The students answered a survey form (see Appendix D) at the end of the term to identify their perspectives and to evaluate their learning experience. In order to assess the students' performance, the researcher tallied the frequency of errors of the multiple choice part of the final examination (see Appendix I). The school's policy on the procedures of the final examinations was followed.

Significance of the Study

This research will be beneficial to the following:

- **Teachers / Instructors / Professors**. This research will guide the teachers on how they will effectively utilize the learning activities to develop essential understanding. The results of this research will give the teachers an idea on how the students will respond to the activities for them to effectively plan their own learning activities.

- **Students**. This research aims to evaluate OBE in order to come up with a better curriculum to help the students.

- **Administrators**. The coordinators, deans and administrators will know the students' perspective on OBTL. Furthermore, they will be able to assess how the teacher implemented the activities and how the students reacted to it which will be their guide in making decisions on how to implement OBE in their respective colleges or universities.

- **Educational Policy Makers**. This paper is beneficial to them because the results provide baseline information and insights about OBTL. In particular, it provides insights into how the students responded to OBE to further improve

the curriculum. It serves as a guide for them to make rational decisions on assessment of student's progress and development.

- **Curriculum Developers and Writers**. The result of this study is a potential source of information that will guide them in curriculum planning and enhancing academic programs to improve the educational system.

- **Other Researchers**. This research may be used by other researchers to conduct similar studies in other level and areas.

Definition of Terms

The following terms are defined in this study as follows:

Assessment – One or more processes that identify, collect, analyze and report data that can be used to evaluate achievement of the program educational objectives and program outcomes (CHED Memorandum Order # 37, Series of 2012).

Assessment Task (AT) – It is the portfolio required items that addressed each intended learning outcome (Biggs and Tang, 2007). In this study, the assessment tasks used are the following: quizzes, long exams, projects and final examination.

Constructive Alignment – It is a principle used for devising teaching and learning activities and assessment tasks that directly address the learning outcomes intended in a way not typically achieved in traditional lectures, tutorial classes and examinations (Biggs and Tang, 2007). In this study, it is the alignment of intended learning outcomes with appropriate outcomes – based assessment and teaching and learning activities.

Intended Learning Outcomes (ILO) – These are statements written from the student's perspective, indicating the level of understanding and performance they are expected to achieve as a result of engaging in the teaching and learning experience (Biggs and Tang, 2007). In this study, the intended learning outcomes are the learning objects indicated in the syllabus (Appendix K).

Outcomes Based Education – It is a comprehensive approach to organizing and operating an education system that is focused on and defined by the successful demonstrations of learning sought from each student (Biggs and Tang, 2007).

Outcome Statement – It is a statement of how we would recognize if or how well students have learned what is intended (Biggs and Tang, 2007). In this study, the outcome statement in the learning plan is adopted from the syllabus (Appendix K).

Teaching and Learning Activity Plan (TLA) – It is a plan of activities to be done to meet the intended learning outcomes (Biggs and Tang, 2007). In this study, the teaching and learning activity plan (Appendix A) was developed by the researcher which will be implemented and evaluated.

CHAPTER II

REVIEW OF RELATED LITERATURE

This chapter discusses the theories, and researches related to this study. The literary works were carefully studied to come up with a relevant concept. Theories related to Outcomes –Based Education were discussed, students' perceptions on different teaching strategies were interpreted, students learning styles were identified and implementation of OBE was evaluated in this chapter.

Constructivism

Constructivism is the root of OBTL. It is the educational philosophy that inspired the proponents of OBTL to come up with an educational curriculum. Constructivism has a long history in cognitive psychology (Piaget ,1950); it takes on several forms: individual, social, cognitive and postmodern (Steffe and Gale, 1995). The emphasis of this theory is that the learners construct knowledge with their own activities and building on what they already know. Teaching in this sense is not a matter of transmitting but of engaging students into active learning and constructing their own knowledge in terms of what they already understand. Many researchers tried to prove that constructivism, in any form, whether in basic or tertiary education is the most effective way of teaching compared to the traditional view of teaching which is the lecture – based method.

Constructivism is a modern way of a learning process where the students play an active role in learning. Many researches favored studies related to constructivism. A research by De Caprariis, Barman, & Magee (2001) concludes that lecture leads to the ability to recall facts, but discussion produces higher level of comprehension. The discussion described in this study is the student's ability to communicate their knowledge.

Cooperstein and Kocevar - Weidinger (2004) defined a constructivist learning in four general aspects. First, learners construct their own meaning; from being passive, students learn to manipulate, discover and create knowledge. Second, new learning builds on prior knowledge; students must make connections between old knowledge and new information. They must learn to compare and question, challenge and investigate, accept or discard old information and beliefs in order to progress. Third, learning is enhanced by social interaction. Constructivist process works best in social settings as students learn to share and compare ideas with others. Fourth, meaningful learning develops through "authentic" tasks; activities are chosen to stimulate those that will be encountered in real life.

These aspects described by Cooperstein and Kocever – Weidinger are very much parallel to the theories believed by the proponents of Outcomes – Based Education as cited in the book Teaching for Quality Learning at University (Biggs and Tang, 2007).

In a constructivist view, the teacher has a very big role in the learning process. In an article published by International Education Studies, Jia (2010) discussed the implication of constructivism teaching theory on China's basic education, teachers not only students must change their views about learning. The article also discussed the implications of traditional teaching and constructivist approach. In the traditional teaching mode, teachers explain, analyze, and introduce too much and students receive knowledge passively. They have few time and space for thinking. The traditional mode neglects students' practicing process and just input fixed things into students. As a result, students will refuse to think by themselves. This method of taking teachers' teaching as the center is not good for developing students' potentials and their development.

In contrast, constructivism agrees that learning is initiative and positive. In learning, students are the subject of teaching. Without students' initiative participation, the learning is meaningless. In teaching, teachers are the subject of teaching. Teachers mean to inspire and guide students to learn knowledge effectively.

Constructivism learning theory is the further development as behaviorism arrives at cognitivism (Jia, 2010). Knowledge is uncertain. The learning process of knowledge is the construction process of knowledge. Students construct knowledge on their own initiatives. They are the main body of the learning activity. Jia (2010) further explained in the said article that in the same concept, teachers are the drivers and helpers for

students to construct knowledge. These views or theories generate implications for China's reform.

In relation to OBTL, the teachers are challenged to be creative in their strategies and methodologies. Activities should direct the students to learning and not the other way around. Biggs and Tang (2007) even listed the components of a good learning plan where teaching and learning activities are creatively designed for students to develop learning on their own.

Theory of Hermeneutics

Champlin-Scharff (2010) introduced Heidegger's theory of hermeneutics as "a hermeneutically informed understanding involves recognition of the idea that meaning is not something contained "out there" in the world, but is ultimately dependent on how one makes sense of what is experienced. Meaning is not an objective property to be uncovered but the result of individual interpretation".

OBTL in particular is proposing the utilization of experiences for students to learn; from setting up realistic and doable objectives to designing a learning plan that will enable students to discover ideas and learn from experiences and interactions (Biggs and Tang, 2007). In relation to that theory, Tyler(1949) once said that learning takes place through active behavior of the students; it is what he does that he learns,

not what the teacher does. That is the reason why in OBTL, teachers are encouraged to create activities which will lead the students to become active learners.

Sociocultural Theory / Collaborative Learning Theory

Aside from constructivism, another theory which has been studied by psychologists is the sociocultural theory or activity theory which is about the influence of the social world on an individuals' development (Vygotsky, 1978, 1981). Wilson and Peterson (2006) described this theory in two principles; the first principle in this theory is that knowledge is inseparable from practice: we know by doing. We need to look at people while they are doing something if we want to "see" what they know. Second, learning is fundamentally a social phenomenon that takes place within the communities we belong. These two principles led the idea that knowledge and learning exist in the interactions between individuals, the contexts in which they live in and activities they participate in. Thus, "learning communities" becomes critical to learning (Wilson and Peterson, 2006).

Gokhale (1995) examined the effectiveness of individual learning versus collaborative learning in enhancing drill-and-practice skills and critical thinking skills. The study was conducted among undergraduate students of industrial technology enrolled in Basic Electronic course at Western Illinois University. The treatment comprised of two parts: lecture and worksheet. The researcher delivered a common lecture to both treatments, and then one section was randomly assigned to the

individual learning group while the other was assigned to collaborative learning group and the same worksheet was given to both groups. In the individual learning group, the task was first explained to the students and then they worked by themselves at their own level and rate. After 30 minutes, students were provided with a sheet where answers and solutions to the questions were written. The participants were given time to compare their answers with those on the solution sheet. After which, the participants were given a post test.

In the collaborative learning group, the task was first explained to the students and then the instruction sheet where key elements of collaborative process were pointed out was distributed to the students. The students were encouraged to communicate their ideas and solutions to the problem. Each member was given the opportunity to share his or her own thoughts, and then the group will compromise until they come up with a solution. After 30 minutes, students were provided with solutions and answers to the problem. They once again discussed the correct solutions and answers with group and together they compared it with their answers and a post test was given after the activity.

In the findings, there is no significant difference in an achievement test comprised of drill-and-practice between students learning individually and students learning collaboratively. But, there was a significant difference in an achievement test comprised of critical-thinking items between students learning individually and students learning collaboratively. The researcher concluded that collaborative learning fosters

the development of critical thinking through discussion, clarification of ideas and evaluation of other ideas.

The researcher finds this study of Gokhale relevant since OBE recognizes the importance of collaborative learning in developing “deep understanding”. The interactions in the collaborative activities prepared by the teachers will lead the students to creating knowledge on their own, furthermore, if that knowledge will be communicated to others, the deeper the learning becomes (Biggs and Tang, 2007). Bruner (1986) contends that cooperative learning methods improve problem solving strategies since students are confronted with different interpretations and ideas of the given situation. The peer support system makes it possible for learners to internalize both critical thinking skills and external knowledge and convert them into tools for intellectual functioning.

Another research on group-oriented discussion methods has shown that team learning and student led discussions not only produce favorable student performance outcomes, but also foster greater participation, self-confidence and leadership ability (Perkins & Saris, 2001; Yoder & Hochevar, 2005). These abilities acquired by the students will equip them to become professionals and team leaders in their respective work place in the future.

On students' perception on different teaching strategies

Many educators believed that constructivism as a theory is the root of the different effective ways of teaching that develop essential understanding, but learning in its sense still depends on the students. The students' perception on those teaching strategies somehow affects their learning. In support to that statement, the researcher tried to find evidences related to that claim.

Studies have been made on how the students perceive constructivism in different ways. They were able to justify how it affected the students learning experiences. A study by Qualters (2001) suggests that students do not favor active learning methods (constructivism) because of the in-class time taken by the activities, fear of not covering all of the material in the course, and anxiety about changing from traditional classroom expectations to the active structure. This point of view was reflected on other researches especially if change was done abruptly from traditional to constructivist. A research by Casado (2000) examined perceptions across six teaching methods: lecture or discussion, laboratory work, in – class exercises, guest speakers, applied projects, and oral presentations. Though most students preferred the lecture/discussion method the other strategies like laboratory work, oral presentation, and applied projects were also favorably regarded.

On the other hand, Hunt and colleagues (2003) noted the favorable student attitudes towards active learning methods. They say that the best way to learn is to

enjoy what you do, that is why these students favored the activities that they enjoy doing. This is what challenged most of the teachers now a days; how to motivate the students to learn. With the presence of a lot of distractions, how will you effectively engage the students to the activities in order for them to learn?

In a research made by Carpenter (2006) about the perception of the students in a large class, different approaches were investigated to find out the most effective method in teaching a large class size. Five teaching methods were employed: Jigsaw, Case Study, Lecture, Lecture – Discussion and Team Project. The researcher suggests that a moderately-active learning method such as the jigsaw method is more effective than the lecture, lecture/discussion, and case study methods. However, more extreme active learning methods such as team projects completed outside of class may not be as effective as moderately-active or passive teaching methods.

A study made by Ya – Ching Chang (2010) found that there is no significant difference between students' perceptions of teaching styles and learning strategies used. The study was conducted to investigate Taiwanese junior high school students' perceptions of their teachers' teaching styles and the students' own use of learning strategies and to determine if there was a significant relationship between perceived teaching style and learning strategy use. The data for this study were gathered from a sample of 95 junior high school students enrolled in four Chinese language classes at Yuanlin Junior high school. The students completed the Junior High School Teacher's

Teaching Style Questionnaire and the Taiwanese version of the Motivated Strategies for Learning Questionnaire.

The findings from this study led to the following conclusions: (1) the students preferred to use learning strategies that enabled them to use time well and choose environments conducive to learning. Moreover, they preferred to seek assistance from their teachers or classmates when encountering learning difficulties; (2) gender differences in learning strategy use were not significant. Among nine learning strategies, male and female students both exhibited more use of strategies for Effort Management, Help-seeking, and Time and Study Management; (3) the dominant teaching style, as perceived by the students, was indifference; (4) the results revealed that there were no significant relationships between students' perceptions of teaching styles and learning strategy used.

Soliven (2004) researched on the relationships of mathematics performance to the following aspects: attitude towards mathematics, teaching and learning and perception of students towards teaching and learning. The study was conducted to 200 students of Eastern Pangasinan Agricultural College for SY 2003 – 2004. The findings and conclusions of the exploratory study were as follows. One, there was a moderately small significant relationship between math performance and attitudes of the students; attitude that the students holds towards mathematics teaching and learning in some ways can affect their performance in mathematics. Two, perception towards mathematics teaching and learning influence the way students perform in their

mathematics class. Three, attitude and perception of the students towards mathematics teaching and learning affect each other in some point.

These findings led Soliven to the following recommendations: first, teachers must develop positive attitude among students. Second, interesting way of teaching enhances favorable attitudes towards the subject. And third, teachers must select various strategies suited to the students' level of understanding to develop favorable perception towards mathematics teaching and learning.

Hughes (2009) researched on students' perception of teaching styles in mathematics learning environment. The participants of the study were 117 students in three different sections of a pre-calculus class. The different sections were randomly assigned to experimental and control conditions with two instructors assigned in experimental condition and one to the controlled condition. The teachers assigned in the experimental condition employed a teaching style that incorporated a frequent use of questioning designed to engage students, provide greater opportunities to learn and improve their understanding of the concepts. It also involved more examples in "real world" contexts. However, the teacher assigned in the control condition used traditional approach. The students' perceptions were gathered through a survey questionnaire which they answered at the end of the semester.

Hughes concluded that there were no significant differences in students' perceptions of the amount of interaction that occurred between themselves and their teachers across experimental and control sections of a pre-calculus class. But when

asked of their preferred teaching style, 98.3% of the students surveyed preferred a teaching style that has “some interaction” or is “mostly interactive”. Even if the result has no significant difference, the researcher was surprised when students in the control section, 100% responded that they would prefer some type of interaction in a future mathematics class.

In a research made by Flegg, Mallet and Lupton (2011) on students’ perceptions on the relevance of mathematics in engineering, five (5) curriculum issues raised by their respondents which are engineering students were discussed. First issue is the difference in perceived importance of mathematics within different engineering majors. Coupland, Gardner and Carmody (2008) found out the difference of students’ perception of mathematics between engineering majors, according to them, mechanical engineering students appear to see the relevance of mathematics more than the other engineering fields. Second issue raised by the students is the difficulty in seeing the relevance of mathematics in future studies. It has been found out that first year engineering students cannot appreciate yet the connection between their experiences to their soon to be engineering subjects.

Third issue raised by the students is about problem solving tasks; it is believed that the most effective way to teach mathematics to engineering students is in terms of concepts that they already understand and relating those concepts in real life. Fourth, is the relevance of formal/rigorous mathematics; the students in this study were learning mathematics from mathematicians in a unit alongside undergraduate mathematics

students and they were able to see the value of learning mathematical rigour in this context. Fifth issue is the assessment in engineering mathematics which was heavily weighted on the final examination. Students in this study thought that final examination may not be the most appropriate assessment for engineering mathematics subjects.

In relation to the researcher's study, those were the same issues that Outcomes – Based Education was trying to address. Students have to see that relevance of their courses in order for them to be interested in learning. They have to see the relevance of their lessons in real life for them to appreciate the importance of learning.

On students' learning styles

In an editorial written by Evans and Cools (2009), they explained that a styles approach is not about adapting instruction to every student's needs in all situations; it is about having at the core of curriculum design, an understanding of the importance of individual differences and an awareness of how different ways of teaching can impact differentially on students with specific styles profiles. It simply explains the reason why no matter how good the teacher is, how excellent the delivery of the lesson is in spite of a very good and inter – active learning activity, some of the students still were not able to grasp the concept; because it simply do not suit their learning styles; third of the most important factors that an educator must consider in planning their Teaching and Learning Activities.

The term learning strategy refers to the implementation of a set of learning tactics or procedures for learning (Schmeck, 1988). Individuals through their underlying cognitive styles adopt specific strategies within learning contexts (Riding, 1997). The complex relationships between styles and strategies is touched upon by Schmeck (1988) who argues that style partially influences approach and approach determines the learning outcome which in time may change style. A personal learning style on the other hand includes a range of cognitive and learning styles and strategies. This involves cognitive; thinking and knowing, motivational and affective; mood, feelings and physiological behaviors which is associated with preferred working environments, approaches to studying and learning processes (Evans &Waring, 2009). In order to come up with an effective plan or strategy, an educator must know how his / her students learn.

Broadfoot (2008) highlighted this central need for universities to pay more attention to how students learn and how best to teach them. She argues that universities have been backward in recognizing the need to understand the learning process itself, and thus how they can best teach and support their students (Attwood, 2008) and that crucially important dispositions such as ‘knowing what to do when you do not know what to do’, a central feature of a Personal Learning Styles Pedagogy (PLSP; Evans & Waring, 2009) are being squeezed out. Furthermore, the need to abandon ‘ineffective pedagogies’ (Broadfoot, 2008) in favor of new technologies more suited for the ‘digital natives’ of Generation Y (Shaw & Fairhurst,2008) is required.

These are the essential features of Outcomes – Based Teaching and Learning. Educational world is opening up to the importance of understanding the various ways students learn and recognizing the vital role this plays in attaining widespread academic success (Collinson, 2000). Spady (1994) defines OBE as a comprehensive approach to organizing and operating an educational system that is focused on and defined by the successful demonstrations of learning sought from each student. Education is aimed at creating teaching and learning environments that would bring about desired changes in learners; whether to be more knowledgeable, better skilled or to influence attitudes and values positively.

On the implementation of Outcomes – Based Education

Spady (1993) defined outcome as a culmination demonstration of learning; it is what the student should be able to do at the end of the course. OBE is an approach to education in which decisions about the curriculum are driven by the learning outcomes that students should display at the end of the course. These include curriculum content, educational studies, student selection and assessment. In OBE "product defines process" (Harden, Crosby & Davis,1999).

Outcome – based education is one of the most significant global developments in medical education in recent years. Many medical schools have identified outcomes for their curricula (Pales, Cardellach, Estrada, Gomar, Pons & Bombi, 2004). Several medical schools published their case study on how OBE was implemented. Here are

the case studies presented by Davis and colleagues (Harden, Crosby & Davis, 1999) of the four medical schools who started and implemented outcomes-based education.

University of Dundee

The University of Dundee medical school in Scotland, UK moved to outcomes – based education in 1997 (Harden,1999). The outcomes provide the framework of the students' learning from day 1 until graduation and even beyond in postgraduate. The range of teaching and learning methods is employed in the medical school and the emphasis of the educational process is shifted to the product of curriculum. There are individual exams which are blue printed on the outcomes and course content. The final exam is a portfolio assessment, which provides the holistic approach to assessing the individual students' achievement of the appropriate standard in every outcome (Davis, Friedman, Harden, Howie, Ker, McGhee, Pippard & Snadden, 2001).

The change of process in the curriculum of the University of Dundee brought an amount of work to the faculty and administrators, but the curriculum evaluation has been positive which encouraged continuation of the outcomes-based approach. Dundee medical students had the highest level of confidence among other UK medical students which is attributed to how their medical school education prepared them well (Goldacre, 2003). This has made all the efforts of the faculty and administration of Dundee medical school worthwhile. With the success achieved by the University of Dundee, it becomes one of the living witnesses on how OBE works effectively.

Mayo Medical School (MMS)

The Mayo clinic is a non-profit academic health centre with integrated medical campuses in Minnesota, Folrida and Arizona. The Mayo Medical School (MMS) was established in 1972. It has defined specific learning outcomes and initiated a major curriculum redesign to ensure that their graduates will achieve critical outcomes such as mastery of knowledge, cognitive skills and technical competency (Harden, 1999; McNeil, 2006). The major goal of this curriculum reform is to transform a course-based curriculum to a block-structured curriculum which integrates basic and clinical sciences and employing student centered learning modalities. They were able to identify critical themes which require a longitudinal presence throughout the curriculum. The critical themes identified are: scientific foundations of medical practice, clinical experiences, leadership, physician and society, and pharmacology and principle of therapeutics. Committees were organized to define the learning outcomes and ensure that the themes are represented throughout the curriculum (Davis, 2007).

The mentorship program of MMS is the key feature of their revised curriculum. Every student is assigned to a mentor prior to matriculation; the mentor then facilitates student transition to medical school, provides opportunities for early clinical exposure and provides resources needed for the achievement of curricular objectives. MMS believed that their revised curriculum based on specific and accessible outcomes will facilitate integration of basic clinical sciences, promote flexibility and embrace innovation that is essential for continued viability of their educational structure (Davis,

Friedman, Harden, Howie, Ker, McGhee, Pippard & Snadden, 2001). Innovation is central to the long term success of any curriculum; it requires an understanding of the institutional culture (Dowton, 2005).

Aga Khan University

Aga Khan University (AKU) was the first private university in Pakistan in 1983 with campuses in Asia, Africa, and Europe. This university is committed to excellence in education, research and service. AKU medical college aims for international standards and relevance to national health needs. By the end of their five year curriculum, students should be able to demonstrate achievement AKU's professional attributes and competencies. Their curriculum has four major goals which are: to address problems of primary health care; to acquire clinical competence in primary care and hospital settings; to gather, evaluate and generate new knowledge; and to be prepared for further training and various clinical and non – clinical specialties (Smith & Dollase, 1999). AKU has a tradition of curricular review and a task force was established for planning a student centered curriculum from April 2000 to September 2002. The task force identified strategies to meet unmet attributes, incorporating exit and enabling objectives and disseminated these widely to ensure that the students and faculty knew which outcomes were to be achieved and to what extent each year.

In AKU, students learn through multiple methods such as lectures, tutorials, community visits, practicals, student presentations, clinical and communication skills sessions, workshops and by being active members of health teams. Assessment on the other hand is multimodal with contextual integrated assessment of knowledge. To maintain the university's international standards, they recently invited a team from Canada, USA, Pakistan and Malaysia for program review to be conducted according to liason committee for medical education standards (Liason Committee for Medical Education of 2004). These achievements will not be possible for AKU without the supportive an enlightened leadership of committed faculty qualified in medical education; adequate planning; faculty development; perseverance and extensive faculty and student involvement (Davis & colleagues, 2001).

Yong Loo Lin School of Medicine

Yong Loo Lin School of Medicine proposed a broad outcome of the curriculum which is to produce graduates who are competent as house officers and have the foundations to become competent specialist clinicians. This proposed curriculum is based on the principle of student centered, self–directed and lifelong learning; horizontal and vertical integration; planned repetition of content and skills with increasing complexity; and valid and reliable assessment that supports student learning. It intends to provide greater clinical relevance and more meaningful patient contact.

In the said curriculum of Yong Loo Lin School of Medicine, teaching and learning methods will be mixed with appropriate use of self-directed learning, small group tutorials, interactive sessions and didactic method. Information management and literacy that will go beyond information gathering will be given greater emphasis. Assessment on the other hand will be matched against the learning outcomes and will support student learning. Assessment will be progressive where components of earlier phases could be tested in succeeding years. Examinations will be in written and performance-based multi-station examination formats. The proposed elective period will allow students to pursue clinical electives, do research, and pursue community service or gain insights and experience into public health policy.

As a summary of the four medical school's case study report on OBE, Harden (Davis, Friedman, Harden, Howie, Ker, McGhee, Pippard & Snadden, 2001) described them as beavers who worked assiduously to successfully transform their curriculum. Successful transformation of the curriculum to OBE of these four medical schools involves realignment of infrastructural support and committee structures to support the new integrated curriculum design. Knowledge about the approach, wide staff consultation and buy in are essential for success of the curriculum's implementation. Leadership backed up by expertise in medical education, adequate planning, financial resource, persistence and willingness to take feedback are the important requirements for beavers in implementing OBE (Davis, Friedman, Harden, Howie, Ker, McGhee, Pippard & Snadden, 2001).

These case studies of medical schools presented by Davis et al. (Davis, 2007), on how they planned and implemented the reform of their curriculum; anchoring outcomes-based education, were found by the researcher to be very relevant to her research. The literary resources on OBE presented in chapter I was validated by these studies. It is now proven that OBE is not just an "ideal" curriculum which is too good to be true, but rather a "reality" when started to put into action. All four schools have one thing in common; the desire to improve the educational system. And that desire leads them to reform, organize, plan and eventually implement an outcomes-based curriculum.

On Philippines implementation of OBE

CHED Memorandum Order (CMO) No. 37, Series of 2012 explains the policies and guidelines in the establishment of an Outcomes – Based Education (OBE) system in higher education institutions offering engineering programs. This policy is in accordance to Republic Act (RA) No. 7722, known as the "Higher Education Act of 1994," by virtue of Resolution No. 198 – 2012 of the Commission *en banc* dated July 25, 2012. The purpose of transforming engineering education into an outcomes – based system is in order to meet the demands of global equivalency of quality standards in engineering programs and to promote continuous quality improvement in higher education institutions (HEIs).

The rationale of this policy is belief that Quality education measured not only by effectiveness, sustainability and efficiency, but also by relevance. It would mean addressing the needs of the students and providing future graduates of global comparability. According to the said Memorandum Order, six (6) countries, represented by their engineering professional societies, signed the Washington Accord (WA) in 1989, defining common standards for equivalency among their graduates of engineering programs.

Washington Accord is an international accreditation agreement for professional engineering academic degrees. Signatories agreed that graduates from their accredited engineering programs shall be mutually recognized among their countries as having met the academic requirements for entry to practice engineering. Since 2000, accreditation standards among members of WA have shifted from Input – Based to an Outcomes–Based Education system (OBE). The focus is for the institutions to demonstrate that their engineering graduates have met an acceptable level of knowledge, skills and attitude demanded by their different fields of practice. Also, accreditation demands that program outcomes must be aligned with the mission and educational objectives, and that OBE system is supported by a continuous quality improvement program (CHED Memorandum Order No. 37, 2012).

In order to ensure the sustainable delivery of OBE, the following components shall be in place for each engineering program offering; Mission and Vision, Program Educational Objectives, Program Outcomes, Matrix of Courses with Program Outcomes (Curriculum Map), Outcome – Based Teaching and learning Delivery Process, Program Assessment and evaluation Process and Continuing Quality Improvement Program. The said guidelines were implemented last Academic Year 2012 – 2013. And CHED shall release additional implementing guidelines aligned with its implementation and monitoring plan as needed (CMO No. 37, Series of 2012).

The Philippine Technological Council (PTC) is the only umbrella organization of all professional engineering organizations in the Philippines since 2009. It has led the preparation and application for the Philippines to become a provisional member of WA. As of 2013, the signatories of WA are Australia, Canada, Chinese Taipei, Hong Kong China, Ireland, Japan, Korea, Malaysia, New Zealand, Russia, Singapore, South Africa, Turkey, The United Kingdom and United States. And as of June 2013, the PTC is now a provisional member of the Washington Accord (WA). This means we are now on our way to having a body fully accredited under this international agreement. Filipino engineers will be given a fair chance at succeeding in the global market (Manila Bulletin, July 14, 2013).

Synthesis

The researcher found these literatures significant to her research. OBTL will not be conceptualized without those theories on teaching and learning. Constructivism and collaborative learning are just some of the principles behind OBTL. The way learners construct knowledge through activities and interaction is the objective of OBTL (Biggs and Tang, 2007). Based on the studies and articles reviewed, one thing is common, that constructivism and collaborative learning theory lead learners to a deeper understanding. Gokhale (1995) even pointed out in his study that collaborative learning enhances critical thinking. It fosters the development of critical thinking through discussion, clarification of ideas and evaluation of other ideas.

This study aims to identify the students' perceptions on OBTL; the reason why the researcher included researches on how students look at the different teaching strategies. The researcher would like to find out if the students' perception affects their learning. Since the researcher will be developing a learning plan, it will be helpful if she will know the different learning styles of the students to help her design the activities creatively. The researcher was able to find studies on student's learning style and how it affects the learning. Studies on students' perceptions on teaching strategies have different results and conclusions. Some favored constructivist approach over traditional methods since students preferred active learning over simple lecture and discussion.

Though in some studies, students still preferred traditional over constructivist approach due to some factors such as readiness and implementation.

Since adaptation of Outcomes – Based Education is a very long process; the resources are limited. Some are still in the process of doing it or even on the planning stage. The researcher was able to find case studies on OBE which were implemented on medical schools and universities. The articles were very helpful for we were able to see the how it was done and how it affected their respective educational system. Philippines on the other hand was able to start with the implementation OBE on the engineering programs. In this fast – paced time and age, nothing is permanent. People tend to look for effective ways and means to improve. This move of implementing OBE to universities and colleges is one step closer to improving our nation.

CHAPTER III

RESEARCH METHODOLOGY

This chapter presents a discussion of the methods and procedures used in the study. It includes a discussion of the research design, respondents, research instruments, data gathering procedure and data analysis procedure.

Research Design

A descriptive approach was followed in this research. The focus of the study is to evaluate the curriculum alignment and the student's learning experience through their own perceptions in a mathematics course under Outcomes – Based Teaching and Learning (OBTL). This study used ranking, listing and averaging in the survey form (see Appendix D) and evaluation tools (see Appendix G and Appendix H) to describe the students' perception. On the other hand, frequency of errors in the examination (see Appendix I) was used to evaluate the students' learning.

Respondents

The respondents of this research are the students enrolled in two sections of Mathematics of Investment (Math 015) which was handled by the researcher and a partner instructor. Two sections were chosen based on the ratio of the number of

students per program enrolled in the said classes. These two classes had the closest number of Accountancy students among four sections of Math 015 for the Second Term of A.Y 2013 - 2014. Math 015 is mathematics course which is a requirement for the following programs: Accountancy, Entrepreneurship, Multimedia Arts (MMA) and Tourism Management (TM). This course is also taken by students of these programs as their elective: Information Technology (IT), Computer Science (CS) and others.

The first section has a total of 40 students and the second has a total of 39 students at the beginning of the term. Two students from the first class, and one from the second, dropped out of the course for some personal reasons. A total of 76 students were the respondents of this research. 90.8% or 69 students were freshmen, 5.3% or 4 students were sophomores, and 3.9% or 3 were graduating students. These students were enrolled in the following programs: Accountancy with 58 students or 76.3%, Entrepreneurship with 12 students or 15.8%, Multimedia Arts with 4 students or 5.3%, Information Technology with 1 student or 1.3%, and Tourism Management with 1 student or 1.3%. The said courses were taken during the second term of the school year 2013 – 2014. Two sections, heterogeneous in nature, both with a total of 38 students were handled by the researcher and a partner instructor.

92.1% of the respondents or 70 out of 76 answered the survey questionnaire and twenty (20) of them were randomly picked for an interview. 97.4% or 74 out of 76 took the final examinations; 2 students were not able to take the examination for

personal reasons and by their own choice. The partner instructor was also interviewed with questions parallel to the questions asked to the students.

Research Instruments

Learning Plan

A learning plan (see Appendix A) for Math 015: Mathematics of Investment was developed by the researcher at the beginning of the term. The plan has the three essential features of OBTL; intended learning outcomes (ILO), teaching and learning activities (TLA) and assessment tasks (AT). This was patterned on how the institution would like it to be implemented and it strictly followed the course syllabus (see Appendix K) given by the department. The learning plan was initially evaluated by the coordinator and after some revisions; it was again evaluated by the coordinator and other three experts, whose profile is at Appendix M, based on its implementation.

Evaluation Tools

Two sets of evaluation tools were self-constructed to evaluate the learning plan and assessment task (see Appendix E and F). The following components were evaluated in the learning plan: establishing an appropriate motivational context, constructing a base of interconnected knowledge, relevant learner activity, formative

feedback and reflective practice and self – monitoring. For the assessment task, the following components were evaluated: objectives, instructions, creativity, grading components, and outcome. Those components were enumerated by Biggs and Tang (Biggs & Tang, 2007) as indicators of an effective learning plan and assessment task. The evidence of the presence of each component in the learning plan and assessment task was evaluated as “excellent”, “very good”, “average”, “poor” and “fair”.

Survey Questionnaire

The survey questionnaire (see Appendix D) was self-constructed to determine the perception of the students on Outcomes – Based Education in three (3) criteria items: the factors that helped them in understanding the lessons; the factors that hindered them in understanding the lessons; and evaluation of learning experience.

The first criterion has seven (7) components which they rated as “most influential”, “more influential”, “influential”, “fairly influential” and “least influential”. The second criterion has ten (10) components with which students identified based on their experience. The third criterion is the evaluation of their learning experience rated as “excellent”, “very good”, “average”, “poor” and “very poor”.

To quantify the student’s response in the first and third criterion, the following point system was utilized:

1st Criteria: Factors Influential to Learning

Rate	Level of Influence
5	Most Influential
4	More Influential
3	Influential
2	Fairly Influential
1	Least Influential

3rd Criteria: Rating of Their Learning Experience

Rate	Interpretation
5	Excellent (Deep learning)
4	Very Good (Learning took place)
3	Average / Neutral
2	Poor (Learning is a challenge)
1	Very Poor (No learning)

After the instrument construction, the survey questionnaire and evaluation tools were face validated and critiqued by the researcher's adviser. After some revisions, they were evaluated by another three (3) experts and professors of Malayan Colleges Laguna (refer to Appendix M for their profile). The experts' evaluation form for the

survey questionnaire (see Appendix G) and evaluation tools (see Appendix H) were rated based on the following criteria: clarity, format / readability, comprehensiveness and suitability.

These points were used to interpret the average rates of the three evaluators:

Range	**Level of Acceptability**
4.20 – 5	Highly Acceptable
3.40 – 4. 19	Acceptable
2.6 – 3.39	Fairly Acceptable
1.8 – 2.59	Unacceptable
1 – 1.79	Highly Unacceptable

After the evaluation of the survey form, the researcher tabulated the ratings of the three evaluators and an average of 4.43 was computed. It means that self-constructed survey is “highly acceptable” and was ready to be administered. One of the evaluators suggested to revise or rephrase one statement in the survey form and it was implemented in the revision. All of them agreed that the survey form perfectly fits the objectives of the study.

The corresponding points for the response to each criterion in the survey form are as follows:

Table 1. Experts' Evaluation on the Survey Questionnaire

Criterion	Evaluator 1	Evaluator 2	Evaluator 3
Clarity	5	4.5	5
Format / Readability	4.5	4	4.5
Comprehensiveness	4.5	4	4
Suitability	5	4	4
Average	**4.75**	**4.125**	**4.375**
	4.42		

The experts' evaluation of the learning plan and assessment tasks evaluation tools has an average of 4.875 which is interpreted as "highly acceptable". Without further comments and suggestions from the evaluators, it means that the self-constructed evaluation tool was ready to be administered.

The corresponding points for the response to each criterion in the survey form are as follows:

Table 2. The Experts' Evaluation on the Learning Plan and Assessment Tasks Evaluation Tools

Criterion	Evaluator 1	Evaluator 2	Evaluator 3
Clarity	5	5	5
Format / Readability	5	5	4.5
Comprehensiveness	4.5	5	4.5
Suitability	5	5	5
Average	**4.875**	**5**	**4.75**
	4.875		

Data Gathering Procedure

The first step of the researcher in gathering data was to secure the consent from the Dean of the College and the Mathematics Coordinator and asked for the cooperation of the partner instructor and the respondents.

The research started with the implementation of the revised syllabus (see Appendix K) which was evaluated by a committee assigned by the coordinator. The

researcher prepared a Teaching and Learning Activity Plan for Math 015: Mathematics of Investment (see Appendix A) based on the syllabus and features of OBTL. The learning plan was reviewed by the coordinator and was implemented to the participants. One section was handled by the researcher and the other one was handled by the partner instructor. Both sections used the same learning plan and assessment tasks (see Appendices B and C). The implementation of the lesson and activities was observed by another teacher and was evaluated.

A final examination (see Appendix I) was conducted, following the procedures of the department where same set of examinations was given to all sections at the same time. It was made by a team with three members, assigned by the coordinator, where the researcher is one of the members. The table of specifications (see Appendix J) used in the final examination matched the intended learning outcomes with the questions in the examination. The coordinator and the team checked the alignment of the questions with the intended learning outcomes. The result of the final examination was evaluated through item analysis in order to assess the learning.

The researcher personally administered the survey to the two (2) sections. After the survey, twenty (20) students were randomly selected for an interview. They were asked of how they learn best and how OBTL has contributed to that learning. The partner teacher was also interviewed and was asked on how his students learn best and how OBTL contributed to that learning.

Data Analysis Procedure

The results of the survey were processed by computing the weighted mean of the scores and ratings in each component in the survey form. The following arbitrary points and corresponding verbal description to perception was used to interpret the responses:

1st Criteria: Factors Influential to Learning

Range	Level of Influence
4.20 – 5	Most Influential
3.40 – 4. 19	More Influential
2.6 – 3.39	Influential
1.8 – 2.59	Fairly Influential
1 – 1.79	Least Influential

3rd Criteria: Rating of Their Learning Experience

Range	Interpretation
4.20 – 5	Excellent (deep learning)
3.40 – 4. 19	Very Good (learning took place)
2.6 – 3.39	Average / Neutral
1.8 – 2.59	Poor (learning is a challenge)
1 – 1.79	Very Poor (no learning)

The learning plan evaluation (see Appendix E) has two categories, the first category is to identify if all the essential components are evident in the learning plan and it is answerable by YES or NO. The said components were adopted from Biggs and Tang (2007) which they described as components of a good learning plan. To describe the response in this category, the average was computed and 80% was set as an arbitrary. The tally of yes response was divided by the total number of evaluators; computed quotient which is 80% or more was described as “Evident”. The second category is to rate the learning plan using the following arbitrary points:

Range	**Interpretation**
4.20 – 5	Excellent
3.40 – 4. 19	Very Good
2.6 – 3.39	Average
1.8 – 2.59	Poor
1 – 1.79	Fair

The assessment task evaluation (see Appendix F) has two categories which was rated based on the following arbitrary points:

Range	**Interpretation**
4.20 – 5	Excellent
3.40 – 4. 19	Very Good
2.6 – 3.39	Average
1.8 – 2.59	Poor
1 – 1.79	Not evident

The final examination (see Appendix I) was interpreted by frequency of errors. The mean of the correct response for each item was computed. The number of students who were able to answer the particular item correctly was divided by the total number of respondents. The result was interpreted as follows:

Percentage (%)	**Description**
96 – 100	Mastered
86 – 95.9	Closely approaching mastery
66 – 85.9	Moving towards mastery
35 – 65.9	Average mastery
14 – 34.5	Low mastery
0 – 13.5	Very low mastery

CHAPTER IV

PRESENTATION, ANALYSIS AND INTERPRETATION OF DATA

This chapter includes the presentation, analysis, and interpretation of data gathered from the survey, interview and examination.

Problem #1

What are the students' perspectives of the whole learning experience?

What are the factors that helped them understand the lessons?

What are the factors that hindered them in understanding the lesson?

What is their assessment of the learning that they have experienced?

Problem number 1 is about the student's perspectives of the whole learning experience under OBTL. The problem includes identification of factors that they found influential to their learning and factors which hindered them in understanding the lessons. In this part, the students were asked to assess or evaluate the learning that they have experienced.

Below are the findings to answer the first problem:

Table 3. Students' Perception of Factors Influential to Learning

Item No.	Factors	5 Most Influential	4 More Influential	3 Influential	2 Fairly Influential	1 Least Influential	Mean	Interpretation
1	Objectives were clearly stated at the start of the lesson	33	30	7	0	0	**4.37**	Most Influential
2	Multimedia usage in presenting the lesson	39	18	10	3	0	**4.33**	Most Influential
3	Creativity in teaching	33	23	13	1	0	**4.26**	Most Influential
4	Employment of different methods and teaching strategies	32	23	14	1	0	**4.23**	Most Influential
5	Provision of drill exercises and online activities	28	26	13	3	0	**4.13**	More Influential
6	Use of textbooks and other references	23	25	19	2	1	**3.96**	Influential
7	Project: Assessment Task	28	26	14	1	1	**4.13**	More Influential

In table 3, it is shown that thirty – three (33) or approximately 47% of the students thought that the first component; "objectives were clearly stated at the start of the lesson" was most influential, thirty (30) or 43% rated it as more influential and the remaining 10% or seven (7) students rated it as influential when it comes to understanding the lesson. Its average mean was 4.37 which interpreted as "most influential". Students believed that one of the factors that greatly influenced their

learning or understanding the lesson is their awareness of the intended learning outcomes; first of the three essential features of OBTL. As what the proponents of OBTL believed in, the alignment should start with the objectives and students should know what is expected of them. The data supports that belief since most of the students find it most influential if objectives are clearly stated at the beginning of the lesson.

The second component, “multimedia usage in presenting the lesson” was also interpreted as “most influential” with a mean average of 4.33 since thirty – nine (39) or approximately 56% agreed that multimedia usage in presenting the lesson is most influential, eighteen (18) or approximately 26% found it more influential, 10 or 14% found it influential and three (3) or 4% found it fairly influential. The survey shows that students still find it more interesting if lessons will be presented with the aid of multimedia.

The third component; “creativity in teaching” had a mean average of 4.26 which was interpreted as “most influential”. Thirty – three (33) or 47% found it most influential in learning, twenty – three or 33% found it more influential, thirteen (13) or 19% found it influential and one (1) or 1% found it fairly influential. Component four, “employment of different methods and strategies” was related to the third component. With a mean average of 4.23 it was interpreted as “most influential” since thirty – two (32) or 46% found it most influential, twenty – three (23) or 33% found it more influential, fourteen (14) or 20% found it influential and one (1) or 1% found it fairly influential.

Aside from creativity and employment of different strategies, component five; “provision of drill exercises and online activities” was rated as “more influential” with a mean average of 4.13. Students found it quite influential if they were given additional tasks or assignments and even additional online activities. Twenty – eight (28) or 40% rated it as most influential, twenty – six (26) or 37% rated it as more influential, thirteen (13) or 19% rated it as influential and three (3) or 4% rated it as fairly influential.

On the other hand, component six, “use of textbooks and other references” is rated as “influential” with a mean average of 3.96. Notice that three (3) or 4% found it fairly or least influential, nineteen (19) or 27% found it influential and forty – eight (48) or 69% found it most and more influential.

The last item, which is an important component, is the “assessment task or project”. Twenty – eight (28) or 40% of the students found it most influential, twenty – six or 37% rated it as more influential, fourteen (14) or 20% find it influential and two (2) or 3% find it fairly and least influential. The assessment task had a mean average of 4.13 interpreted as “more influential”.

The survey shows that the three important components of OBTL are essential to learning since most of the categories were rated as “most influential” and “more influential”. The first component, the intended learning outcomes was rated as most influential in learning. The teaching and learning activities were evaluated in the 2nd, 3rd,

4th and 6th components which were rated as most influential, more influential and influential in learning. The assessment tasks which were in component 5 and 7 were interpreted as more influential.

Here are the factors that the students found to be “most influential” in understanding the lessons:

1.) Objectives were clearly stated at the start of the lesson

2.) Multimedia usage in presenting the lesson

3.) Creativity in teaching

4.) Employment of different methods and online activities

The students also identified some factors which were not listed in the questionnaire. According to them, aside from those listed above, they found collaborative activities to be very influential to learning. The students enjoyed doing activities and drill exercises with their peers. Also, they found that the teacher’s delivery of the lesson is an influential factor for their learning. In an interview, the students were asked on how they learned best and here are their answers:

1.) By listening carefully to the teacher during lectures and discussions.

2.) By participating in the activities and drill exercises.

3.) By doing the project.

4.) By studying and reviewing the lessons every day.

The next data is about the students' perception of hindrances to learning. The students were asked to identify the factors that hindered them in understanding the lessons. In the second part of the questionnaire (see Appendix D), the students were asked to check all the factors that they think were hindrances to learning based on what they have experienced.

Table 4 shows the different factors that hindered the students from understanding the lesson. The students were asked to check all that apply.

Table 4. Students' Perception of Hindrances to Learning

Factors	Response	Percentage (%)
1 The time frame was too short	30	19.11
2 The phasing of the lesson was too fast	46	29.30
3 Lack of mastery of the basic skills	9	5.73
4 The teaching style was not appropriate to the students' learning style	11	7.01
5 The teaching strategies/methods were not appropriate to the lesson	7	4.46
6 The learning activities were too difficult	11	7.01
7 The learning activities were neither essential nor helpful	2	1.27
8 The learning activities were not in line with the objectives and assessment	3	1.91
9 The teaching strategies were not interesting	11	7.01
10 Lack of motivation	18	11.46
none	9	5.73
Total	**157**	

Out of 70 students, nine (9) or 13% of them did not identify any of the factors listed. The statement with the highest number of responses was item #2, “the phasing of the lesson was too fast”. Notice that 46 or 66% of the students found it difficult to understand the lesson if the phasing was too fast.

Second to the highest is item #1; “the time frame was too short” with thirty (30) students or 43% who found it difficult to understand the lesson if the time frame was too short. These two statements are related to each other. If the time frame was too short, the tendency is for the teacher to discuss or cover all the lessons in the given period which makes the phasing a bit faster than the usual. Malayan Colleges is trimestral, and with that short period of time given per term the students and teachers really have to double the effort in order to cope up with the required lessons to be covered. It is understandable that students ranked these two items as the highest among the other factors which have minimal responses.

Item #10; “lack of motivation” was identified by eighteen (18) or 26% of the students as a hindrance in understanding the lesson. Eleven (11) or 16% of the students identified the following factors as hindrances in understanding the lesson: teaching style was not appropriate to the students’ learning style (item #4), the learning activities were too difficult (item #6), and the teaching strategies were not interesting (item #9). Nine (9) of the students or 13% identified that lack of mastery of the basic skills was a hindrance (item #3), seven (7) or 10% of them thought that the teaching

strategies / methods were not appropriate to the lesson (item #5) while three (3) and two (2) or approximately 4% of them identified the last two items as hindrances in understanding the lesson which are: the learning activities were not in line with the objectives and assessment and that the activities were neither essential nor helpful.

Here is the summary of the factors that hindered the students in understanding the lesson:

1.) The phasing of the lesson was too fast

2.) The time frame was too short

3.) Lack of motivation

Table 5 shows the result of how students assessed their learning experience under Outcomes – Based Education (OBTL). They were asked to rank their experience as “excellent (deep learning)”, “very good (learning took place)”, “average or neutral”, “poor (learning is a challenge)” and “very poor (no learning)”.

Table 5. Mean of Students’ Rating of Their Learning Experience

Rate	Frequency	Mean	Percentage
5	12	60	17.14
4	34	136	48.57
3	20	60	28.57
2	0	0	
1	0	0	
No answer	4		5.71
Total	**70**	**3.88**	**Very Good (Learning took place)**

As presented in table 5, twelve (12) or approximately 17% experienced deep learning, thirty – four (34) or 49% thought that learning took place and twenty (20) or 29% experienced learning in an average level. This category has a mean average of 3.88 which was interpreted as “very good” or “learning took place”.

Out of 20 students who were interviewed, thirteen (13) or 65% experienced deep learning. According to them, the activities provided by the teacher made them understand the lesson more. Also, the projects assigned to them were very helpful not just in understanding the concept but also in realizing how it is done in real life.

One student says: “Ganun pala pag accountant na, nakita naming yung sitwasyon pag kami na yung nasa lugar nila. Dahil sa project, na-experience naming pumasok sa bangko at makipagusap sa teller. Mas naintindihan naming yung mga dini - discuss sa classroom dahil na-experience naming mismo.” Four (4) of them or 20% rated their learning as very good (learning took place) and three (3) or 15% described their learning experience as average or neutral. When asked on how they learned best, aside from self-motivation, the most common response was through cooperative learning or collaboration with their peers which involves group activities, team teaching, and group discussions.

Problem # 2

What is the assessment of the students' performance after the whole learning experience?

The second problem is to assess the students' performance after the whole learning experience through an examination. This was done to support or to validate the students' evaluation of their learning process in problem #1. In relation to the students' claim that "learning took place", the frequency of errors of the final examination agrees with the students' evaluation.

The data gathered was from the final examination conducted to both sections which were parallel to the intended learning outcomes. The examination has thirty – five (35) items multiple choice questions (see Appendix I). As per department's policy in making examinations, it was made validated by a team assigned by the coordinator (see Appendix J). The mean average for each item was computed where the number of correct responses was divided by the total number of students.

One (1) item or 3% was identified as "mastered", seven (7) items or 20% was "closely approximating mastery, eighteen (18) items or 51% was "moving towards mastery", five (5) items or 14% was "average mastery", three (3) items or 9% was "low mastery" and one (1) item or 3% was "very low mastery". The table below shows the interpretation of the students' examination.

Table 6. Final Examinations' Frequency of Errors and Interpretation

Item No.	Topic	TOTAL	PERCENTAGE (n = 74)	Interpretation
1	Annuity	47	63.51	average mastery
2	Annuity	50	67.57	moving towards mastery
3	Simple Interest	68	91.89	closely approximating mastery
4	Compound Interest	63	85.14	moving towards mastery
5	Compound Interest	9	12.16	very low mastery
6	Promissory note	52	70.27	moving towards mastery
7	Promissory note	60	81.08	moving towards mastery
8	Promissory note	67	90.54	closely approximating mastery
9	Compound Interest: Accumulation	63	85.14	moving towards mastery
10	Compound Interest: discounting	59	79.73	moving towards mastery
11	Equivalent rate	69	93.24	closely approximating mastery
12	Compound Interest: Discounting	57	77.03	moving towards mastery
13	Basic Concept	35	47.3	average mastery
14	Simple Interest	72	97.3	mastered
15	Simple Interest: finding the time	60	81.08	moving towards mastery
16	Simple Interest: Less than a year	25	33.78	low mastery
17	Actual time between dates	63	85.14	moving towards mastery
18	Promissory note	54	72.97	moving towards mastery
19	Compound Interest	20	27.03	low mastery
20	Simple Interest: Identifying the rate	56	75.68	moving towards mastery
21	Basic Concept	32	43.24	average mastery
22	Basic Concept	61	82.43	moving towards mastery
23	Simple Interest: discounting	14	18.92	low mastery
24	Simple Interest	45	60.81	average mastery
25	Actual time between dates	57	77.03	moving towards mastery
26	Annuity	44	59.46	average mastery
27	Amortization	53	71.62	moving towards mastery
28	Simple Interest: Banker's Rule	61	82.43	moving towards mastery
29	Simple Interest: Accumulation	54	72.97	moving towards mastery
30	Equivalent rate	54	72.97	moving towards mastery
31	Actual time between dates	71	95.95	closely approximating mastery
32	Approximate time between dates	69	93.24	closely approximating mastery
33	Sinking fund	64	86.49	closely approximating mastery
34	Annuity	68	91.89	closely approximating mastery
35	Equivalent rate	56	75.68	moving towards mastery

The students did well in the following topics: computation of simple interest, identifying the number of days between dates, solving for the equivalent rates and some basic concepts on promissory notes. The students had difficulty in answering problems about compound interest and discounting.

Since74% of the items belonged to the upper categories; mastered, closely approximating mastery and moving towards mastery, this data supports the students' claim that learning took place.

Problem # 3

Were the assessment tasks in line with the intended learning outcomes and teaching learning activities?

The third problem is to evaluate the teaching and learning activities in the learning plan (see Appendix A) and the assessment tasks (see Appendices B and C). Since OBTL is a constructive alignment of the intended learning outcomes, activities and assessment tasks, this problem aims to evaluate the self-constructed learning plan and assessment tasks of their alignment to the intended learning outcomes and its compliance to the essential components of OBTL.

The Assessment Tasks were evaluated by three evaluators (see Appendix M for their profile) who were able to see the actual presentation of the projects. The evaluators are the coordinator of mathematics department, the partner instructor and a

colleague who observed the activities and assessment tasks. These are their ratings of the components of Assessment Tasks:

Table 7. Results of the Evaluation of the Assessment Tasks

Criterion	Rating			Average	Interpretation
I. Components	Evaluator 1	Evaluator 2	Evaluator 3		
A. The objectives were clearly stated.	5	5	5	5	Excellent
B. The task / project were in line with the intended learning outcomes.	5	5	5	5	Excellent
C. The instructions were clearly understood by the students.	5	5	5	5	Excellent
D. The understanding of the concept was evident.	5	4	5	4.67	Excellent
E. The students were able to demonstrate essential learning/understanding.	5	4	3	4	Excellent
F. The student's creativity was developed.	5	5	3	4.33	Excellent
G. The grading components in the rubric were in line with the objectives of the task/project.	5	5	4	4.67	Excellent
H. The grading system (rubric) manifests fairness.	5	5	5	5	Excellent
II. Outcome					
A. The assessment task is appropriate to the lesson.	5	5	5	5	Excellent
B. The assessment task developed the student's understanding of the concept.	5	5	5	5	Excellent

The results show that the compliance of the criteria was highly remarkable. During the interview, the two teachers agreed that understanding of the lesson was evident in the presentation. The students, according to them, were very eager in presenting their project and sharing their experiences. In the interview with the students,

according to them, they enjoyed doing their projects and wished to have more activities similar to that for them to understand the lessons deeper. One student even pointed out that the experience itself brought him to a deeper understanding of the concept. When asked if the activities were in line with the objectives, all of them have the same response and they agreed that they were all in line with the assessment tasks.

The learning plan was evaluated by the mathematics coordinator, the partner instructor who implemented it as well and a colleague who was invited to observe some of the classes. Table 8 and 9 describe the response of the three evaluators and all of them agreed that the components listed were evident (100% in all components) in the learning plan. Here are the components, adopted from Biggs and Tang (2007):

1.) Establishing an appropriate motivational context
    a.) Students take more responsibility for their learning.
    b.) Tasks are attainable.
    c.) Tasks are valued by the students.
2.) Constructing a base of interconnected knowledge
    a.) It makes use of the students' existing knowledge.
    b.) It emphasizes structural interconnections between topics.
3.) Relevant learner activity
    a.) Knowledge is constructed through learner activity and interaction.
    b.) Activities are generally active which provides alertness and efficiency.

c.) Activities use different sensory modes of learning to provide multiple access to what has been learned.

4.) Formative feedback

a.) Misconceptions were confronted and corrected.

b.) Teachers and students are useful sources of feedbacks.

5.) Reflective practice and self-monitoring

a.) Encourage student's awareness of their own knowledge construction.

b.) Situations that require self-monitoring and self-directing of learning were provided.

Table 8 shows that 100% of the evaluators were able to see all the components of OBTL in the learning plan. Table 9, on the other hand, shows the evaluators' rating which has an average of 5 and was interpreted as "Excellent". The learning plan was creatively made and the constructive alignment was very evident. One suggestion was given which is to incorporate more ICT – based activities since it is the school's thrust to be an ICT based institution. One of them even commended the alignment of the objectives, activities and assessment task. According to him, "there is an assurance that the learners are guided throughout to attain the Intended Learning Outcomes".

Table 8. Results of the Evaluation of the Learning Plan (Category A)

Components	Response (N=3)		Average Percentage	Interpretation
	Yes	No		
1 Establishing an appropriate motivational context	3		100%	Evident
2 Constructing a base of interconnected knowledge	3		100%	Evident
3 Relevant learner activity	3		100%	Evident
4 Formative feedback	3		100%	Evident
5 Reflective practice and self-monitoring	3		100%	Evident

Table 9. Results of the Evaluation of the Learning Plan (Category B)

	Evaluator 1	Evaluator 2	Evaluator 3	Average	Interpretation
Overall rating of the Learning Plan	5	5	5	5	Excellent

Since all components were evident and all criteria were met, the learning plan was creatively made and implemented. The constructive alignment of the learning outcomes, teaching and learning activities and assessment tasks was evident.

CHAPTER V

FINDINGS, CONCLUSIONS, AND RECOMMENDATIONS

This chapter presents the interpretation of the data collected. This includes summary of findings, conclusions and recommendations.

Summary of Findings

Outcomes Based Education (OBE) which has been practiced abroad is now becoming the new standard in our education system. It was already implemented by some universities and colleges and the others are in the process of doing it. Each institution has its own version of OBE, each of them is trying to come up with a better plan. But whatever their versions are, one is common to all, that it aims to improve our educational system and that it will help us cope with the challenges brought by globalization.

This study aimed to evaluate the curriculum alignment and students' learning experience under Outcomes – based Teaching and Learning. The instruments used in this research were learning plan, survey questionnaire and evaluation tools. This research is descriptive in nature which utilized the following statistical tools: mean, frequency and percentage. Two sections with a total of 76 respondents were evaluated in this research.

The first problem focused on the students' perceptions and evaluation of their learning experience under OBTL. The mean average of the three important components of OBE such as, intended learning outcomes, teaching and learning activities, and assessment task is 4.24. This average was interpreted as "most influential". It goes to show that in their perception, the three essential features of OBTL arethe most influential factors in understanding the lessons.

When asked of their perception on the hindrances that they had experienced, 66% of them identified that if the phasing of the lesson is too fast, they are having difficulty in catching up and understanding the lessons. In relation to that, another item with the highest response with 43% thought that learning is a challenge if the time frame was too short. These two items are related to each other, that if the time frame was too short, then the phasing of the lesson was faster than the usual. These factors for them are hindrances in understanding the lessons.

In the students' point of view, after the whole experience, learning took place. They evaluated their learning experience with a mean average of 3.88 which was interpreted as "very good", which means that learning took place.

The second problem is the assessment of the students' performance through an examination. Out of 35 items, 3% of the items were "mastered" by the students, 20% was "closely approximating mastery" and 51% was "moving towards mastery". The record supports the claim of the students that learning really took place. It goes to show that the whole experience was essential to the learning and understanding of the

concept. In particular the students did well in the following topics: computation of simple interest, identifying the number of days between dates, solving for the equivalent rates and some basic concepts on promissory notes.

The third problem is the evaluation of the learning plan and assessment tasks. Using the evaluation tools (see Appendix E and F), the learning plan and assessment tasks were evaluated as “excellent”. The criteria or components of a good learning plan were evident and the assessment tasks were in line with the intended learning outcomes and activities. In the evaluator’s point of view, the three components are aligned to each other and the learning plan was creatively developed to match the students’ learning styles and needs.

Conclusions

Based on the findings of the study, the following conclusions are made.

1. Students learn the lesson best when objectives are clearly stated, multi – media is used in presenting the lesson, teachers are creative in terms of using various strategies and methodologies, and online activities are employed. Also, students are having difficulty in understanding the lessons if the phasing is too fast, the time frame is too short, and if they are not motivated.

2. OBTL helped the students achieve a very good level of understanding of the lessons as evidenced by the students' performance in the achievement test.
3. The learning plan and assessment tasks used in Mathematics of Investment (Math 015) were in line with the intended learning outcomes.

Recommendations

In light of the findings of this study, the following recommendations were made:

1.) In designing learning plans, consider the following factors which students' thought to be most influential to learning:
    a. Objectives must be clearly stated at the start of the lesson;
    b. Different methods and teaching strategies must be employed; and
    c. Assessment task must be authentic and well planned.
2.) In designing the learning plan, the time frame must be considered. Students' find it a hindrance if the time frame is too short and the phasing of the lesson is too fast. Plan the activities ahead of time to address that problem or concern immediately.
3.) For a learning plan to be effective, the teaching and learning activities, and assessment tasks must be aligned to the intended learning outcomes.
4.) Studies that look into the effectiveness of OBE should be conducted.

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APPENDIX B

Assessment Task #1

Loans and Investments

Objectives:

- To demonstrate understanding of the concept of simple and compound interest
- To apply the concept of simple and compound interest by creating their own terms and conditions for loans and investments
- To develop cooperative learning

Procedure:

1.) Research on the different terms and conditions that banks and lending companies offer for loans and investments.
2.) Create your own bank or lending company and come up with your own terms and conditions that will be beneficial for you and for the borrowers or investors of your bank or company.
3.) Present the terms and conditions in the class and show a sample computation. This question must be answered in your presentation: Why will I borrow or invest my money in your bank or company?

Rubric:

CRITERIA		SCORE			
		Fair	**Good**	**Very Good**	**Excellent**
A. Understanding of the Concept	1.) The students were able to demonstrate understanding of the concepts through analysis of different resources related to their project. (10 points)	1 – 3	4 – 6	7 – 9	10
	2.) The students were able to apply the concepts by creating a relevant and reasonable terms and conditions for loans and investments. (10 points)	1 – 3	4 – 6	7 – 9	10
B. Presentation	1.) The PowerPoint Presentation was made in a creative manner and aided the presenters in explaining their project. (5 points)	1	2	3 – 4	5
	2.) The students were able to communicate their thoughts and ideas effectively. (5 points)	1	2	3 – 4	5
C. Cooperation	Cooperation and camaraderie is evident in the presentation. There is unity among members of the group that leads to an organized and clear presentation of their project. (5 points)	1	2	3 – 4	5

Total: _____

Group #: _____

Names: _____

_____

_____

_____

Evaluator: _____

APPENDIX C

Assessment Task # 2

IT 101: Amortization and Sinking Fund

Objectives:

- To demonstrate understanding of the concept of amortization and Sinking Fund
- To apply the concept of annuity by creating an excel file of an amortization table and sinking fund schedule

Procedure:

1.) Write a problem about amortization and another problem about sinking fund.
2.) In an Excel File, show the complete solution for the problem that you have created in #1.
3.) Create a table for the amortization problem and another for the sinking fund schedule.

CRITERIA		SCORE			
		Fair	Good	Very Good	Excellent
Understanding of the Concept	1.) The students were able to demonstrate understanding of the concepts by creating realistic real life problems. (10 points)	1 – 3	4 – 6	7 – 9	10
	2.) The students were able to demonstrate understanding the concepts of the concepts by presenting a complete and correct solution of the problems they have created. (10 points)	1 – 3	4 – 6	7 – 9	10
Application of the Concept	3.) The students were able to apply the concepts by creating an excel file of amortization table and sinking fund schedule. (10 points)	1 – 3	4 – 6	7 – 9	10

Total: _____

Name: _____

Evaluator: _____

APPENDIX D

Survey Questionnaire

Survey on Student's Perception on Outcomes – Based Teaching and Learning

Name (optional):_____ Date/Term: _____

Program: _____ Course: _____

A. Rate how the following factors helped you in understanding the lessons. 5 being the highest; encircle the number for each category.

5 4 3 2 1	1.) Objectives were clearly stated at the start of the lesson
5 4 3 2 1	2.) Multimedia usage in presenting the lesson
5 4 3 2 1	3.) Creativity in teaching
5 4 3 2 1	4.) Employment of different methods and teaching strategies
5 4 3 2 1	5.) Provision of drill exercises and online activities
5 4 3 2 1	6.) Use of textbook and other references
5 4 3 2 1	7.) Project: Assessment Task

Others: _____

B. What are the factors that hindered you in understanding the lessons? Check all that apply.

____ 1.) The time frame was too short

____ 2.) The phasing of the lesson was too fast

____ 3.) Lack of mastery of the basic skills

____ 4.) The teaching style was not appropriate to the student's learning style

____ 5.) The teaching strategies / methods were not appropriate to the lesson

____ 6.) The learning activities were too difficult

____ 7.) The learning activities were neither essential nor helpful

____ 8.) The learning activities were not in line with the objectives and assessment

____ 9.) The teaching strategies were not interesting

____ 10.) Lack of motivation

Others: _____

C. If you are to rate your learning experience; 5 being the highest, what would it be?

5 - Excellent (deep learning)

4 - Very Good (learning took place)

3 - Average / Neutral

2 - Poor (learning is a challenge)

1 - Very Poor (no learning)

APPENDIX E

Learning Plan Evaluation Tool

Learning Plan

A. Identify if the following components are evident in the learning plan. Check the appropriate column.

Components	Yes	No
1.) Establishing an appropriate motivational context a.) Students take more responsibility for their learning. b.) Tasks are attainable. c.) Tasks are valued by the students.		
2.) Constructing a base of interconnected knowledge a.) Making use of the students' existing knowledge. b.) Emphasizing structural interconnections between topics.		
3.) Relevant learner activity a.) Knowledge is constructed through learner activity and interaction. b.) Activities are generally active which provides alertness and efficiency. c.) Activities use different sensory modes of learning to provide multiple access to what has been learned.		

4.) Formative feedback a.) Misconceptions were confronted and corrected. b.) Teachers and students are useful sources of feedbacks.		
5.) Reflective practice and self-monitoring a.) Encourage student's awareness of their own knowledge construction. b.) Situations that require self-monitoring and self-directing of learning were provided.		

B. What is your overall rating of the learning plan? Encircle your response.

5 - Excellent
4 - Very Good
3 - Average
2 - Poor
1 - Fair

C. Comments/Suggestions

_____

_____

_____

_____

Name of Evaluator

APPENDIX F

Assessment Tasks Evaluation Tool

Assessment Task

Rate the following components of the assessment task. Encircle the number that corresponds to your response.

5	Excellent
4	Very Good
3	Average
2	Poor
1	Not Evident

I. Components of the Assessment Task

A.	The objectives were clearly stated.	5	4	3	2	1
B.	The task / project is in line with the intended learning outcomes.	5	4	3	2	1
C.	The instructions were clearly understood by the students.	5	4	3	2	1
D.	The understanding of the concept was evident in the presentation.	5	4	3	2	1
E.	The students were able to demonstrate essential learning/understanding.	5	4	3	2	1
F.	The student's creativity was developed.	5	4	3	2	1
G.	The grading components in the rubric were in line with the objectives of the task/project.	5	4	3	2	1
H.	The grading system (rubric) manifests fairness.	5	4	3	2	1

II. Outcome of the Assessment Task:

A.	The assessment task is appropriate to the lesson.	5	4	3	2	1
B.	The assessment task developed the student's understanding of the concept.	5	4	3	2	1

Comments/Suggestions

_____
_____
_____

_____

Name and Signature of Evaluator

APPENDIX G

Experts' Evaluation on the Survey Questionnaire

Name: _____

School: _____

Number of years in teaching: _____

Educational Background:

College (Course/School): _____

Graduate Studies: _____

Please read each item carefully. Below are characteristics of a good questionnaire. Please place a check on the corresponding column to indicate your rating, 5 being the highest and 1, the lowest.

Criterion	5	4	3	2	1
A. Clarity					
1. The statements in the questionnaire are worded simply and clearly.					
2. The statements are easy to complete.					
B. Readability/Format					
1. The questionnaire is designed for easy tabulation.					
2. The statements are logically ordered.					
C. Comprehensiveness					
1. The questionnaire is complete, covering almost every aspect of identifying the students' perception.					
2. The questionnaire adheres to the objectives of the study.					
D. Suitability					
Each statement is placed in the appropriate category.					

Other comments and suggestions:

_____

_____

_____

_____

These points will be used to interpret your rates:

Range	**Level of Acceptability**
4.51 – 5.00	Highly Acceptable
3.51 – 4.50	Acceptable
2.51 – 3.50	Fairly Acceptable
1.51 – 2.50	Unacceptable
1.00 – 1.50	Highly Unacceptable

APPENDIX H

Experts' Evaluation Form on Evaluation Tools

Name: _____

School: _____

Number of years in teaching: _____

Educational Background:

College (Course/School): _____

Graduate Studies: _____

Please read each item carefully. Please place a check on the corresponding column to indicate your rating, 5 being the highest and 1, the lowest.

Criterion	5	4	3	2	1
A. Clarity					
1. The statements in the evaluation forms are worded simply and clearly.					
2. The statements are easy to complete.					
B. Readability/Format					
1. The evaluation forms are designed for easy tabulation.					
2. The statements are logically ordered.					
C. Comprehensiveness					
1. The evaluation forms covered almost every aspect of the essential elements required in the learning plan and assessment task.					
2. The evaluation forms adhere to the objectives of the study.					
D. Suitability					
Each statement is placed in the appropriate category.					

Other comments and suggestions:

_____

_____

_____

_____

These points will be used to interpret your rates:

Range	**Level of Acceptability**
4.51 – 5.00	Highly Acceptable
3.51 – 4.50	Acceptable
2.51 – 3.50	Fairly Acceptable
1.51 – 2.50	Unacceptable
1.00 – 1.50	Highly Unacceptable

APPENDIX I

FINAL EXAMINATION

MATH 015: Mathematics of Investment

Multiple Choice: Choose the letter of the best answer.

Course Objective Codes
CO1
ILO 22

1. The series of equal periodic payments which are due at the beginning of the period.
   A. Annuity due
   B. Ordinary annuity
   C. Deferred annuity
   D. Periodic payment

CO1, CO2
ILO 23, ILO 24

2. Find the present value of an ordinary annuity of P750 per month for 8 years if money is worth 7%, compounded monthly.
   A. P50,000
   B. P65,450
   C. P55,010.70
   D. 85,000

CO1
ILO 1

3. Interest in which only the original principal bears interest for the entire term of the loan.
   A. simple
   B. compound
   C. periodic
   D. equivalent

CO1
ILO 10

4. Interest added to the principal at the end of a certain period of time after which the interest is computed on the new principal, and this process is repeated until the end of the term of the loan is reached.
   A. simple
   B. compound
   C. periodic
   D. equivalent

CO1, CO2, CO3
ILO 15, ILO 16

5. A man purchases a house and lot, and agrees to pay P850,000 cash and P25,000 at the end of each month for 20 years. What is the cash value (in million) of the house and lot if money is worth 9%, compounded monthly?
   A. 3.6 M
   B. 5 M
   C. 2.1 M
   D. 7.5 M

For nos. 6-8, refer to the simple interest note as shown below:

P100,000	Cabuyao City, Laguna	June 29, 2013

One hundred twenty days after the above date, the undersigned promises to pay to the order of Juan Dela Cruz the sum of one hundred thousand and no/100 pesos with interest at 16% per annum payable at Malayan Bank & Trust Co. of Cabuyao City, Laguna, Philippines.

Signed by Robert Langdon

CO1, CO2, CO3
ILO 11

6. As can be gleaned from above note, the payee is_____.

   A. Juan Dela Cruz C. Malayan Bank & Trust Co.
   B. Robert Langdon D. Cabuyao City, Laguna

CO1, CO2, CO3
ILO 8

7. In the above note, the maker is_____.

   A. Juan Dela Cruz C. Barangay Bank & Trust Co.
   B. Robert Langdon D. Quezon City, Phil.

CO1, CO2, CO3
ILO 12

8. The maturity value of a note is _____.
   A. P105, 333.33 C. P 120,000.00
   B. P115, 220.30 D. P 124,44.00

CO1, CO2
ILO 12

9. Accumulate P5,000 for 7 ¼ years at 15% compounded quarterly.
   A. P12,550,05 C. P16,327.06
   B. 14,542.03 D. P18,558.98

CO1, CO2, CO3
ILO 11, ILO 12

10. How much must be invested today in a savings account in order to have P9,000 in 4 years if money earns at the rate of 4% compounded quarterly?
    A. P3,284.79 C. P7,675.39
    B. P5,500.55 D. 8,001.05

CO1, CO2
ILO 17, ILO 18

11. What is the effective rate that is equivalent to 12% compounded semi-annually?
    A. 12.36% C.15.10%
    B. 14.00% D.17.35%

CO1, CO2, CO3
ILO 14, ILO 15

12. How much must a 15 year- old boy deposit in a bank that pays interest at 11% converted quarterly so that he will have P50,000 after 10 years?
    A. P16,892.61 C. P19,9448.07
    B. P17,572.00 D. P21,0223.50

CO1
ILO 1

13. The person or institution which loans the money.
    A. Banker
    B. Debtor
    C. Lender
    D. Maker

CO1, CO2
ILO 2

14. Find the interest on $P1{,}200$ at 4.5% simple interest for 5 years.
    A. P27
    B. P270
    C. P2, 700
    D. P270,000

CO2
ILO 4

15. How long should a merchant pay a loan of P15, 000 at 3.5% interest rate if the interest is P1,575?
    A. 30 days
    B. 3 months
    C. 3 years
    D. 9 months

CO1, CO2
ILO 3

16. Find the amount on $P40{,}000$at 12 ¼% simple interest for 9 months.
    A. P3,675
    B. P43,675
    C. P44,100
    D. P84,100

CO1, CO2
ILO 5

17. What is the date 46 days after 5th of May 2013?
    A. June 18, 2013
    B. June 19, 2013
    C. June 20, 2013
    D. June 21, 2013

CO1, CO2, CO3
ILO 12

18. A note of P5,000 will mature in 80 days with interest at 12.75%. When is the due date if the note is dated Nov. 27, 2013?
    A. February 15, 2014
    B. February 16, 2014
    C. February 14, 2013
    D. February 17,2013

CO1, CO2,
ILO 14

19. It is the total number of conversion periods converted quarterly for 18 months.
    A. 72
    B. 36
    C. 6
    D. 4.5

CO1, CO2, CO3
ILO 2

20. Ida borrowed P150, 000 payable for 32 months. What was the rate of interest if she paid a total amount of P198, 000?
    A. 12%
    B. 9.5%
    C. 6%
    D. 1%

CO1
ILO 14

21. It is the ratio of the rate and conversion period per year.
    A. Effective rate C. Nominal rate
    B. Interest rate D. Periodic rate

CO1
ILO 1

22. The capital or sum of money invested.
    A. Principal C. Proceeds
    B. Interest D. Savings

CO1, CO2
ILO 10

23. Discount P 10, 500 for 125 days at 8.2% simple interest.
    A. P10, 209.32 C. P8, 172.97
    B. P10, 613.19 D.P8, 197.86

CO1, CO2, CO3
ILO 6

24. Brian borrowed P30 000 from a financing company charging $13\frac{2}{5}\%$ simple exact interest for 180 days. How much did Brian pay back the company at the end of the term?
    A. P32, 010 C. P 37, 242.68
    B. P31, 982.47 D. P35, 508

CO1, CO2
ILO 3

25. It is the actual time from January 15, 2013 to September 28, 2013.
    A. 255 C. 257
    B. 256 D. 258

CO1
ILO 22

26. Annuity made at the beginning of the payment interval.
    A. ordinary annuity C. deferred annuity
    B. annuity due D. amortization

CO1
ILO 29

27. Is the gradual extinguishment of any obligation over a period of time
    A. sinking fund C. amortization
    B. periodic payment D. present value

CO1, CO2, CO3
ILO 5, ILO 6

28. On March 23, 2013, Mary applied for a $\mathrm{P}48{,}000$ loan at 9.5% simple interest. She promised to pay on July 12, 2013. Compute for the interest of the loan using Banker's Rule.
    A. P1, 386.74 C. P1,406.00
    B. P1, 361.75 D. P1, 380.67

CO1, CO2
ILO 10

29. Accumulate P24, 000 if it is invested at 9.5% for 5 years.
    A. 16,271.19 C. 35,400
    B. 21,820 D. 36,218.12

CO1, CO2, CO3
ILO 18

30. At what rate compounded semi-annually could an investor get as much interest as he could with 16% compounded quarterly?
    A. 14.15% C. 17.25%
    B. 16.32% D. 18%

31-32. Given: March 23 to October 16,213

CO1
ILO 5

31. What is the actual time?
    A. 203 days C. 300 days
    B. 207days D. 350days

CO1, CO2
ILO 5

32. What is the approximate time?
    A. 203 days C. 300 days
    B. 207days D. 350days

CO1
ILO 33

33. A savings fund productively invested in anticipation for future expenses.
    A. sinking fund C. amortization
    B. periodic payment D. present value

CO1
ILO 25

34. A father purchased a car worth P2, 300, 000 payable for 10 years at 15% converted monthly. How much will his monthly payments be at the beginning of each month?
    A. P 36, 468.39 C. P36, 648.93
    B. P 36, 684.93 D. P36, 864.39

CO1, CO2
ILO 17, ILO 18

35. What nominal rate compounded monthly will yield the effective rate of 4%?
    A. 3.93% C. 1.6%
    B. 13.5% D. 5.3%

APPENDIX J

Table of Specification

Item No.	Course Objective	Intended Learning Outcomes
1	CO1	ILO22
2	CO1, CO2	ILO23, ILO24
3	CO1	ILO1
4	CO1	ILO10
5	CO1, CO2, CO3	ILO15, ILO16
6	CO1, CO2, CO3	ILO11
7	CO1, CO2, CO3	ILO8
8	CO1, CO2, CO3	ILO12
9	CO1, CO2	ILO12
10	CO1, CO2, CO3	ILO11, ILO12
11	CO1, CO2	ILO17, ILO18
12	CO1, CO2, CO3	ILO14, ILO15
13	CO1	ILO1
14	CO1, CO2	ILO2
15	CO2	ILO4
16	CO1, CO2	ILO3
17	CO1, CO2	ILO5
18	CO1, CO2, CO3	ILO12
19	CO1, CO2	ILO14
20	CO1, CO2, CO3	ILO2
21	CO1	ILO14
22	CO1	ILO1
23	CO1, CO2	ILO10
24	CO1, CO2, CO3	ILO6
25	CO1, CO2	ILO3
26	CO1	ILO22
27	CO1	ILO29
28	CO1, CO2, CO3	ILO5, ILO6
29	CO1, CO2	ILO10
30	CO1, CO2, CO3	ILO18
31	CO1	ILO5
32	CO1, CO2	ILO5
33	CO1	ILO33
34	CO1	ILO25
35	CO1, CO2	ILO17, ILO18

APPENDIX K

COURSE SYLLABUS

COLLEGE / DEPARTMENT	:	**COLLEGE OF ARTS AND SCIENCES**
COURSE CODE	:	**MATH015**
COURSE TITLE	:	**Business and Investment Mathematics**
PRE-REQUISITE	:	MATH001 OR MATH011
CO-REQUISITE	:	None
CREDIT UNIT(S)	:	3 units
CLASS SCHEDULE	:	1.5 hours per meeting/ 4.5 hours per week

COURSE DESCRIPTION

This course covers the basic mathematical tools and operations met in business and investment problems. It deals with theories, application and mathematical aspects of interests, discounts, annuities and amortization.

COURSE OBJECTIVES

A student completing this course should at the minimum be able to:

1) apply the concepts of interest, discounts, annuities, amortization and sinking fund in business transactions.
2) demonstrate logical and critical thinking skills in solving problems.
3) solve “real-world” problems involving business and investment.
4) value the importance of saving and spending wisely

COURSE COVERAGE

WEEK NO.	TOPIC	LEARNING OUTCOMES	DATE COVERED*
1 - 3	**Simple Interest** • Computation of Simple Interest • Calculating time between dates **Simple Discount** • Computation of Discount • Accumulation and Discounting	1. Define terms and concepts of simple interest **(C01)** 2. Compute for the simple interest **(C02)** 3. Compute for the interest for less than a year **(C02)** 4. Solve for the unknown quantities (Principal, Rate or Time) in a problem **(CO1, CO2, CO3)** 5. Identify the actual and approximate time. **(C01)** 6. Solve for the ordinary and exact interest **(CO1, C02)** 7. Understand the concept and terms in discounting **(CO1, C02)** 8. Derive a formula for: **(CO1)** a.) Discount b.) Final Amount c.) Discount Rate d.) Time e.) Present Value / Proceeds 9. Solve problems involving discount **(CO1, C02, CO3, CO4)** 10. Solve problems involving accumulation and discounting (Simple Interest and Discount) **(CO2, CO3, CO4)**	
	FIRST LONG EXAMINATION **Date Given:**	**Validated By:**	
4 - 6	**Promissory Notes** • Parts of a Promissory Note • Problem Solving **Compound Interest** • Compounding • Nominal and Effective Rates • Equivalent Rates • Continuous compounding	11. Identify the different parts of a promissory note**(C01)** 12. Identify the following parts of a promissory note through computation: **(CO1, CO2)** • Interest • Maturity Value • Maturity date • Bank Discount • Proceeds 13. Solve problems involving promissory notes **(C02, CO3, CO4)** 14. To understand the concept and terms in compound interest **(CO1)** 15. Manipulate formula to solve for the unknown quantities in a compound interest: **(CO1)**	

		• Rate • Time • Present Value • Final Amount 16. Solve problems involving accumulation and discounting (Compound Interest) **(CO2, CO3)** 17. Solve for the nominal or effective rate of interest **(CO1, CO2)** 18. Solve for the equivalent rate **(CO1, CO2)** 19. Solve problems involving continuous compounding **(CO2, CO3, CO4)** 20. Understand inflation and the consumer price index **(CO1, C02, CO4)** 21. Understand the time value of money **(C01, CO4)**	
	SECOND LONG EXAMINATION **Date Given:**	**Validated By:**	
7 -8	**Simple Annuities** • Ordinary Annuity • Annuity Due • Deferred Annuity	22. Identify the different types of annuities **(C01)** 23. Derive a formula to solve for the unknown quantities of an ordinary annuity **(CO1, CO2)**: a.) Amount of Annuity b.) Present Value c.) Periodic Payment d.) Interest Rate e.) Term of an annuity f.) Concluding payment 24. Solve problems involving ordinary annuity **(CO2, CO3, CO4)** 25. Derive a formula to solve for the unknown quantities of an annuity due **(CO1, CO2)**: a.) Amount of Annuity b.) Present Value c.) Periodic Payment d.) Concluding payment 26. Solve problems involving annuity due **(CO2, CO3, CO4)** 27. Derive a formula to solve for the unknown quantities of a deferred annuity **(CO1, CO2)**: a.) Amount of Annuity b.) Present Value c.) Periodic Payment d.) Term of an annuity e.) Concluding payment 28. Solve problems involving deferred annuity **(CO2, CO3, CO4)**	

	THIRD LONG EXAMINATION **Date Given:**	**Validated By:**	
9- 11	**Amortization and Sinking Fund** • Amortization • Sinking Fund	29. Understand the concept amortization througproperties and real estates and debts **(C01, CO4)** 30. Use the formula for amortization to find the amount of periodic payment **(CO2, C03)** 31. Solve for the interest and outstanding balance in any amortation payment **(CO2, C03)** 32. Set up an amortization table **(CO1, CO2, C03)** 33. Define terms and concepts of sinking fund **(C03)** 34. Sove for the amount of a sinking fund Payment **(CO2, C03)** 35. Compute for interest and the growth of a fund **(CO2, C03)** 36. Set up a sinking fund schedule **(CO1, CO2, C03)** 37. Determine the interest earned every period **(CO2, C03)** 38. Determine the amount before and after periodic deposits **(CO2, C03)** 39. Set up a sinking fund to retire specific debts. **(C03)**	
	FINAL EXAMINATION **Date Given:**	**Validated By:**	

APPENDIX L

Item Analysis of the Results of Final Examination

Item No.	TOTAL	TOTAL(74)	REMARKS
		%	
1	47	63.51	average mastery
2	50	67.57	moving towards mastery
3	68	91.89	closely approximating mastery
4	63	85.14	moving towards mastery
5	9	12.16	very low mastery
6	52	70.27	moving towards mastery
7	60	81.08	moving towards mastery
8	67	90.54	closely approximating mastery
9	63	85.14	moving towards mastery
10	59	79.73	moving towards mastery
11	69	93.24	closely approximating mastery
12	57	77.03	moving towards mastery
13	35	47.3	average mastery
14	72	97.3	mastered
15	60	81.08	moving towards mastery
16	25	33.78	low mastery
17	63	85.14	moving towards mastery
18	54	72.97	moving towards mastery
19	20	27.03	low mastery
20	56	75.68	moving towards mastery
21	32	43.24	average mastery
22	61	82.43	moving towards mastery
23	14	18.92	low mastery
24	45	60.81	average mastery
25	57	77.03	moving towards mastery
26	44	59.46	average mastery
27	53	71.62	moving towards mastery
28	61	82.43	moving towards mastery
29	54	72.97	moving towards mastery
30	54	72.97	moving towards mastery
31	71	95.95	closely approximating mastery
32	69	93.24	closely approximating mastery
33	64	86.49	closely approximating mastery
34	68	91.89	closely approximating mastery
35	56	75.68	moving towards mastery

APPENDIX M

Experts' Profile

Name	School	Educational Background	Number of years in Teaching
Gilbert L. Fabila	Malayan Colleges Laguna	Post Graduate Certificate (PG Cert – MET) Master Level 1 Southampton Solent University, United Kingdom BSIE Physics – Marikina Polytechnic College	20
Arvin D. Guingguing	Malayan Colleges Laguna	Ph.D. in Statistics – UPLB BS STAT and Master of Math – MSU - IIT	13
Anthony Jefferson S. Atienza	Malayan Colleges Laguna	Master of Arts in Environmental Engineering BS Electrical Engineering major in Power Engineering	10
Anthony S. Morfe	Malayan Colleges Laguna	MS in Mathematics – University of Batangas BS in Mathematics – De La Salle Lipa	3
Romel L. Santiago	Malayan Colleges Laguna	BS Mathematics – UPLB	2

Curriculum Vitae

IRISH MAE GARCIA MAGTAGÑOB

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Personal Information

Date of Birth:	**September 18, 1984**
Place of Birth:	**Calamba City, Laguna**
Gender:	**Female**
Civil Status:	**Single**
Citizenship:	**Filipino**
Height:	**5'**
Weight:	**48 kg**
Religion:	**Roman Catholic**
Profession:	**Teacher**

Educational Background

Graduate:

Master of Education with specialization in Mathematics

Philippine Normal University

Taft Ave., Manila

Undergraduate:

Bachelor of Secondary Education major in Mathematics

Philippine Normal University

Taft Ave., Manila

March 2005

Secondary Education:

Canossa Academy

Calamba City, Laguna

March 2001

Elementary Education:

Canossa Academy

Calamba City, Laguna

March 1997

APPENDIX A

TEACHING AND LEARNING PLAN

Math 015: Business and Investment Mathematics

Course Description

This course covers the basic mathematical tools and operations met in business and investment problems. It deals with theories, application and mathematical aspects of interests, discounts, annuities and amortization.

Course Objectives

A student completing this course should at the minimum be able to:

1.) apply the concepts of interest, discounts, annuities, amortization and sinking fund in business transactions.
2.) demonstrate logical and critical thinking skills in solving problems.
3.) solve "real-world" problems involving business and investment.
4.) value the importance of saving and spending wisely

Week No.	Topic / Lesson	Intended Learning Outcomes (ILO)	Teaching and Learning Activities (TLA)	Assessment Task (AT)
1 – 2	**Simple Interest** • Basic Concepts (Principal, Rate and Time) • Calculating time between dates • Ordinary and Exact Interest	1.) Define terms and concepts of simple interest (CO1) 2.) Compute for the simple interest (CO2) 3.) Compute for the simple interest for less than a year (CO2) 4.) Solve for the unknown quantities (Principal, Rate or Time)in a problem (CO1, CO2, CO3) 5.) Identify the actual and approximate time (CO1)	➢ Introduction: Video Presentation (http://www.youtube.com/watch?v=2dVNmBBvQlo) Objective: To understand the concept of interest Guide Questions: 1.) What is interest? 2.) How do you gain interest? 3.) Name situations which involves interest ➢ Lecture 1.) Explain the basic concepts of simple interest	➢ Seat Work

3 – 4	**Simple Discount** • Computation of Discount • Accumulation and Discounting	6.) Solve for the ordinary and exact interest (CO1, CO2) • Io – Acct • Io – App • Ie – Act • Ie – App 7.) Understand the concept and terms in discounting (CO1, CO2) 8.) Derive a formula for (CO1): a.) Discount b.) Final amount c.) Discount rate d.) Time e.) Present Value / Proceeds 9.) Solve problems involving discount (CO1, CO2, CO3, CO4) 7.) Solve problems involving accumulation and discounting (Simple Interest and Discount) (CO2, CO3, CO4)	2.) Ask the students to manipulate the formula to solve for the following: a.) Principal b.) Rate c.) Time 3.) Explain the difference between the actual and approximate time. Ask the students so solve for the actual and approximate time between dates: a.) By listing down the actual and approximate number of days per month b.) Using a table 4.) Explain the difference between exact and ordinary interest. 5.) Ask the students to manipulate a formula for the following: a.) Io – Act b.) Io – App c.) Ie – Act d.) Ie – App ➢ Situation Analysis Cite a situation which involves discounting. Based on the situation, let the students explain the concept of discounting and derive a formula for the other quantities. ➢ Lecture Define accumulation and discounting Let the students identify problems which involve accumulation and discounting.	**<u>Activity #1</u>:** Number of Days in a Year • Create a table of the exact number of days in a year ➢ Seat Work ➢ Seat Work ➢ Quiz #1: Simple Interest ➢ Seat Work **<u>Activity #2</u>:** Problem Set Quiz #2: Accumulation and Discounting
FIRST LONG EXAM				
5 – 7	**Promissory Notes** • Parts of a Promissory Note • Problem Solving	10.) Identify the different parts of a promissory note (CO1) 11.) Identify the following parts of a promissory note through computation: (CO1, CO2)	➢ Show an example of a promissory note. • Let the students identify the different parts of a promissory note. • Explain the concepts and computations involving promissory	➢ Seat Work ➢ Quiz #3: Promissory

	Compound Interest • Compounding • Nominal and Effective Rates • Equivalent Rates • Continuous compounding	• Interest • Maturity Value • Maturity date • Bank Discount • Proceeds 12.) Solve problems involving promissory notes (CO2, CO3, CO4) 13.) To understand the concept and terms in compound interest (CO1) 14.) Manipulate formula to solve for the unknown quantities in a compound interest: (CO1) • Rate • Time • Present Value • Final Amount 15.) Solve problems involving accumulation and discounting (Compound Interest) (CO2, CO3, CO4) 16.) Solve for the nominal or effective rate of interest (CO1,CO2) 17.) Solve for the equivalent rate (CO1, CO2) 18.) Solve problems involving continuous compounding (CO2, CO3) 19.) Understand inflation and Consumer Price Index (CO1, CO2, CO4) 20.) Understand the time value of money (CO1, CO4)	notes. ➢ Introduction: Video Presentation (http://www.youtube.com/watch?v=1j0bAIdBJrU) Objective: To differentiate simple interest from compound interest Guide Questions: 1.) What is compound interest? 2.) How is compound interest different from simple interest? 3.) Can you cite examples involving compound interest? 4.) How is compounded interest computed? ➢ Lecture 1.) Define the different terms used in compound interest. 2.) Derive a formula to solve for the unknown quantities. 3.) Relate the concept of compound interest in accumulation and discounting through problem solving. 4.) Explain nominal and effective rates. 5.) Explain the different formula to solve for the equivalent rate. • Compound – Compound • Simple – Compound • Compound – Simple 6.) Explain continuous compounding. ➢ Situation Analysis Economics: Inflation and Consumer Price Index • Through discussion and presentation of data, the students should be able to understand inflation and consumer price index. • The students should be able to think critically on how those concepts affect the economy. ➢ Valuing: How do you value your money?	Notes **Activity #3:** Research • Group Work • Look for a sample computation of Compound Interest (eg: brochure of properties which are being sold) • If you are the owner of the property, what interest rate would you like to use? Show the complete computation. ➢ Quiz #4: Compound Interest ➢ Seat Work ➢ Quiz #5: Equivalent Rates **ASSESSMENT TASK /PROJECT#1**: **Loans and Investments** *Refer to the attached file for the description of the project.

SECOND LONG EXAM				
8 – 9	**Simple Annuities** • Ordinary Annuity • Annuity Due • Deferred Annuity	21.) Identify the different types of annuity (CO1) 22.) Derive a formula to solve for the unknown quantities of an ordinary annuity (CO1, CO2): a.) Amount of Annuity b.) Present Value c.) Periodic Payment d.) Interest Rate e.) Term of an annuity f.) Concluding payment 23.) Solve problems involving ordinary annuity (CO2, CO3, CO4) 25. Derive a formula to solve for the unknown quantities of an annuity due (CO1, CO2): a.) Amount of Annuity b.) Present Value c.) Periodic Payment d.) Concluding payment 26. Solve problems involving annuity due (CO2, CO3, CO4) 27. Derive a formula to solve for the unknown quantities of a deferred annuity (CO1, CO2): a.) Amount of Annuity b.) Present Value c.) Periodic Payment d.) Term of an annuity e.) Concluding payment 28. Solve problems involving deferred annuity (CO2, CO3, CO4)	➢ Lecture 1.) Explain and differentiate the different types of annuity. 2.) Present real life applications of annuities. • Explain to the students how credit card companies compute for the monthly periodic payments. • Ask the students to present their research on theterms and conditions of time deposits. 3.) Present to the students the formula to solve for the annuity and how it is being computed. 4.) Let the students derive a formula for the unknown quantities.	➢ Seat Work ➢ Research: 1.) Ask the students to visit any real estate's company and ask for a sample computation. 2.) Ask the students to research on the terms and conditions of time deposits. ➢ Quiz #6: Annuities

10 – 11	**Amortization and Sinking Fund**	29. Understand the concept amortization througproperties and real estates and debts (C01, CO4) 30. Use the formula for amortization to find the amount of periodic payment (CO2, C03) 31. Solve for the interest and outstanding balance in any amortation payment (CO2, C03) 32. Set up an amortization table (CO1, CO2, C03) 33. Define terms and concepts of sinkingfund (C03) 34. Sove for the amount of a sinking fund payment (CO2, C03) 35. Compute for interest and the growthof a fund (CO2, C03) 36. Set up a sinking fund schedule (CO1, CO2, C03) 37. Determine the interest earned every period (CO2, C03) 38. Determine the amount before and after periodic deposits (CO2, C03) 39. Set up a sinking fund to retire specific debts. (C03)	➢ Based on the concept of annuities, let the students set up an amortization table and sinking fund schedule	➢ Seat Work ➢ Quiz #7: Amortization and sinking Fund **ASSESMENT TASK/PROJECT#2**: **IT 101:Amortization and Sinking Fund** *Refer to the attached file for the description of the project.
THIRD LONG EXAM				
FINALS				