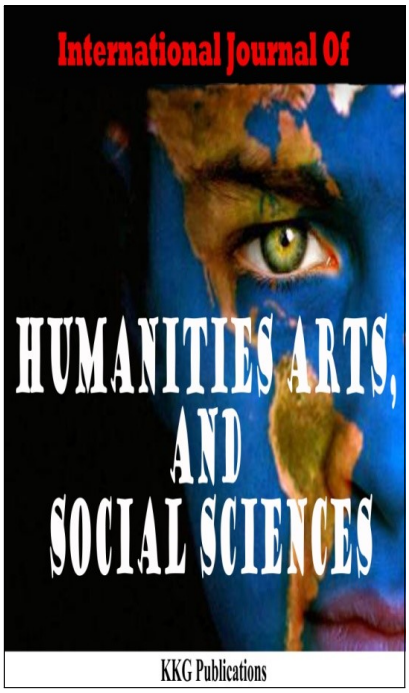

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Design and Development of an Electronically Generated Table of Specifications (TOS)

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DESIGN AND DEVELOPMENT OF AN ELECTRONICALLY GENERATED TABLE OF SPECIFICATIONS (TOS)

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Abstract. This study was conducted to design and develop a computer-based TOS that could fast track the preparation and construction of the TOS. The researchers conducted a documentary analysis in order to gather the needed data and interview to clarify information requirements. The study employed the descriptive developmental research. This is suitable whenever the output needs to be developed, validated, and tried out to determine if the proposed system is acceptable to the users. The development of the TOS underwent through the following four (4) stages: (1) Planning Stage, (2) Developmental Stage, (3) Evaluation Stage, and (4) Output Stage. Each stage had different process from others. The content validity and acceptability of the developed system were assessed by ten (10) chairpersons and faculty members respectively. After careful scrutiny of the evaluation results, the developed system got an average mean of 4.51 with a descriptive rating of Strongly Agree. As for the acceptability, it got an average mean of 4.07 which can be interpreted as Acceptable. Having found the level of acceptability of this system is high, the researchers strongly recommend that the system will be utilized by the faculty members of the campus. Further studies should also be conducted in line with this study.

INTRODUCTION

Providing quality education is the biggest objective of every educational institution. In educational institutions, quality instructional process and methodologies play a significant role in ensuring that there is maximum impart of knowledge and skills to students. As such, varied instructional techniques to wit: film showing, projects, group dynamics, case study, workshops, simulations, and others, aside from professional lectures are employed. Aside from instruction, assessment of student performance is also important. Assessment is at the core of student experience and Rust (2002) suggested that the principles, procedures, and processes of all assessment should be explicit, valid, and reliable.

Assessment of academic performance is necessary to ensure that every student is able to gain the learning competencies in a particular subject. The academic performances of students are derived from the cumulative test scores using different assessments on contents that they have gone through a particular time frame (Mee, Musah, Al-Hudawi, Tahir & Kamil, 2015). Thus, teachers must have a systematic approach to test construction to ensure that the assessment instruments used are valid and relevant. Bridge, Musial, Frank, Roe, and Sawilowsky (2003) mentioned in their study that measurement experts generally agree that blueprint approach to test construction is one fundamental method to generate content-valid exams. The Commission on Higher Education suggests that educational institutions follow a test blueprint or a Table of Specifications (TOS) in tests administered so that a balanced test representing varied skills can be achieved.

As cited in the study of Alade and Omoruyi (2014), constructing fair test that gives accurate information about students' learning is an important skill for teachers. The table of specifications is often useful to organize planning process of designing a test which allows the teacher to determine the content of the test. Using a TOS ensures that a balance test is administered to the students as it would have representative questions appear on the test.

According to Notar, Zuelke, Wilson and Yunker, (2004), a TOS, sometimes called a test blueprint, is a table that helps teachers align objectives, instruction, and assessment. It is a tool being used by teachers to guide them in the preparation of tests. It helps to ensure that there is a match between what is taught and what is tested. TOS can be used to help teachers frame the decision-making process of test construction and improve the validity of teachers' evaluations based on tests constructed for classroom use. It can help teachers map the amount of class time spent on each objective with the cogni-

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tive level at which each objective was taught thereby helping teachers to identify the type of items they used to include in their tests (Fives & DiDonato-Barnes, 2013). It can also serve to clearly define the scope and the focus of the test (Fives & DiDonato-Barnes, 2013). It ensures that teachers include test items that tap different levels of cognitive complexity when measuring students' assessment (Kubiszyn & Borich, 2003).

The main benefits of a TOS are the following: 1) to ensure content validity, that is to make sure that questions cover higher level objectives that the most important objectives are appropriately emphasized by assigning an appropriate number of items and 2) verify that the test contains a representative sample of the corresponding content and emphasis given in class for the various areas.

In PSU Urdaneta City Campus, different departments prepare their TOS before or after exam period and are being submitted as a requirement before each term. TOS is usually needed in the accreditation of different programs of the campus. Thus, preparing it is a must. Sometimes, the TOS is overlooked and is not prepared before the instructor/professor administers the exam. Therefore, without a TOS, the test questions were not well-represented in the exams based on the course outline. More time is being spent in the preparation and generation by the instructors/professors. Thus, there is a need for a system that can fast track the preparation and generation of TOS. According to the findings of the study made by Alade and Omoruyi (2014), some problems in preparing TOS include lack of coherence in TOS that leads to test that fails to provide evidence with which teachers can make valid judgment; construction of the table of specification if not properly done encourages content validity problems to mention but few. With the reasons mentioned above, the campus needs to acquire a system that will help them generate a TOS and speed up the process of preparing it.

Objectives of the Study

The main objective of the study is the development of a Computerized TOS for PSU Urdaneta City Campus. Specifically, it sought to attain the following:

- What particular contents should be included in the development of a computerized TOS?
- What is the validity and acceptability of the proposed computerized Table of Specifications?

LITERATURE REVIEW

The review is organized under the general headings to understand how to create a well-planned TOS namely:

- Significance of a TOS
- Creating a TOS,
- Aligning Assessment with Learning Objectives, and
- the Three Taxonomy of Learning Objectives.

Significance of TOS

The cornerstone of classroom assessment practices is the validity of the judgments about students' learning and knowledge (Wolming & Wikstrom, 2010). A TOS is one tool that teachers can use to support their professional judgment when creating or selecting test for use with their students (Fives & DiDonato-Barnes, 2013). It can be used in conjunction with lesson and unit planning to help teachers make clear the connections between planning, instruction, and assessment (Fives & DiDonato-Barnes, 2013; Artz & Armour-Thomas, 1992).

When constructing a test, teachers need to be concerned that the test measures an adequate sampling of the class content at the cognitive level that the material was taught (Fives & DiDonato-Barnes, 2013). The TOS can help teachers map the amount of class time spent on each objective with the cognitive level at which each objective was taught thereby helping teachers to identify the types of items they need to include in their tests (Fives & DiDonato-Barnes, 2013). By providing a table of specification prior to the items writing stage, the teachers can guarantee that the resulting instrument contains a proper balance of topics and taps a desired range of cognitive skills (Alade & Omoruyi, 2014). According to Akem and Agbe (2003), and Mehrens and Lehmann, (1998), as cited in the study of Alade and Omoruyi, (2014), TOS will help to ensure that

- Teachers are able to determine what topic is being stressed and also assist in the preparation of tests that reflect what students have learnt and also limit the amount of time spent on each unit.
- No important objective or content area will be advertently omitted.
- The table of specifications can assist immensely in the preparation of test items, production of valid and robust test, in the classification of objectives to both teacher and students, and in assisting the teacher to select the most appropriate teaching strategy.
- Only those aims and objectives actually involved in the instructional process will be assessed.

Creating a TOS

There is both a real and perceived mismatch between the content examined in class and the material assessed at the end of chapter/unit test (Fives & DiDonato-Barnes, 2013). This lack of coherence leads to a test that fails to provide evidence

from which teachers can make valid judgments about students progress (Brookhart, 1999). One strategy to address this problem is to develop a TOS.

As cited in the study conducted by Alade and Omoruyi (2014), Carey (1988) enumerated six major elements that should be included in the preparation of TOS for a comprehensive examination. It includes: balance among goals selected for examination, balance among levels of learning, the test format, the total number of items, the number of test items for each goal and level of learning, and the enabling skills to be selected from each goal framework.

The study of (Fives & DiDonato-Barnes, 2013) stressed that the teachers need to determine the following: (1) the number of test items to include and (2) the distribution of these items in the taxonomy of learning objectives. In a similar study, Fives and DiDonato-Barnes (2013) mentioned that the number of items to include on any given test is a professional decision made by the teacher based on the number of objectives in the unit, his/her understanding of the students, the class time allocated for testing, and the importance of the assessment. Shorter assessments can be valid, provided that the assessment includes ample evidence on which the teacher can base inferences about students' scores (Fives & DiDonato-Barnes, 2013). Longer tests can include a more representative sample of the instructional objectives and students' performance. They generally allow for more valid inferences. However, students are more likely to get fatigued with longer tests and perform less well as they move through the test (Fives & DiDonato-Barnes, 2013). They noted that the ideal test is one that students can complete in the time allotted, and to check their answers before turning in their completed assessment.

To determine the percentage of total class time that was spent on each objective, you take the minutes spent on the objective and the total minutes multiplied by 100 and to determine how many test items should be used to assess each objective, multiply the percentage of the test with each objective that should be assessed by the number of items the teacher has decided to include on the test (Fives & DiDonato-Barnes, 2013). In the study of Alade and Omoruyi (2014), they mentioned that there are many approaches to formatting in developing and using a Table of Specification. The teacher needs to make his/her own TOS provided that it should include the six major elements as mentioned by (Carey, 1988).

Meanwhile, Abadines (2012), enumerated five steps in creating a TOS. The first thing to do is to determine the coverage of the test/exam. Select the topics to include and wish to test in the exam. The test questions will not be able to cover all the topics as long as the teacher selects only the most important topics.

Second is to determine the testing objectives for each topic. Familiarization with Bloom's taxonomy of thinking skills is a must. Bloom has identified the hierarchy of learning objectives, from the lower to the higher thinking skills of evaluation and synthesis which include Knowledge, Comprehension, Application, Analysis, Synthesis, and Evaluation. The objectives per topic area should use very specific verbs on how you intend to test the students using the Bloom's taxonomy.

Third is to determine the time spent for each content area. This is important because it will determine how many questions you should devote for each topic. The longer the allotted time, the more questions should be put into that area.

Fourth is to determine the assessment type for each objective which is the next step. Align the learning objectives to the Bloom's taxonomy. For example, knowledge questions can be accomplished easily through multiple choice questions or matching type exams. To test evaluation or synthesis of a topic, create exam type questions that create diagrams and explain their diagrams in their analysis.

And the last step is to polish the TOS. Make sure that the test covered the topics the teacher taught and the number of items in the test should be sufficient for the time allotted for the test. Consult expert to give a feedback on how to improve the TOS.

Aligning Assessment with Learning Objectives

Reeves (2003) stressed that better assessment and enhanced alignment in college teaching and learning will require a larger investment in assessment and evaluation than most institutions are expending at this time. Assessment focuses on learning, teaching, and outcomes. It provides information for improving learning and teaching. It is an interactive process between students and faculty that informs faculty how well their students are learning what they are teaching (Angelo & Cross, 1993). For example, administering a pretest. Evaluation, on the other hand, is focused on judging whether the program or instruction has met its Intended Learning Outcomes (ILO) such as administering a summative test.

According to Mellon (2017), assessments need to provide the instructors and the students with evidence of how well the students have learnt. She mentioned that there are two reasons for aligning assessments with learning objectives. First, alignment increases the probability that teachers will provide students with the opportunities to learn and practice the knowledge and skills that will be required on the various assessments. Second, when assessments and objectives are aligned, having a good scholastic performance will translate into good learning. Also, when objectives and assessments are misaligned, many students will focus their efforts on activities that will lead to

good grades on assessments, rather than focusing their efforts on learning.

When designing assessments, it is important to make sure that any exams or assignments match the learning outcomes of the course (Mellon, 2017). Assessments should be based on material covered in the course, and students should perceive the material as relevant and fair (Mellon, 2017).

In a handout made by Ryerson University, (2016), she noted that when designing a new assessment or revising an old one, "the most important component is to be sure there is a match between the objectives of the unit/course/lesson being assessed, the teaching/learning activities used, and the assessment tool". As excerpted by Ryerson University, (2016) from "Evaluating Your Assessment", Indiana University suggested asking the following questions:

- What are the objectives of the course/unit/lesson that are being assessed?
- What level from Bloom's taxonomy is being assessed: knowledge, comprehension, application, analysis, synthesis, and/or evaluation? Is the level appropriate given the objectives of the course/unit/lesson?
- Is the assessment at a level appropriate to the level of the course?
- How well does the content of the assessment match the objectives being assessed?
- How well does the content of the assessment match the learning opportunities presented in the unit/lesson/course (i.e., does the assessment assess what was taught)?
- Is the assessment organized in such a way as to aid clarity and understanding of its requirements?

"Learning Outcomes or learning objective (Los) are statements that predict what learners will gain as a result of learning. A carefully thought-out learning outcome will give a solid indication of what kinds of assessment are appropriate, and of the skills and knowledge the learners will have to demonstrate to pass. The clearer the learning outcome, the easier it will be to devise an appropriate assessment" (O'Farrell, 2016). A good LOS explains the intended learning outcome and answers the question what the students should be able to do at the end of the course that they could not do before (Saul, Becker, Hofmann, & Pharow, 2011). According to Foster (2003), LOSs should be SMART (specific, measurable, achievable, realistic, time-bound) and also simple, clear, and precise.

As summarized by http://www.deakin.edu.au (2016), "each intended learning outcome should describe the observable knowledge or skills that you expect students to be able to demonstrate as a result of their work in the unit. It should contain: A verb that is appropriate to the type of knowledge or skill required and a noun that describes the content the verb is meant to address." The following are the points to remember when designing assessments to match learning outcomes as excerpted from (GIHE, 2016):

- The assessment should align firstly with the overall desired learning outcomes and secondly with the more detailed content of the course.
- Be clear about what you are trying to assess. This will make writing assessment tasks or questions much easier. Most courses will need a range of assessment methods to adequately assess the content and desired learning outcomes.
- Pay attention to the cognitive level of the assessment task or question. Some tasks operate at a low level of factual recall, while others ask students to analyze, synthesize or evaluate information. The cognitive level of the task or question should match your goals in the desired learning outcomes or curriculum plan.

Burke (2010) suggested to create a test blueprint or TOS to help align your assessment with your course outcomes. The table can have a column for learning to be measured or course outcomes, weight per course outcomes, level, and domain of knowledge e.g., Bloom's Taxonomy, and Timing/Pacing.

In 1956, Benjamin Bloom, University Examiner at University of Chicago, together with other educational psychologists, proposed a classification of the various levels of knowledge mastery that may be achieved by a learner (Bloom, 1956). Bloom's Taxonomy or BT describes levels of student learning within the cognitive dimension (Bloom, 1956). This taxonomy was motivated in part by the observation that most exam questions require only rote memorization and regurgitation of knowledge; as a result, such questions cannot truly assess how well a student has mastered the concepts (Starr, Manaris, & Stalvey, 2008). Bloom identifies six levels of learning mastery, namely knowledge, comprehension, application, analysis, synthesis, and evaluation (Akem & Agbe, 2003).

After considering what should be taught within a course, it is important to decide to which extent and under which circumstances the competencies should be mastered by the students (Modritscher & Sindler, 2005). Therefore, a teacher has to define learning objectives following some kind of taxonomy, for instance the one by Modritscher and Sindler (2005).

The following studies illustrate how the BT may be used to specify assessable learning objectives and provide pointers on how it may be used for assessment.

The study of Starr et al., (2008) noted that the Bloom's Taxonomy has been used for creating exams and other student

assessment instruments. They proposed the use of Bloom's Taxonomy as a vehicle for exploration, specification, and refinement of assessable learning objectives in CS courses. They've found out that Bloom's Taxonomy improves course preparation and delivery through better specification of course material communication among faculty is enhanced through the specification of learning outcomes for courses and programs. A Bloom-level specification of each learning objective enables more concise and informative communication during course development and deployment. They illustrated a simple process for applying it in computer science (and other disciplines), and presented a case study of how it may be applied in a CS1 course. It was believed this process has considerably strengthened department's assessment program.

Lister and Leaney (2003) used BT in an introductory programming course to assign grades based on Bloom-level mastery of tiered curricular components. Students earn a grade based on subject mastery.

Scott (2003) stated that exams usually do not test students' knowledge across all levels of the BT; therefore, the instructor does not discover the level of mastery of a given topic for each student. The solution is to offer exam questions related to each level or each tier for every topic covered on the exam. This technique ensures that students have the opportunity to demonstrate their achieved level of mastery.

In the study of Oliver, Dobele, Greber and Roberts (2004), they used BT to assess the cognitive difficulty of computing courses in an IT program by formulating and calculating a Bloom Rating. A Bloom level was assigned to each assessment/test question according to the level of cognitive behavior required to properly answer it. A Bloom Rating for each course was determined using a weighted average of the Bloom levels of all the assessment materials for that course.

Manaris and McCauley (2004) and Manaris et al. (2007) applied BT within CS to specify learning objectives of human-computer interaction courses. They present a collection of courses for various target audiences, including freshman non-majors, junior/senior majors, and graduate students. For each course, they provide an outline containing learning objectives using BT, the amount of time to be spent on each topic, and related in-class activities.

Applying Bloom's Taxonomy of Educational Objectives to evaluate learning effectiveness can not only reflect the learners' learning effectiveness, but can also give educators clear guidance (Shen, Hwang, Lin, Chen, Ke and Liao, 2005). Hwang, Tsai and Yang (2008) proposed an expert system which adopts several cognitive processes in Bloom's taxonomy of educational objectives. The results showed that the experimental group students had significantly better achievements than the control group students in the "remember," "apply," "analyze," and "evaluate" categories, while no significant difference was found in the "understand" category.

The study of Hwang, Chen and Huang (2016) developed a Personalized Ubiquitous Multi-Device Certification Tutoring System (PUMDCTS) based on "Bloom's Taxonomy of Educational Objectives", and applied it to help students obtain HTML certificates. The system can help students learn more effectively and acquire certificates more successfully through the mechanism of personalized strengthening practice and the function of the learning diagnostic light table. The experimental results show that compared with the control group, the experimental group has significantly better cognitive test scores.

In other paper by Haris and Omar (2012), the study describes a natural language processing technique to analyze the cognitive levels of Bloom's taxonomy for each question through the development of rules. The Bloom's Taxonomy acts as a main guideline in assessing a student's cognitive level. The paper aimed to provide lecturers with a tool that can ease their task to assess the student's cognitive levels from the written examination questions. Preliminary results from the experiments show that it is a viable approach to help categorize the questions automatically according to Bloom's Taxonomy.

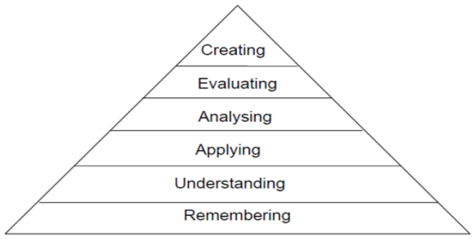
Taxonomy of Educational Objectives

In the onset of 1948, a group of educators undertook the task of classifying education goals and objectives. They intend to create a classification for these three domains: the cognitive, affective, and the psychomotor.

The cognitive domain relates to the capacity to think or one's mental skills. As originally defined by Bloom (1956), and revised by Anderson et al. (2001), the cognitive domain has six levels. It starts from the simplest to the most complex. These are knowledge, comprehension, application, analysis, synthesis, and evaluation. As cited in the study of Modritscher and Sindler (2005), the lowest level of objectives is about recognizing and recalling assimilated information. Based on these abilities, a student can comprehend and explain what he internalized. In the next step, the gained knowledge can be applied in new situations. At the analysis level, the student is able to analyze, structure, and organize the facts and concepts. Synthesis describes the ability to reassemble the pieces of assimilated information to create new knowledge. At the highest level, a student can even evaluate the value of ideas and cognitive materials. The lower order levels are the first three and the high order levels are the remaining. The categories can be

thought of as degrees of difficulties. That is, the first ones must be mastered before the next one can take place. Anderson et al. (2001) revisited the cognitive domain and changed the six levels from noun to verb forms.

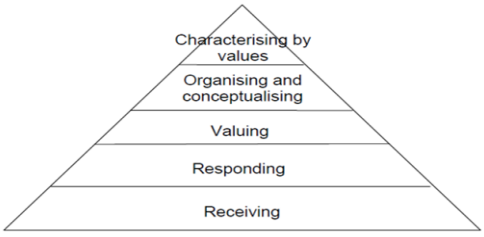
FIGURE 1
A Revised Taxonomy of Cognitive Domain



Source: Anderson (2001)

The affective domain (Krathwohl, Bloom and Masia, 1964) is about emotions and feelings, especially in relationship to a set of values. It ranges from receiving or becoming aware of stimuli that evoke feelings to manifesting behaviour characterized by a set of consistent and predictable values. It describes the way people react emotionally, such as feelings, values, emotions, motivations, and attitudes (Saul, Becker, Hofmann, & Pharow, 2011).

FIGURE 2
Taxonomy of Affective Domain



Source: Krathwohl et al., (1964)

And the third is, the psychomotor domain is concerned with the mastery of physical skills ranging from reflexive movements to exhibiting appropriate body language (Harrow, 1972). It is based on learning physical skills, which includes movement, coordination, and manipulation (Saul et al., 2011). The development of these skills requires practice and can be measured, for example, in terms of speed and precision (Saul et al., 2011). There are several taxonomies existing in this domain, one is the one developed by Dave in 1970. It consists of different categories such as imitation, manipulation, precision, articulation, and naturalization.

It is clear that most instruction in higher education is focused on the cognitive domain rather than the affective or psychomotor domains (Sperber, 2005). Much more attention is paid on the cognitive domain usually to the lower order thinking skills such as remembering, understating, and applying than it is to the higher order thinking skills e.g. analyzing, evaluating, and creating (Reeves, 2003). According to Reeves (2003), this problem stems largely from the relative ease with which the skills encompassed in the lower half can be taught and tested within most fields or disciplines. He stressed that teaching and assessing the cognitive skills required for analysis, evaluation, and creation take more time and effort than many.

Contributions of the Study

As of this writing, there has been no developed application that generates a computerized TOS. There are some studies which only noted the relevance of TOS in the classroom such as the studies of Fives and DiDonato-Bernes (2013) and Ryerson University (2016). They only gave insights on how to construct a TOS. The reviewed literature also stressed the importance of aligning assessments to learning outcomes/objectives (Foster, 2003; Haris & Omar, 2012; Hofmann, & Pharow, 2011; Hwang et al., 2016; Hwang et al., 2008; Lister & Leaney, 2003; Manaris et al., 2007; Modritscher & Sindler, 2005; Oliver et al., 2004; Saul et al., 2004; Scott, 2003; Shen et al., 2005; Starr et

al., 2008) as it yields good grades, thus, translating into good learning by having a guide such as the TOS (Burke, 2010). It is also important to note that the cognitive domain is not enough. It is the combination of the three domains of learning; the cognitive, affective, and psychomotor domains that effectively assess the students' learning. Thus, the study not only includes the cognitive domain but also the other two domains of learning such as the affective and psychomotor domains are considered. With the development of this electronically generated TOS, this could fast track the preparation and generation of TOS which could benefit the professors of the university. And above all, to ensure a balance test could be provided to the students. This could also serve as an extension project which could help the teachers of the institutions who have inked an agreement with the university.

MATERIALS AND METHOD

In the conduct of the study, the descriptive and developmental research was used. This is suitable whenever the output of a study needs to developed, validated, and tried out to determine if the proposed system is acceptable to the end users. It is a research approach whose intent is to produce knowledge with the aim of generating the TOS for PSU Urdaneta City Campus. The researchers employed different techniques in collecting relevant data to come up with feasible and accurate source input information. Interview was made to the different chairpersons of the department to solicit their recommendations on the contents of the TOS and further clarify the needed requirements in the preparation and construction of the TOS. Survey questionnaires were also employed in the conduct of the study. These are the questionnaires used to assess the content validity of the proposed system and the evaluation checklist adapted by the researchers using the statements in the POST Study Usability Questionnaire developed by Lewis (1995) for IBM. This questionnaire targeted the overall satisfaction, system usefulness, information quality, and interface quality. The first questionnaire formulated will determine the contents of the TOS based on the collective responses of the 10 (ten) chairpersons of the campus. The latter will be used to test the level of acceptability of the proposed system. Aside from these, the documentary analysis was also conducted. The researchers obtained sample TOS from the faculty members in order to have a better understanding of the contents of the TOS that must be included in the development of the system. Faculty members from Pangasinan State University Urdaneta City Campus and the different chairpersons who have prior knowledge in the creation of Table of Specifications were identified as the respondents of the study. For the evaluation of the content of the TOS, total enumeration of the 10 department chairpersons of the campus was selected since they are responsible for checking the submitted TOS that was prepared by the faculty members at the end of semesters. And they are referred to be as the first group of respondents. The second group of respondents are the faculty members who used to evaluate the acceptability of the proposed system. It utilized the random sampling technique. Slovin's formula with a margin of error 0.05 was utilised to select the sample size of respondents who were identified to be the faculty members of PSU Urdaneta City campus. The 63 faculty respondents were randomly selected from the different departments of the campus.

TABLE 1
Subjects of the Study

Respondents	Number of Participants
1st Group	10 chairpersons
	63 faculty members
	ARCHI 4
	CE 7
	COE 4
	EE 7
	ME 5
2nd Group	ABEL 8
	BEED 3
	BSED 3
	IT 7
	MATH 10
	GENED 5

The responses of the 10 chairpersons were tabulated and analyzed. In order to determine the level of validity and acceptability of the proposed system, average weighted mean was used. Mean average was computed to attain an average mean which, in turn, interpreted the validity of the proposed system. Likert Scale was employed to interpret the results of the content validity questionnaire and evaluation checklist.

Design and Development of Computerized TOS

The study underwent four different phases that were used by Tablatin, Patacsil and Cenas (2016), in their study: Planning, the development, the evaluation, and output stage. These series of steps performed throughout the study are discussed below.

Planning Stage

The first stage in the design and development of a computerized TOS is the planning phase. In this stage, specification of the proposed system is obtained. During this phase, the data that will be collected from will be examined and analyzed in order to determine the design and functionalities of the proposed system.

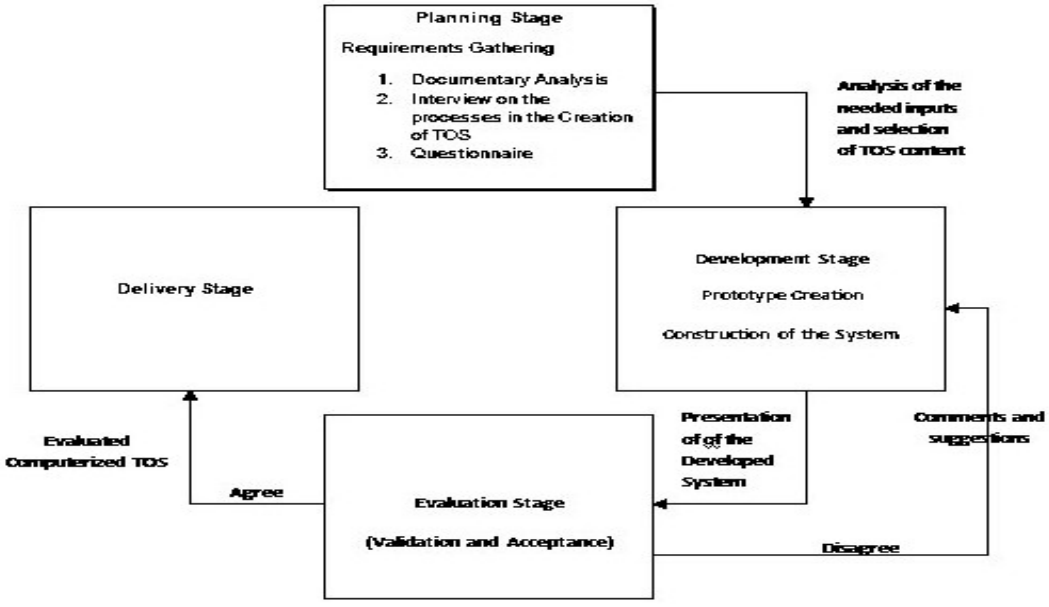
The researchers underwent documentary analysis. It is the use of outside sources, documents used in the organization to analyze in the preparation, and construction of a TOS. The researchers will obtain sample TOS documents from the instructors/professors of PSU Urdaneta City Campus in order to have a better understanding of the proposed system and to have an idea of what is included in the TOS. The prescribed OBEdized format of TOS from the university is taken into consideration.

Also an interview of the 10 department chairpersons of the campus was initiated to further clarify what is to be included in the TOS. Upon analyses of these data, a list of specifications will be formulated based on the inputs of the 10 department chairpersons and the reviewed TOS from the instructors and professors.

Development Stage

In the development stage, the researchers translated the specifications of the proposed system that was formulated during the planning phase. The researchers worked directly with faculty members and finalized the design, and built the system. They would be presented with a prototype to clarify information requirements. Through the use of prototype, they were able to see a preliminary concept about the system as well as to identify additional requirements. The interface design was finalized before the system is built. The researchers will present the prototype to source out comments, suggestions, and criticisms given by the faculty members. These were incorporated in the system until the users were satisfied. Continuous involvement is encouraged to come up with the specified design specification to be followed in the construction of the proposed system. Construction of the system is next once the design specification is approved.

FIGURE 3
Phases of System Development



The third stage undertook validation and evaluation of acceptability of the system. The proposed system is evaluated for its content validity to ensure that it contains the necessary data that can be found in the Table of Specifications. It was validated by the 10 department chairs. The researchers presented the developed modules to the instructors/faculty for assessment. Their comments, suggestions, and criticisms were incorporated in the TOS. Assessment of the acceptability of the TOS by the different instructors/professors of PSU Urdaneta City campus comes after the validation. This is undertaken by administering the evaluation checklist that was adapted using the POST Study Usability Questionnaire.

Output Stage

This is the final stage where the system is now ready for utilization by the teachers of Pangasinan State University Urdaneta City Campus.

The proposed system can be used by the faculty members in the process of teaching, particularly as a guide in the preparation of test. The following figures illustrate the actual interfaces of the developed computerized generation of TOS.

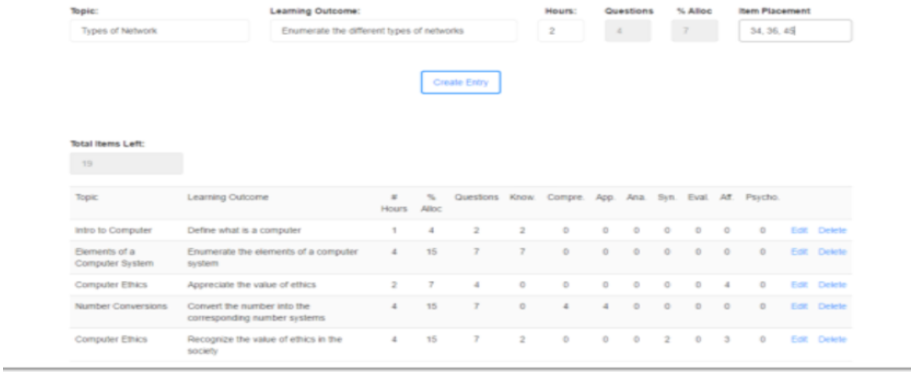
There are two users of the system: the (1) administrator, and (2) the faculty members who serve as the end user of the system.

The administrator page contains the links to manage the (1) users, (2) examination type, (3) courses, (4) taxonomy of domains of learning, and (5) campus. On the other hand, as illustrated below, this shows the faculty page which enables the faculty members to create a new TOS.

FIGURE 4
Create TOS Page

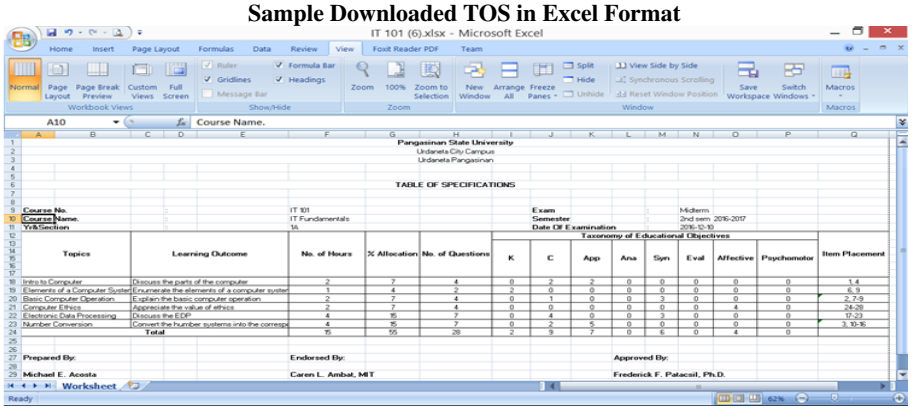
The faculty needed to fill-out the information as indicated above to create a new TOS. After this, the created TOS appears on the table where it can be edited or removed, viewed, and downloaded. The View link serves to insert a new TOS entry where the user can encode the topics or subject matter, learning objectives for each topic, and the time spent for each topic, and the item placement for questions. The questions and percentage allotment is derived based on the number of time allotment entered.

FIGURE 5
Create TOS Entry Page



The developed system distributes automatically the questions based on the learning outcome. The Download link, as shown in Figure 6, lets the faculty members to download the TOS in Excel format. Therefore, it allows the faculty members to review the TOS before printing it. The figure shows the sample TOS generated by the system.

FIGURE 6
Sample Downloaded TOS in Excel Format



RESULTS AND DISCUSSION

The data were collected and analyzed to determine whether the proposed system is accepted in terms of content validity and level of acceptability. The validation was done based on the contents of TOS by the faculty members. This was done using the content validity questionnaire. Comments and suggestions from faculty members were included to solicit feedback on their perception towards the content of the TOS. As shown in Table 2, the proposed system obtained an overall mean of 4.51 which reveals that department chairpersons Strongly Agree with the contents of the generated TOS. This strongly reflects that these criteria are important contents that should be included in the TOS. Further, this result was also parallel to the comments coming from the validators that distribute evenly the questions across the taxonomy of educational objectives and classify the affective and psychomotor domains of learning.

TABLE 2
Result of the Department Chairpersons Validation

Criteria	WM	Description
1) Selection of topics/subject matter	5.00	SA
2) Identification of the learning outcomes	4.20	A
3) The number of items on the entire test	4.40	SA
4) Time spent/allotment per topic	4.80	SA
5) The number of questions for each topic	5.00	SA
6) The item placement for each topic	4.20	A
7) Distribution of the questions across the taxonomy of educational objectives eg. cognitive, affective, psychomotor	4.20	A
8) Proper content heading of the TOS eg. course code, course description, exam, yr & section, SY & semester, date of exam	4.80	SA
9) Proper signatories should reflect below the TOS	4.00	A
Overall Mean	4.51	SA
Department Chairpersons comments and suggestions: 1. Identify the specific taxonomy of objectives for affective and psychomotor domain 2. Distribute evenly the questions across the taxonomy of educational objectives		

SA-Strongly Agree, (4.21-5.00), A - Agree, (3.41-4.20), U - Undecided, (2.61-3.40), D Disagree, (1.81-2.60), SD Strongly Disagree, (1.0-1.80)

As can be gleaned on Table 3, the result of the mean score for all areas being evaluated is 4.07 which signifies that the faculty members Agree to accept the proposed system in terms of its overall satisfaction, usefulness, information quality, and attractiveness of UI. This denotes that the developed system is pleasant to the users, the users feel in charge, the system has the information needed by the user, the system provides the user information to solve their problems, the system is easy to absorb by first timers, and has easy to learn facilities. Suggestions were also considered by the faculty members. Therefore, the developed system has met the requirements of the end-users.

TABLE 3
Result of Faculty Members Acceptability

Criteria	WM	Description
1. Overall, I am satisfied with how easy it is to use this system.	4.17	A
2. It was simple to use this system	4.08	A
3. I could effectively complete the tasks using this system	4.00	A
4. I was able to complete the tasks quickly using this system	4.08	A
5. I was able to efficiently complete the tasks using this system	4.00	A
6. I felt comfortable using this system	4.17	A
7. It was easy to learn to use this system	4.17	A
8. I believe I could become productive quickly using this system	4.25	A
9. The system gave error messages that clearly told me how to fix problems	3.83	A
10. Whenever I made a mistake using the system, I could recover easily and quickly	4.08	A
11.The information provided with this system was clear	4.00	A
12. It was easy to find the information I needed	4.25	A
13. The information provided for the system was easy to understand	4.08	A
14. The information was effective in helping me complete the tasks	4.00	A
15. The organization of information on the system screens was clear	3.91	A
16. The interface of this system was pleasant	4.16	A
17. I liked using the interface of this system	4.25	A
18.This system has all the functions and capabilities I expect it to have	3.83	A
19. Overall, I am satisfied with this system	4.16	A
Overall Mean	4.07	A
Faculty members' comments and suggestions:		
1. Downloaded TOS should be formatted correctly		
2. Downloaded TOS must include university logo		

SA-Strongly Agree (4.21-5.00), A - Agree, (3.41-4.20), U - Undecided, (2.61-3.40), D Disagree, (1.81-2.60), SD Strongly Disagree, (1.0-1.80)

CONCLUSION AND RECOMMENDATION

The TOS is considered a vital tool of the teacher in the assessment of learning in the classroom. It ensures a balanced test that taps different levels of cognitive complexity.

On the basis of the findings gathered by the study, the researchers arrived at the following conclusions:

- The contents of the TOS generated by the system comprised of all the needed data in the preparation and construction of the TOS. It is a comprehensive TOS which includes the 3 classifications of objectives: cognitive, affective, and psychomotor domains of learning as indicated in the institutional format of TOS. It also included the topics, learning outcome, no. of hours, % of allotment, distribution of questions per domains of learning, and item placement. The different department chairs were solicited for the contents of the TOS that further clarified the needed requirements in the preparation and construction of the TOS.
- The developed system has met the requirements in the preparation and construction of TOS. The result of the validity and acceptability has shown that the department chairs and faculty members agree with the content and features of the developed system. It gained a positive acceptance from both the faculty and department chairs.

The developed system should be used as a blue print for creating a test. Hence, it should include the preparation of test items to fully maximize the use of TOS. For future work, it is recommended that the system should be integrated to a computerized exam to ensure that assessment is aligned with the learning outcome. Further studies along this line should be conducted for refinement.

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