

# A CRASH COURSE IN AUTOMATING TOS CONSTRUCTION TO ENHANCE STUDENT TEACHERS' PROFICIENCY: AN ACTION RESEARCH STUDY

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**ABSTRACT.** *Despite the significance of Tables of Specifications (TOS) as a valuable tool for teachers in developing tests and assessing student learning, BTLED student teachers who were employed in the College of Technology (COT) in a Science and Technology University in Northern Mindanao, Philippines encountered difficulties in constructing TOS due to a lack of proficiency in this area. An action research method was used to address the pre-service teachers' lack of proficiency in TOS construction by providing an intervention through a crash course in Automating TOS. Thematic analysis was used to analyze the experiences and perceptions of pre-service teachers after attending the crash course. There were seven participants who were identified to join the crash course in Automating TOS since these were the pre-service teachers who have shown a lack of proficiency in TOS construction. Observation, researcher-made questionnaires, and interviews were used to gather data. The result reported two main themes that emerged from the analysis: enhanced knowledge and understanding, and efficient technical skills. The crash course provided participants with a comprehensive understanding of TOS construction and participants developed efficient technical skills. The use of automated TOS was found to enhance efficiency by saving time, simplifying construction, and providing error-checking features. Based on the findings, recommendations were made to implement targeted interventions, such as comprehensive training, workshops, and hands-on practice, to further enhance student teachers' proficiency in TOS construction*

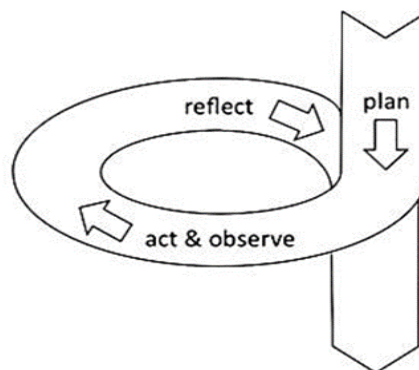
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## INTRODUCTION

In today's dynamic and ever-evolving educational landscape, the role of effective assessment practices cannot be overstated. As aspiring educators, student teachers play a pivotal role in shaping the future of education [1]. However, an area that often poses challenges for these budding professionals is the construction of a Table of Specifications (TOS). The TOS is a valuable tool that helps educators design assessments that align with desired learning outcomes and provide a comprehensive overview of the content and skills to be assessed [2]. Given its direct connection to the assessment of learning, it becomes paramount for future teachers to possess a high level of proficiency in this specific area. Proficiency usually describes pure ability that comes from training and practice [3]. One being proficient means skilled and with a high understanding of doing something. In this study, proficiency refers to the student teachers' comprehensive understanding of TOS, encompassing its purpose, relevance, and technical competence in accurately applying calculations.

Despite its significance, many student teachers face difficulties in constructing a TOS due to a lack of proficiency in this area [4]. This concern has been identified among the in-campus BTLED pre-service teachers assigned to the College of Technology (COT). It became evident through the examination of their sample works submitted for assessment preparation as part of their task and the feedback provided by their respective cooperating teachers during class monitoring. This issue is of great concern as it hampers their ability to create well-structured assessments that accurately measure student learning [2]. Without a clear understanding of how to develop a TOS, pre-service teachers may struggle to identify the appropriate balance between content areas, cognitive levels, and the weighting of assessment items. We can shed light on the necessary steps to improve pre-service teachers' proficiency in constructing a TOS by digging into the reasons behind this lack of proficiency.

To address this gap in pre-service teachers' proficiency related to TOS construction, this action research implemented a crash course in Automating TOS as a form of intervention. The intervention workshop comprises three key components: a review of the technicalities involved in constructing TOS, a recall of Bloom's Taxonomy to align test items to the desired learning outcomes, and a hands-on activity involving automated TOS. By combining both theoretical knowledge and hands-on practice, it empowers student teachers with the necessary tools to construct effective TOS that align with the desired learning outcomes of their students. The outcome of this action research project will benefit BTLED student teachers and have broader implications for the education system as a whole. By equipping aspiring educators with the skills to construct well-designed TOS, we can ensure that assessments accurately reflect student learning and provide valuable insights into instructional effectiveness. Moreover,



**Figure 1. Action Research Model phases based on Kemmis and McTaggart (1988)**

this research may inform teacher education programs on the importance of including comprehensive training in assessment design.

Action research is a methodology that asks participants, particularly teachers, to investigate a specific activity's components to ascertain whether changes can result in an effective and positive improvement in student learning. Action research is an educational process that teachers use to improve the teaching and learning process continuously. It also helps them better understand academic situations and contexts [5].

This is how the model was used in this study. First is the planning phase, where the current situation and problems are determined. In the current situation, student teachers face difficulties constructing a TOS due to a lack of knowledge and skills. This situation was seen as a problem in terms of constructing a TOS that aligns with the desired learning outcomes of the students.

Acting Phase is where the intervention or action was carried out by implementing a crash course in Automating TOS. The Crash Course includes constructing TOS, recalling Bloom's Taxonomy, and the hands-on of automated TOS. The students were initially engaged in a pre-activity where they crafted a TOS based on their existing knowledge and skills. During the pre-activity, it was observed that pre-service teachers had a hard time with the calculations and item distributions. Following this, a detailed discussion took place on the manual construction of a TOS. The discussion covered several topics, such as determining the total number of hours allocated for each learning objective, establishing the desired total number of test items, assigning percentages to cognitive levels associated with the learning objectives, distributing test items accordingly, and performing the necessary calculations to construct an accurate and reliable TOS. After, a review of Bloom's Taxonomy was presented to provide a quick review of its application and significance in TOS construction in order to yield valid measurements of students' achievement.

Meanwhile, the Automated TOS was presented as a tool to help pre-service teachers design their TOS effectively in a way that aligns with the desired learning objectives. The Automated TOS was created using Microsoft Excel, which has a matrix divided into two sections: content categories and cognitive levels. The content categories reflect the topics covered in the course, while the cognitive level reflects the level of cognition that is intended to be measured in the test. This automated TOS is a pre-design template where a formula has been established according to the nature of the calculation. The user will only input the desired number of hours and the total number of items in the cell, and it will automatically generate percentages per topic and the number of items under each cognitive level. Along with this, pre-service teachers were given the opportunity to engage in a practical task using the automated TOS to create their own.

Observing phase. In this phase the intervention allows the researcher to closely observe the effect of the crash course in Automating TOS to enhance pre-service teachers' proficiency in TOS construction while collecting significant data through sample work, survey questionnaires embedded with open-ended questions, and semi-structured interviews. Lastly, the reflecting phase. This phase permits the researcher to reflect

upon the pedagogical experience and describe what happened in the workshop and how the pre-service teachers reacted using the Automated TOS.

## RESEARCH QUESTION

The goal of this study was to determine the pre-service teachers' proficiency related to TOS construction after the crash course intervention was given. The following research questions are sought in this study:

1. What happens to student teachers' proficiency in constructing TOS after attending the crash course on Automating TOS
2. How does the use of automated TOS affect the student teachers' proficiency in TOS construction?

## METHODOLOGY

### Research Design

This study utilized the action research design. Action research relates to the matter of problem-solving that is evident inside the classroom which in this study refers to the pre-service teachers' lack of proficiency in TOS construction. The main purpose is to improve student teachers' proficiency in constructing TOS. Action research happens when people research their own practice in order to improve it and to come to a better understanding of their practice situations [6]. The action research process is made up of several stages; (1) planning, (2) acting, (3) observing, and (4) reflecting [6]. In this study, the researcher wanted to address the problem of the pre-service teachers' lack of proficiency related to TOS construction. A crash course on Automating TOS including a discussion of the technicalities involved in constructing TOS, a recall of Bloom's Taxonomy to align test items to the desired learning outcomes, and a hands-on activity involving automated TOS was implemented. Using this approach, the researchers were able to gather valuable data and insights while making meaningful changes that improve the proficiency of pre-service teachers regarding TOS construction.

### Participants of Study

The participants of this study were purposively selected. Purposive sampling is a process in which the researcher selects the participants with a purpose in mind, the researcher decides what needs to be known, and sets out to find participants who can and are willing to provide the information from their knowledge or experience [8]. There were seven pre-service teachers from the BTLED program who had their in-campus practice teaching at USTP-CDO, specifically within the College of Technology. The researchers identified these participants based on their relevance to the study, as they were facing challenges and difficulties in constructing TOS.

### Research Location

The study was carried out at a Science and Technology University in Northern Mindanao, where one of its program offerings is the BTLED program. Thus, these education graduates will become feeders that will join the teaching profession in the country later on. Moreover, USTP System has consistently maintained its Level IV status as a State University in the country. Despite being acknowledged as a leading university, it was observed that there was a lack of proficiency in some of its pre-service teachers. These

students were deployed at the College of Technology to have their in-campus internship.

### Data Collection Tools

This research used qualitative data collection techniques. To attain the data, the researcher used several data collection techniques, namely:

#### 1. Observation

The researcher observed how the student teachers construct their TOS during the in-campus internship. The result was used to identify the problem, which determined the planning stage, while in the acting and observing stage, the results were used to describe the student teachers' ability to construct the TOS and the problem that occurred in the implementation of the action. The results of the observation were in the form of field notes, sample work, and feedback from their cooperating teachers.

#### 2. Survey questionnaire embedded with open-ended questions

This tool was used to gather information from the student's teachers about their experiences in constructing the TOS after the implementation of the crash course.

#### 3. Personal Interview

The researcher developed some specific questions but allowed for flexibility according to the interviewee's response. An interview is used to gather data on objects' opinions, beliefs, and feelings about the situation in their own words. Interviews provide information that cannot be obtained from observation or can be used to verify the observation [9]. In this study, the interview was administered after the implementation of the intervention to determine the enhancement of student teachers' proficiency in constructing TOS using the automated template.

### Data Analysis

A qualitative approach was used in this study, and the data were analyzed using thematic analysis. Thematic analysis is a qualitative research method that involves systematically identifying and analyzing patterns and themes within a dataset of text [10]. The study adopted Hsieh & Shannon [11] conventional coding where the researchers familiarized themselves with the data to generate codes, later it was grouped according to categories and finally derived relevant themes.

### Trustworthiness of Study

The researchers used methodological triangulation in this study to combine data from multiple sources, including a survey questionnaire embedded with open-ended questions, interviews, and observation [12]. The researchers provide adequate details on the research location, participants, and methods or procedures used to collect data in the study [13]. Read and re-read of data was done to gain certainty and stability to ensure it was coherent with the research questions. Therefore, the researchers examined the process of data collection and data analysis by matching the research question with the research result of data collection [14]. The researcher ensures and communicates to the reader that the results are based on and reflect the information gathered from the participants and not the interpretations or biases of the researcher [15].

### Ethical Considerations

For the entire duration of this research project, the researchers followed ethical principles and guidelines in conducting research. The data collected was handled with utmost confidentiality, adhering to the regulations stated in the Data Privacy Act of 2012. Proper citations and acknowledgments were given to the work of other researchers incorporated in this study, while the researchers carried out the investigation with integrity, transparency, and impartiality. The study materials, including survey questionnaires and consent forms, were carefully crafted to avoid any offensive or discriminatory language. Lastly, the researchers acknowledged their duty to safeguard participants from harm and foster a cooperative and respectful relationship among all individuals involved in the study.

### FINDINGS AND DISCUSSIONS

*RQ 1. Pre-service teachers' proficiency in constructing TOS after attending the crash course on Automating TOS.*

Through qualitative analysis, two themes have emerged that described the pre-service teachers' proficiency in constructing TOS after the crash course. These themes are: (1) enhanced knowledge and understanding, and (2) efficient technical skill.

#### Enhanced knowledge and understanding

Most participants described that after attending the crash course they have enhanced their knowledge and understanding of constructing TOS. During the intervention, a brief review of the TOS technicalities was presented as well as a review of Bloom's Taxonomy. Most participants shared similar experiences after joining the intervention.

*EKU2: This information has been valuable not only to me but also to other participants who aspire to become future educators. EKU3: I have gained a comprehensive understanding of all aspects related to constructing TOS.*

*EKU4: The crash course served as a refresher and provided me with a clear understanding of the cognitive levels in TOS.*

*EKU5: The crash course has improved my knowledge of TOS construction, particularly in placing items at each cognitive level.*

*EKU6: I now understood how to distribute test items in the TOS*

According to Osebhohiemen, E. [16], refresher or retaining courses should regularly be organized for pre-service teachers. These include seminars, symposiums, workshops, conferences, etc. on test construction. Conducting a crash course is a great way to enhance the knowledge and understanding of student teachers in constructing TOS in a short amount of time. A crash course was designed to provide an intensive learning experience that covers the most important topics and concepts in a condensed format in a way that is easily understood [17]. In order to attain students' ability and proficiency as practitioners, it is necessary to provide them with training, facilitate knowledge acquisition, and support skill development [18]. Constructing TOS is essential for developing a test that aligns with its content and objectives [19]. Participating in the crash course helps pre-service teachers solidify their own knowledge and gain a deeper understanding of how to construct TOS. A well-

constructed TOS will help improve the validity of teacher evaluations based on a given assessment [20].

### ***Efficient technical skill in constructing TOS***

Technically, the literature defines efficiency as the ability to do something or produce something without wasting materials, time, money, methods, or energy [21]. Meanwhile, technical skills or hard skills are often associated with the use of tools related to working correctly and efficiently in all technical matters [22]. The participants expressed their experiences after joining the intervention regarding their technical skills in constructing a TOS.

*ETS1: I know how to compute the exact total number of items in each area.*

*ETS2: I know the formulas and techniques to solve in constructing TOS.*

*ETS3: I can quickly balance the distribution of items in constructing TOS.*

*ETS4: Efficient skill in constructing TOS like item distribution and the computation using the formula*

*ETS5: The time to make the TOS will be less*

*ETS7: I can get the accurate value and percentage in constructing TOS*

The technical skill shared by the participants includes; learning the formula, correct item distribution, accurate values and percentage, and minimal time in TOS construction. This theme suggests that students have enhanced efficient technical skills after participating in the crash course as a form of intervention. Possessing proficient technical skills in constructing a TOS can lead to more accurate assessments that effectively measure the intended learning outcomes [23]. More so, by gaining these technical skills in constructing a TOS, future educators can create a fair and accurate assessment that provides valuable insights into student learning and helps guide future instruction, this is an important skill for teachers [24].

*RQ 2. Automated TOS as a tool to enhance student teachers' proficiency in TOS construction*

### ***Efficiency***

There is one theme that emerged during the data analysis to address how the use of Automated TOS enhances the proficiency of the pre-service teachers in TOS construction. Wojtczak [25] defines efficiency as an ability to perform well or achieve a result without wasted energy, resources, effort, time, or money. The participants shared similar thoughts after navigating the automated TOS.

*EF1: This can save time and allow for more efficient TOS construction.*

*EF2: It makes our TOS construction easier and faster*

*EF3: It utilizes technology resulting in minimal time in making TOS.*

*EF4: It is really a lifesaver especially for teachers because I cannot memorize all the formulas. With this, all you have to do is input and will give results immediately.*

*EF5: It was way easier than manual construction*

*EF6: I can make the TOS faster.*

The automated TOS as a tool is a pre-designed template that eliminates the need for the user to start from scratch. It also reduces the time spent on manual calculations. Furthermore,

the automated TOS significantly enhances the pre-service teachers' efficiency in constructing TOS during assessment planning and preparation. It saves time by eliminating the need for the user to manually establish the respective calculations in preparing a TOS. Additionally, the error-checking features of automated TOS assist pre-service teachers in identifying and rectifying potential inaccuracies in the construction process. This ensures greater precision and reliability in the TOS. The use of innovative practices in the workplace is positively related to efficiency [26]. While adopting and incorporating technologies in teaching can lead to long-term benefits in terms of efficiency and student outcomes [27], learning to be efficient at work not only enhances productivity but also reduces the likelihood of developing burnout [28]. The tool is manipulative to sustain student interest, accessibility, independence, interactivity, and ease of use. These benefits contribute to a more engaging and effective learning experience for both educators and learners [29]. Aside from that, the use of automated TOS expedites the process and enhances the overall efficiency of assessment planning, allowing pre-service teachers to focus more time and energy on other essential aspects of teaching and learning.

### **CONCLUSIONS**

Based on the findings from the qualitative analysis, several conclusions can be drawn regarding pre-service teachers' proficiency in constructing TOS after attending the crash course. It was reported that pre-service teachers showed enhanced proficiency in construction. They gained a deeper understanding of the purpose and advantages of TOS, as well as its practical application in designing assessments that align with desired learning outcomes. Moreover, participants demonstrated efficient technical skills, including the ability to accurately employ formulas, quickly perform item distributions, and the like. In addition, having an automated TOS expedites the preparation, optimizes resources, and enhances the overall efficiency of assessment planning, allowing pre-service teachers to focus more time and energy on other essential aspects of teaching and learning.

### **RECOMMENDATIONS**

Based on these findings, it is recommended to implement targeted interventions to address the identified challenges and enhance pre-service teachers' proficiency in constructing TOS. This could include providing comprehensive training during practice teaching internships, offering workshops or crash courses specifically focused on TOS construction, and providing guidance and feedback from experienced mentors. Additionally, facilitating hands-on practice and ensuring that pre-service teachers understand the underlying principles and steps involved in the formula can improve their technical skills in TOS construction. It is further recommended to dedicate more time to assessment design and emphasize the importance of TOS in the field of teaching. Provide specific instruction and practice opportunities for students to develop their understanding and skills in using the TOS formula. This could include step-by-step guidance, examples, and exercises to reinforce the application of the formula in different contexts. Continue offering crash courses or similar intensive

learning experiences to pre-service teachers, providing them with the opportunity to enhance their knowledge and understanding of TOS construction. These courses should cover the most important topics and concepts in a condensed format and be designed to be easily understood by participants. The study is qualitative in nature, future research may include quantitative data to establish prior competency.

### LIMITATIONS OF THE STUDY

While the findings of the study provide valuable insights into pre-service teachers' understanding of constructing a Table of Specifications (TOS) before and after attending a crash course, it is important to acknowledge certain limitations that may impact the generalizability and reliability of the results. Some limitations of this study include:

1. The study may have relied on a small sample size, which limits the representativeness of the findings. The findings may not be applicable to a larger population or diverse student groups.
2. This study was conducted in a specific program (BTLED), which may restrict the generalizability of the findings to other contexts or settings. Different institutions or programs may have varying approaches to TOS construction and may yield different results.
3. The study focused on the effect of a crash course on pre-service teachers' proficiency in TOS construction. It is unclear whether the improvements observed were solely due to the crash course or if similar outcomes could be achieved through other instructional methods or interventions.

To mitigate these limitations, future research could consider a larger and more diverse sample, utilize mixed-method approaches for data collection, and conduct long-term follow-up assessments to evaluate the sustainability of the improvements in student proficiency.

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