An Electronic Tool based on Bloom Taxonomy and Blueprint for Producing Lesson Plan

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ABSTRACT
Thanks to computer technology, it is now feasible to carry out tasks more precisely and finish challenging issues more rapidly. Teachers must develop a course outline that includes the course's objectives, learning outcomes, and content before each new academic semester starts. High-standard tests must be prepared to evaluate student performance at the end of the semester; questions should be distributed following the Bloom Taxonomy Model, But A survey and in-person interviews were conducted at four institutions to assess how teachers had proven that; Sudanese institutions are not following standards to set up their classes using Bloom Taxonomies or lesson plans. This study has proposed an electronic tool to help teachers organize their classes, streamline the learning process, and save time and energy. A time and effort-saving computerized Tool has been developed to help teachers manage their lessons and facilitate the educational process. The findings after evaluating the Tool suggest that it might enhance teaching effectiveness in Sudanese universities.

General Terms
Learning Objectives, Learning Outcomes, Syllabus, Bloom's Taxonomy, Domains of Learning, Blueprint, Instructional Planning, Assessment, Cognitive Levels

Keywords
Bloom's taxonomy, Blueprint, Electronic Tool, Sudanese universities, Teaching outcomes.

1. INTRODUCTION
Technology has completely changed how we approach schooling in today's quick-paced digital world. With computer technology, teachers can execute duties more precisely and tackle challenging issues more successfully(Kumar and Suneja, 2011). Yet to properly harness the potential of technology in education, teachers must thoroughly understand the course materials, learning objectives, and learning outcomes(MacCoy and Byrne, 2022). As a result, they can create a plan that aligns with the course's instructional objectives and aims to ensure that students get the learning results they want(Eko et al., 2022).

At the start of a new semester, it is typical for Teachers to spend a sizable amount of time planning and preparing their courses in Sudanese colleges. This includes determining the goals, measures, and resources aiding students' learning. The teacher is responsible for manually creating a syllabus that comprises the topics to be taught, the types and quantity of questions to be posed for each subject, and the importance of each question. This process involves careful consideration and the teacher may need to review the questions multiple times to ensure they align with the intended learning objectives and outcomes. Furthermore, modifying the syllabus requirements can be challenging once created and causes the teacher to experience increased stress and effort. The teacher is responsible for manually devising a syllabus that consists of the topics to be taught, the types and quantity of questions to be posed for each Topic, and the significance of each question(Diab and Sartawi, 2017). This process is time-consuming, and the teacher may need to review the questions multiple times to ensure they align with the intended learning objectives and outcomes. Additionally, modifying the syllabus requirements can be challenging once created. As a result, the teacher may experience increased stress and effort.

The learning objectives and results are then connected to the plan. A study states that despite the significance of blueprints and Bloom Taxonomies. Teachers in Sudanese universities do not successfully plan their classes utilizing these ideas. To close this gap, the researcher evaluated the use of Bloom's Taxonomy and blueprints among teachers at four colleges in Sudan through a survey and personal interviews.

This research led to the creation of an electronic tool that can assist teachers in more successfully and efficiently planning their lessons. With this Tool, educators can create lesson plans electronically, connect them to students' cognitive levels and assign questions while saving time and assuring the formalization of the educational process.

2. BLOOM TAXONOMY
Benjamin Bloom created the Bloom Taxonomy, a hierarchical classification system for educational goals and objectives, in 1956; three domains make up the taxonomy: cognitive, effective, and psychomotor. These domains include knowledge or head (cognitive), emotions, feelings, or heart (effective), doing or haptic (psychomotor), and indicate several stages of learning growth(Köksal et al.). Taxonomies are a type of classification, and Bloom's taxonomy was widely used in instructional planning and teaching for almost 50 years before it underwent a modification in 2001. The updated version now presents six important categories in verb rather than noun forms(Hegde, 2019). Figure 1 shows a graphic illustration of the revised Bloom's Taxonomy. The six significant categories of the revised Bloom Taxonomy framework are as follows:

Remembering: This refers to the ability to recall information and recognize it, list it, describe it, retrieve it, name it, find it, and answer related questions.

Understanding: This involves explaining ideas or concepts, interpreting them, summarizing them, paraphrasing them, classifying them, explaining them, and answering questions based on them.

Applying: This category involves using the information in another familiar situation, implementing it, carrying it out, using it, executing it, and answering questions related to its

application.

Analyzing: Breaking down information into parts to explore its understanding and relationships. This includes comparing, organizing, deconstructing, interrogating, finding, and answering questions related to the information analysis.

Evaluating: This involves justifying a decision or course of action by checking, hypothesizing, innovating, experimenting, and judging the questions.

Creating: This category involves generating new ideas, products, or ways of viewing things through designing, constructing, planning, producing, inventing, and answering questions related to creating new ideas.

3. BLUEPRINT

Instructors must use a blueprint or specification table to meet the course's content and learning objectives.

Fairly represented on the test, Instructors can control all learning levels and minimize trial-and-error mistakes using a blueprint(Shaver, 2008). The Blueprint is essentially a diagram or matrix that lists the quantity and variety of exam questions(Dutta and Goswami, 2023). The cognitive component and the degree of proficiency that will be examined for each knowledge domain can also be identified.

Table 1 illustrates how a graph or diagram generally displays this information visually.

A blueprint's primary goal is to conceptually map out the examination's format and subject matter, including the kinds of measurement instruments and the proportion of each question type(Namasivayam et al., 2013). Additionally, it describes each topic and training level, its weight, and any pertinent learning objectives. In the end, a well-designed blueprint aids teachers in creating tests that faithfully represent the course's learning goals and outcomes(Barreira and Bolotnyy, 2022, McDuff, 2012).

4. THE PROPOSED TOOL

The authors of this study have suggested an electronic tool that might help teachers create a plan that complies with scientific norms. As shown in Figure 2, the instructor can use this ground-breaking Tool to develop the learning objectives,

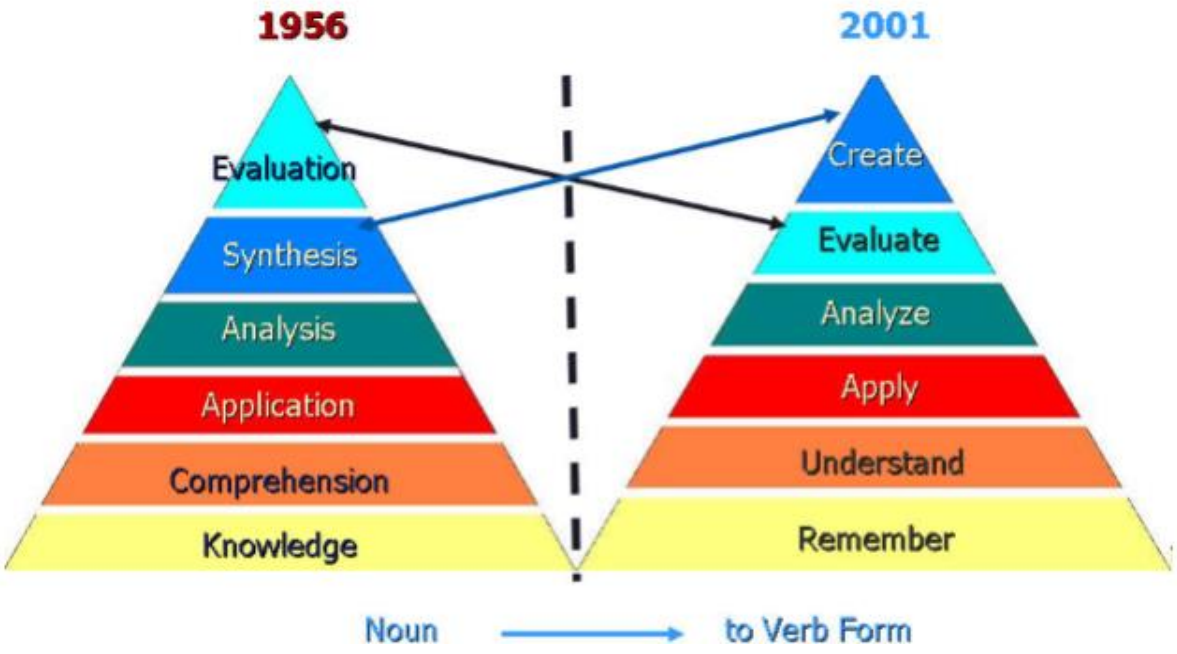

Fig 1: Bloom taxonomy

Table 1. A blueprint matrix

Topic to be tested	% of the period being tested devoted to the Topic	Level of Understanding (From Bloom's Taxonomy)			# of questions	% of tests devoted to the Topic
		Questions measuring recall /comprehension	Questions measuring application/analysis	Questions measuring synthesis/evaluation		

Number of Questions						
% of tests devoted to each level of understanding						

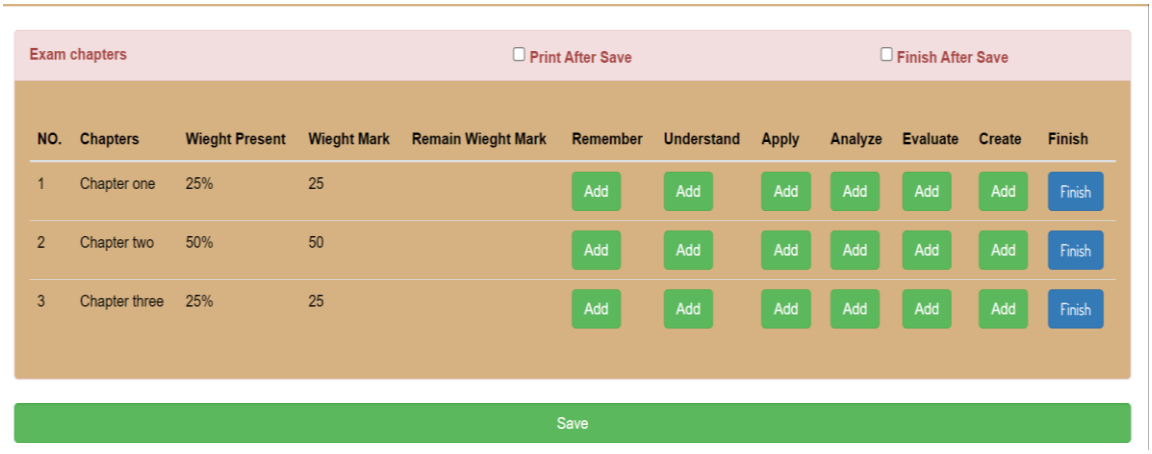

Fig 2: Prepare a blueprint

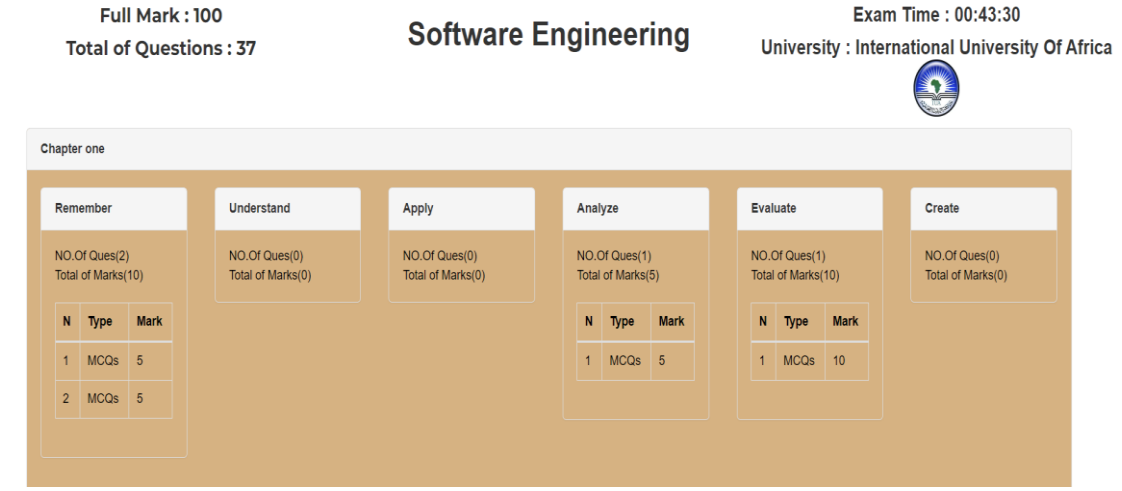

Fig 3: blueprint report with a time standard

Learning outcomes, arrange the exam questions and connect the learning outcomes to the courses. When creating the course lessons, the teacher can split and choose the kinds of questions based on Bloom's taxonomy and the proportion of each chapter or lesson using this Tool and ensuring that the objectives and results align with the assessment and that the review aligns with the instructional content and that the students will experience better learning outcomes.

The teacher can create a thorough blueprint report that includes the expected exam duration depending on the chosen question kinds once they have finished entering the course lessons and assessment questions into the electronic Tool (refer to Figure 3 and Table 2).

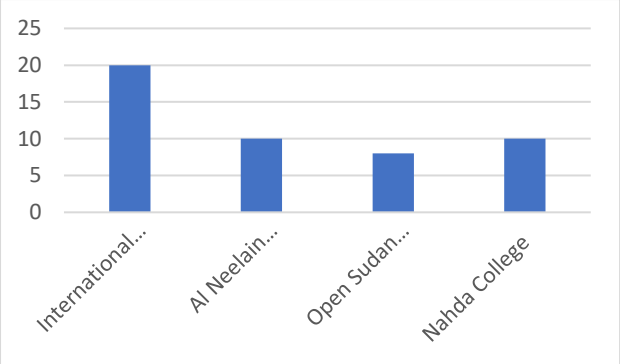

Fig 4: Survey and Interview Responses from Participating Teachers

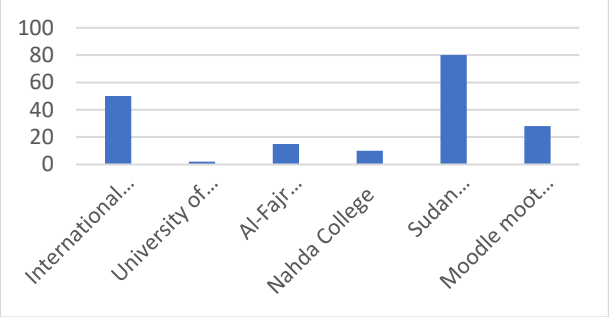

Fig 5: illustrates the number of teachers who have utilized the electronic blueprint design tool for their course design and examination preparation.

Table 2. Question time standard

Item Type	Average Time
True-false	30 Seconds
Multiple choice	1 Minute
Multiple choice of higher-level learning objectives	1.5 Minutes
Short answer	2 Minutes
Completion	1 Minute
Matching	30 Seconds Per response
Short Essay	10-15 Minutes
Extended Essay	30 Minutes
Visual Image	30 Seconds

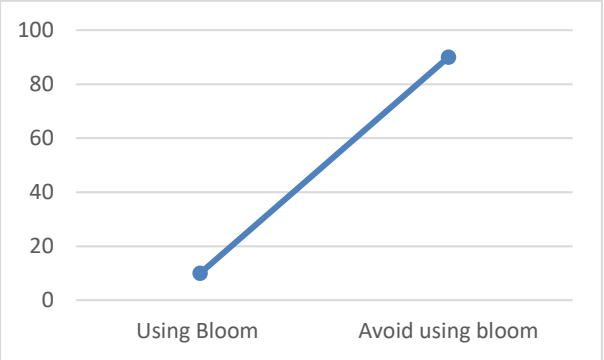

Fig 6: Measured Electronic Exam According to the Bloom Standard Sudanese Teachers

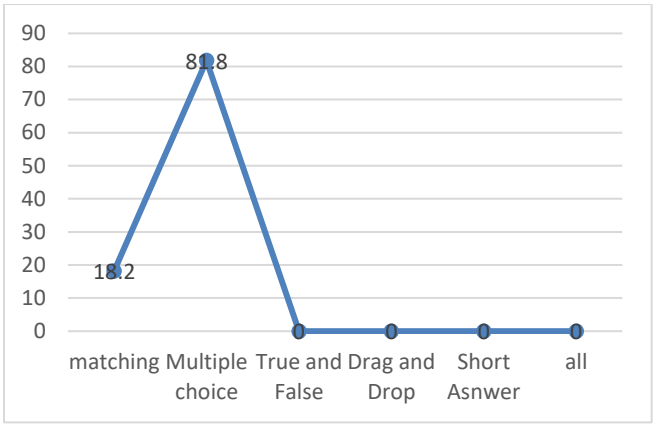

Fig 7: Difficult questions when preparing exam questions in Sudanese Teachers

5. METHOD

The methodology used in this research thoroughly evaluates the electronic Tool's usefulness in assisting the process of creating a blueprint under scientific criteria. The researchers gave out a questionnaire to participants to ensure the study's validity and reliability. They spoke with Teachers personally from the International University of Africa, Alnealine University, Open Sudan University, and Nahda College, four universities in Sudan (See Figure 4). The study's data processing and analysis were performed using SPSS software, specifically Version 19.0, developed by IBM Corporation. Additionally, the statistical Tool was used to present the analyzed data clearly and understandably. This enabled the researchers to understand the data better and derive meaningful insights and conclusions.

Since medical schools have the most expertise with the blueprint method, the questionnaire specifically targeted them. The information gathered from the survey and interviews were examined and utilized to assess the suggested Tool.

The staff of the University of Medical Science and Technology, the Al Fajr College for Science and Technology team, and the faculty of medicine at the International University of Africa tested the Tool and found it effective in facilitating the process of designing a blueprint with scientific standards (See Figure 5).

Also, the researchers presented the suggested approach to the Sudan Medical Specialization Board and received encouraging comments from 80 Teachers from various universities. Most Moodle developers have also given the proposed method during the Moodle moot in Shizuoka, Japan. They agreed that it was a valuable tool for aiding the process of creating a blueprint with scientific standards.

6. DISCUSSION AND RESULTS

Academic institutions rely on faculty members to provide instructional materials and exam topics for the educational process(McGuire et al., 2018). The Blueprint specifies the quantity and variety of test questions (SAEED, 2019, Bakó and Aszalós, 2019). The Bloom Taxonomy is a classification scheme for educational goals and objectives(Fluck, 2019), two techniques frequently employed in Sudanese institutions. Yet, creating a Blueprint and setting up instructional objectives can be difficult and time-consuming(Hansen and Dexter, 1997, Hasmy, 2020).

This study examined the application of Blueprints and Bloom Taxonomy in Sudanese universities using distributed surveys and in-person interviews with lecturers from various faculties

and universities, including the International University of Africa, Al Neelain University, Open Sudan University, and Nahda College, showed in Figure 4. The findings showed that most Teachers relied on ad hoc revisions after setting or after students took the exam rather than following a regular Blueprint. In addition, many teachers had no idea how to split problems or use Bloom's Taxonomy See Figure 6.

The researchers proposed a tool to assist teachers in implementing the Blueprint concept and concurrently used Bloom's Taxonomy to address these problems (Figures 2 and 3). The Tool makes it easier to complete several educational stages, such as creating a Blueprint linked to the course objectives and creating questions based on the plans and goals created using the Tool. The Tool helps teachers become more proficient in using Blueprints and Bloom's Taxonomy while saving time and effort.

The study conducted a survey that included a question regarding the challenges teachers face when creating questions. The results from the study, combined with data collected from four universities, revealed that teachers found starting multiple-choice and matching questions to be a difficult and time-consuming task. Figure 7 illustrates these findings.

The International University of Africa, University of Medical Science and Technology, Al Fajr College for Science and Technology, Sudan Medical Specialization Board, and Moodle moot at Shizuoka, Japan, are just a few of the institutions and cultures that the researchers tested the Tool within order to determine its validity See Figure 5. All teachers praised the Tool as being helpful.

Despite the valuable insights gained from the study, it is essential to acknowledge its limitations, including the fact that it did not cover all universities in Sudan and that the survey tool used was not integrated with any Learning Management Systems such as Moodle. However, these limitations could be addressed in future research using sampling strategies and integrating the survey tool with an LMS which would facilitate data collection and analysis and enhance the accuracy and relevance of the findings.

7. CONCLUSION

The foundation of any academic institution's educational process is the educational materials and exam content created by faculty. This paper's primary contribution is developing an electronic tool that can assist teachers in creating a blueprint with scientific standards. The Tool enables teachers to establish objectives, learning outcomes, set exam questions, and connect the learning outcomes with the lessons. One of the Tool's standout features is the ability to create a blueprint with scientific standards and align it with Bloom's Taxonomy (Cognitive level). This feature helps teachers develop exam questions that align with the course's educational process's formalization.

The success of this Tool demonstrates how computer technology has the potential to raise the standard of instruction in Sudanese colleges. To help instructors use technology more skillfully, it also highlights the need for increased assistance and education. It is possible to further improve the quality of instruction in universities and other institutions throughout Sudan with ongoing study and development.

8. ACKNOWLEDGMENTS

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