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Course Knowledge Assessment Tool Using Python

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Abstract: For teaching faculty, the current trend is to use revised blooms' taxonomy for setting question papers. It's beneficial for both students and faculty on equal levels. For students, a fair assessment is facilitated, whereas for the teachers it's helpful in detailed testing. Different levels of knowledge can be assessed using the verbs of blooms' taxonomy which is used while framing the questions. The tool is designed using Python script. It works on the concept of accepting the students' marks, maximum marks and the revised blooms' taxonomy level for each question. All of these elements are entered as an input, in the form of an excel sheet. The tool processes these values and provides the best skill level as an output. This value is then used to assess a particular student's knowledge level for a particular question, on the basis of overall performance.

Keywords: Computing methodologies, Knowledge representation and reasoning, tool using python

1. Introduction

For educationalist, revised blooms' taxonomy helps in classifying the thinking. It specifies 6 cognitive levels of complexity which helps in writing and revising the course objectives, planning curriculum, and identifying the different skills of knowledge. Revised blooms' taxonomy helps in aligning the assessment techniques. It incorporates different knowledge dimensions and the cognitive process to learn. It facilitates better assessment of the students. The Six categories in revised blooms taxonomy are create, evaluate, analyze, apply, understand and remember. Taxonomy reflects various forms of thinking verbs which describes actions. Blooms' taxonomy is an authentic tool to plan curriculum, instructional delivery and assessment methods. It can be easily applied to any level of education (Weili, Klotzkin, Myers, Wagoner, White, 2015) (Chung, Khor, 2015) (Llamas, Mikic, 2014) (Qinran , Fangxing, Chien, 2015).

The different levels that help assess different dimension of knowledge assessment are as follows:

ANALYSING KNOWLEDGE LEVEL: The knowledge retention level is assessed based on how students recall, restate and remember learned information.

UNDERSTANDING KNOWLEDGE LEVEL: Faculty can test how well the students have grasped the meaning of information based on their interpretation and translation of knowledge.

APPLYING KNOWLEDGE LEVEL: Their practical knowledge can be judged based on how students use the learnt information in a different, yet applicable context.

ANALYSING KNOWLEDGE LEVEL: Faculty can assess the students' capability of breaking down the learned information into parts of best understandable information.

EVALUATION KNOWLEDGE LEVEL: Faculty can assess the decision making capability of the students based on in-depth reflection, criticism and assessment.

CREATING KNOWLEDGE LEVEL: Faculty can assess the creative instincts and ability to leverage the knowledge, in order to form new ideas.

In this paper, authors describe the tool they have developed to assess the knowledge level of students based on their performance in the internal assessment of a course(Liisa , Taina , 2015) (Sousa, Antao, Germano, 2013) (Edmundo, 2013) .

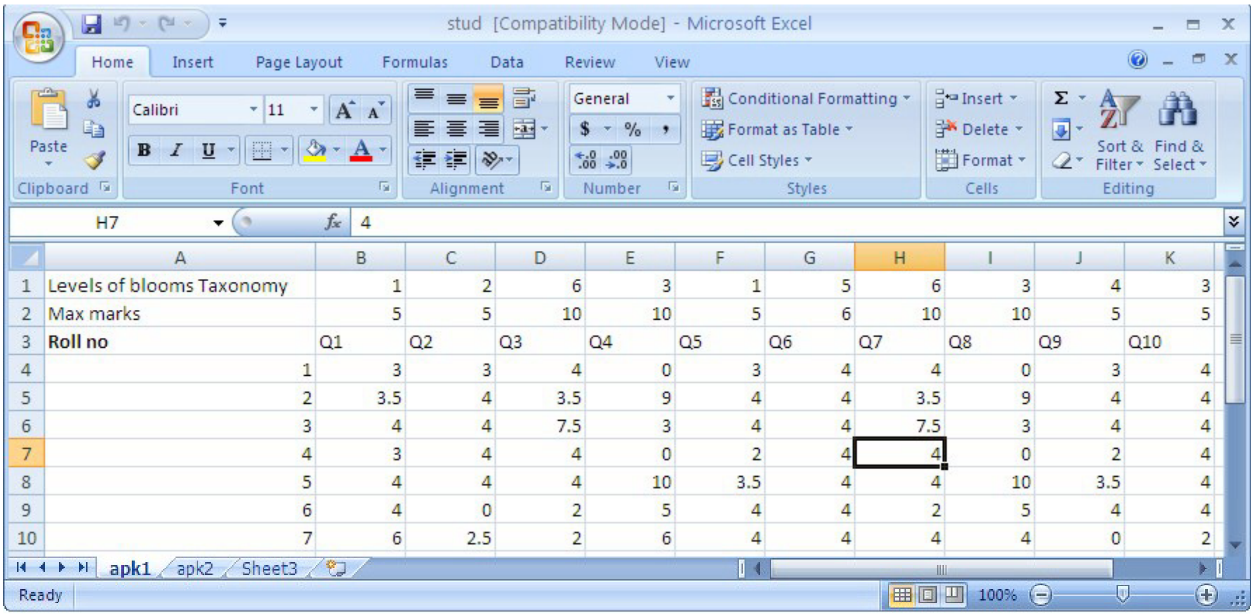
2. Related work

There are plenty of software tools available to analyze outcome based education. There are software tools which help the educationalist to manage learning, content and improvement analysis. The OBE software tools provide different roles such as content delivery, measuring outcome attainment level and OBE analysis. These OBE software tools include eLumen, canvas, Waypoint outcomes, moodle, desire2learn and Livetext.

eLumen focuses on comprehensive assessment, analytics and report the outcome analysis. Canvas is a web based open source OBE tool which helps to manage learning. Moodle is an open source tool which helps to manage content in educational environments. Waypoint outcomes is a tool which helps in assessment and reporting student performance. Desire2learn is a software tool which is helpful in content management and helps in improving the program. Livetext is a tool which helps in program improvement by different strategic planning (Hugh, Gillian, 2013) (Phillip, Wan, 2014) (Zeng, Zhang, Huang, Dong, 2014).

3. Methodology to Identify students' knowledge level Data Collection

The authors have designed a tool using python programming language. The tool accepts an excel file which collates students' performance details in terms of marks. The marks of students in each question is gathered in the excel file. The maximum marks for each question is specified along with the blooms' taxonomy level. This excel file is provided as an input to the tool. The tool processes the input and finds out the knowledge level and excellence of each student (Robert, 2015) (Raman, Achuthan, Nedungadi, Diwakar, Bose, 2014).



	A	B	C	D	E	F	G	H	I	J	K
1	Levels of blooms Taxonomy	1	2	6	3	1	5	6	3	4	3
2	Max marks	5	5	10	10	5	6	10	10	5	5
3	Roll no	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
4	1	3	3	4	0	3	4	4	0	3	4
5	2	3.5	4	3.5	9	4	4	3.5	9	4	4
6	3	4	4	7.5	3	4	4	7.5	3	4	4
7	4	3	4	4	0	2	4	4	0	2	4
8	5	4	4	4	10	3.5	4	4	10	3.5	4
9	6	4	0	2	5	4	4	2	5	4	4
10	7	6	2.5	2	6	4	4	4	4	0	2

Figure 1. Students' performance in excel file

This will serve as a tangible output for the faculty. This parameter of a student's excellence and knowledge level will assist the faculty in forming groups for subsequent study activities. Such group activities will ensure collaborative work amongst students of comparable skill set. Each group will have students excelling in creative, analytical, application, recollecting, understanding and evaluation. In this manner, the outcome of each group in active learning will be better compared to groups formed randomly.In Figure 1. Student performance details are shown. The excel file should have the blooms taxonomy for each question in the first row. In the second row, the maximum marks for each question has to be entered. In the remaining rows, students' marks need to be entered

(Samuel , Christian , Richard , 2014))(Hemingway, Angell, Hartwell, Richard, 2011) (Ching, Gwo, Chien, Chih, 2012) (Ros, Rodriguez, Diaz , 2014).

4. Algorithm to find best knowledge level of student

1. Read each row from the excel file
2. Then count how many questions are from each blooms taxonomy level and maintain in tot_tax[ ] array.
3. Blooms' Taxonomy level for each question is stored in tax[ ] array.
4. Then read the maximum marks for each question, store it in max[ ] array
5. For each student perform the following
    a. Initialize skills[ ] array to zero.
    b. Read marks scored by student in each question one by one from each column
    c. Do the following for each mark from a cell in excel sheet of row rx and column cx
        i. Check among the 6 revised blooms taxonomy, which taxonomy the question belong to. i is the blooms level, where 1≤i≤6
            1. Find out the percentage of mark scored in each question as following and add it to the skills[i] skills[i]=skills[i]+mark *100/max[cx]
    d. After calculating skills of each student based on marks scored in each question, find out the average skill of student in each knowledge level as following.
        i. For each revised blooms level, k from 1 to 6 do the following for each student:
            1. Skills[k]=skills[k]/total_tax[k] ii. To identify best_skill of each student, do the following:
        iii. Initialize top_percentage as 0.
            1. For each blooms level k from 1 to 6, do the following for each student:
    a. If top_percentage<=skills[k]
                i. Top_percentage=skills[k]
                ii. Best_skill=k
    e. Display/store the students best skill identified as the following:
        i. If best_Skill==1 ,then student is good in remembering skill
        ii. If best_skill==2 , then student is good in understanding skill
        iii. If best_skill==3, then student is good in applying skill iv. If best_skill==4, then student is good in analyzing skill
        v. If best_skill==5 then student is good in evaluating skill
        vi. If best_skill==6, then student is good in creative skill

5. Discussion and Results

In Figure 1, students' performance in each question is shown. Questions 1 and 5 are mapped to blooms taxonomy level 1. Question 2 is mapped to blooms level 2. Questions 4, 8 and 10 are mapped to blooms level 3. Question 9 is mapped to blooms level 4. Question 6 is mapped to blooms level 5 Questions 3 and 7 are mapped to blooms taxonomy level 6. As per the algorithm given in this paper, first the total number of questions mapped for each blooms taxonomy level will be calculated. There are two mapped to blooms level 1, one question mapped to level 2, three questions mapped to level 3, one question mapped to level 4, one question mapped to level 5 and two questions mapped to level 6.

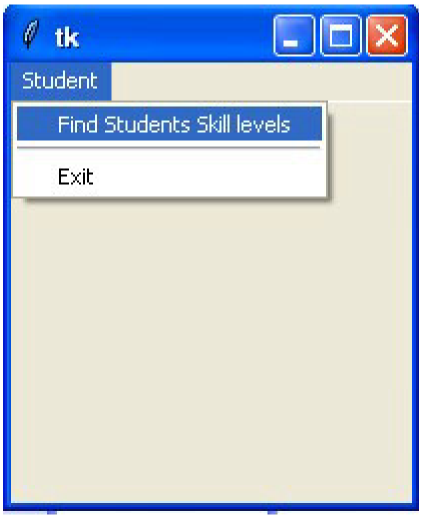


Figure 2. Opening file in tool developed using Python

For the student 1, the skills [1] for blooms level 1 is measured as following: Initially Skills[1]=0 ;Skills [1] =skills [1] + (3*100/5) // 3 marks in Q1, Q1 is mapped to Blooms level 1. Now skills[1]=60; Skills[1]=skills[1]+(3*100/5) // 3 marks in Q5, Q5 is mapped to Blooms level 5.Now skills[1]=60+60=120 .Finally the average skill of student in blooms' knowledge level needs to be calculated. It will be calculated using dividing skills [1] by total_tax[1] which is 120/2. Similarly, the percentage skill of each student, at each knowledge level is measured. For student with roll number 1, percentage of knowledge levels is calculated and their values are, skills[1] is 60, skills[2] is 60, skills[3] is 0, skills[4] is 60, skills[5] is 66 and skills[6] is 40. By comparing all average values, the tool identifies that the student possesses the highest skill value in blooms knowledge level 5. Thus the tool determines that Student-1 is good at 'evaluating' skill. Similarly for all the students, their skill excellence is calculated. This list is given as a recommendation to students and faculty, so that they can form the group which comprises of students with all skill set. In figure 2. The tool developed using python programming language is shown. The faculty can select the excel file which consists of students performance details for each question.

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Roll no	L1	L2	L3	L4	L5	L6	Best Skill of student
1.0	60	60	26	60	66	40	Evaluating Skill
2.0	75	80	86	80	66	35	Applying Skill
3.0	80	80	46	80	66	75	Analysing Skill
4.0	50	80	26	40	66	40	Understanding Skill
5.0	75	80	93	70	66	40	Applying Skill
6.0	80	0	60	80	66	20	Analysing Skill
7.0	100	50	46	0	66	30	Remembering Skill

Figure 3. Result Analysis tool developed using python

In figure 3. Result Analysis tool is shown. For each student their skill set calculations are shown. First student has got the highest average percentage skill in L5 of blooms level and so he is identified for 'evaluating' skill. Second student has highest average percentage skill in L3 of blooms level, so he is identified for 'applying' skill. Similarly, other students' skills are calculated. The authors designed the tool in a manner such that, if the skill score is equal for more than one blooms level, the higher blooms level will be considered. For example, the student 3 has a skill score of 80 in L1, L2 and L5. However, the tool will consider L5 as the students' knowledge level.

6. Conclusion

Identifying the students' knowledge level helps in forming collaborative working groups. These student groups can be involved in technical paper writing, mini projects and assignments. The knowledge level identified for each student can be recommended to the students and faculty in forming groups, so that each group can be formed with students of all knowledge level. With this, the outcome of their work will be appreciable and effective, as students of all knowledge domains are involved in the collaborative work.

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