

Cognitive Prior-Knowledge Testing Method for Core Development of Higher Education of Computing in Academia

Mohit Satoskar¹

¹Research Associate, Department of Computer Science and Information Technology, Ramrao Adik Institute of Technology, Navi Mumbai, Maharashtra, India

Abstract - Aspects and necessity of testing students' real prior knowledge before admission to higher education is analyzed. Prior-Knowledge testing method presented along with inter-dependency of students' knowledge testing components with time machine. Efficiency of students prior knowledge testing is described. It is clearly analyzed how entrance exam techniques affect education system to a larger extent. Algorithm of Cognitive prior-knowledge testing method is briefly highlighted. Three knowledge testing components (Objective, subjective and practical model) are described with hierarchy of structural model. Virtual Lab technique of Information and communication technology (ICT) is presented. The percentile technique is presented to analyze the result for the admission process. It is shown how this method will improve the education system and reduce unemployment rate.

Keywords: prior-knowledge testing method, virtual lab, computing percentile, information and communication technology.

1 Introduction

At present, technological innovation in higher education, particularly the development of educational standards have become core components of development. The general stance was that, significant new technological development proceeded gradually, as, higher educational institutes could not foretell, that the impact of computing education would be needed, at a core of the change. In the battle of quality, many institutes are taking part in developing intensive methodological work. At the same time, the study of computer science can help to design framework, making possible, fully testing of prior-knowledge base with efficiency. These steps will help the higher education system change from mediocre to world-class. It is interesting to note that, this method will provide cream of excellent students who have the right to deserve the admission for higher education. "Education is not the filling of a vessel but the kindling of a flame"- Socrates

It is necessary to work-out prior-knowledge testing method to produce fruitful results to the industry and academia.

Generic root cause:

- student assessment without structural traditional method of entrance exam.
- It will override the so called traditional assumption method of prior knowledge of student.

In many cases, admission to higher education can be given by analysing, judging, testing the core concept, prior to admitting the student[5][6]. In result, it will strengthen the level of education, its quality and automatically it will reduce unemployment to some extent.

In fact, entrance exam technique is not scalable as it also carries small scale syllabus. Instead of that, prior-knowledge testing method can give productive result.

2 Prior Knowledge Testing Method for Academia

Many higher educational institutes boast of their robust education system which has given birth to exemplary entrepreneurs. Continuing with its trend of multiple educational institutions it retains its core speciality i.e. having innumerable types of courses and a customised fee-structure in the educational institutes. Major higher educational institutes offering education to the students based on certificates/ grades don't prove that students are capable for the particular course. It is a traditional method which is based on assumption and presumption technique.

While offering higher education, it is need to test the student's prior-knowledge base of the specific area. As this problem arose, system got covered by the most typical aspect of 'entrance exams'. However, entrance exam is based on set of syllabus and students studies that set for temporary.

Interestingly, it is seen that, even after graduating, students fail to succeed[5][6]. Importantly, prior-knowledge testing should be clearer and the real knowledge should be tested. However, very limited numbers of students are getting fruitful results upon completion of course.

2.1 Analysis and calculation of functional collaborative node

In every walk of life there are certain components present either solely or in the necessary combination namely science, technology, engineering and mathematics. Science can be defined as knowledge about any particular parameter based upon the facts and functions learnt through experiments and the inferences drawn there from. Whereas technology can be stated as the means of application of the acquired knowledge in that particular area. Engineering is the most important function of all. It directs all the personnel and guides other functions to work in a direction to achieve some fruitful results. And mathematics implies the logical functionality. These four functions are omnipresent either in a singular form or in combination [2][3][11].

All these individual functions are of utmost importance but for the optimum results all these four functions should work hand in hand. Proposed model is comprising of all these functions which will help us achieve enormous success. STEM model is a medium to test the logical, theoretical as well as the practical knowledge of the pupil along with its optimum utilization[3]. It is a technology based model which will be platform independent and user friendly. This model will test the theoretical as well as the practical knowledge of the student in the corresponding areas.

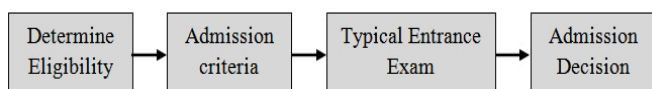


Figure 1 A typical model of admission process

The model shown in Figure 1 suffers from poor analyzing and testing the logic of students prior-knowledge acquisition. Characteristics such as admission criteria, for example 60% is mandatory in previous education for further education does not prove that students have real knowledge. Entrance exam also is not entirely convincing since it ignores certain crucial parameters such as syllabus. Student may study limited amount of given syllabus of entrance exam which however doesn't prove whether they have knowledge or not? Thus it is required to highlight guideline of syllabus for better execution. In addition to that specific percentage criteria lacking to test prior base knowledge. More logical might be the sequence presented in Figure 2.

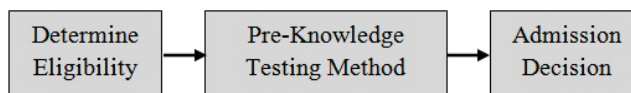


Figure 2 Modified model of admission process with prior knowledge testing method

It is shown that there exist three channels of knowledge delivery: via text, via audio, via video [2]. To test these delivery channels of knowledge, rigorous formation of testing components will strengthen the admission process of higher education.

Strategic Maths

At present, entrance examinations are the part and parcel of current education system. It often also proves to be a barrier to the real potential of a pupil. In certain circumstances, student is unable to act accordingly leading him to the ultimate failure in such examinations. Though a pupil fails to pass the examination with flying colors, does not necessarily implicate that there is some weakness in his knowledge acquisition.

Thus the efficiency of the knowledge has to be tested for the realization of the actual potential of that pupil. Efficiency is the function of application of the acquired knowledge with a close relation to the variable of the time taken for such application.

$$time\ taken(tt) = time\ allotted(ta) - time\ saved(ts) \quad (1)$$

$$efficiency = \frac{question\ covered + accuracy}{time\ taken} \quad (2)$$

In the proposed model for every question stated maximum time that has to be given for the solution of that corresponding question will be stated. Such time can be named as time allowed. Time saved will be the difference between the parameters of time allowed and time taken as we have elaborated in equation 1. Such time saved will determine the efficiency of such student. We can say that the time saved function is directly proportional to the function efficiency.

To this dependant function to work there is a variable playing a vital role named accuracy. Time saved along with the accuracy of the solution will ultimately determine the efficiency of the student. The relativity of the time taken and the accuracy of such solutions with the efficiency of the learner is shown in the equation 2.

In the above stated equation the questions covered are the number of questions which are answered correctly. The variable of accuracy is determined by the certain parameters such as use of certain keywords, also the order of preferential

importance given to such keywords. Thus the accuracy also will be measured cardinally. And the sum total will be thus divided by the constraint of time taken. The greater will be the denominator the lesser will be the outcome which is the efficiency and vice versa.

2.2 Formal structure of the prior-knowledge testing method

In the proposed model there are various components already defined. For the testing of prior-knowledge, all the necessary aspects should be tested accordingly. Current traditional entrance examinations only test the theoretical knowledge possessed by the student. This assessment model fails in the real goals of assessing the knowledge that has been acquired as well as understood and not just acquired knowledge. This constraint is based upon the vital concept of efficient practical application of the acquired knowledge.

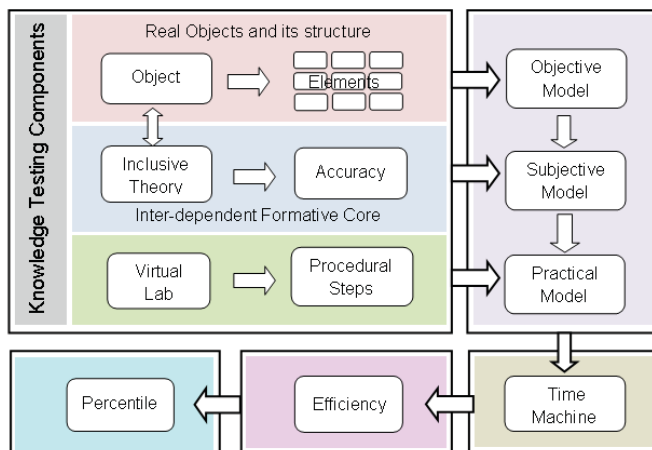


Figure 3 Structural representation of prior-knowledge testing method

In the above prior cognitive knowledge assessment method, the crucial difference is that this model aims at judging the practical knowledge of the learner. In this model question bank will be based within a particular framework which will be guided by the defined syllabus. Questions will be of all the three types namely objective subjective and practical. Objective questions will attempt to test the logical understanding of the learner along with the immediate application of such logical reasoning. Whereas the theoretical also named as the subjective type of questions will judge the actual understanding of the learner of that particular area of knowledge. The whole model will be 'Online Computer Based'.

In this type the constraint of accuracy is also as much important as the constraint of time taken is. The last will be the practical testing where the question will be presented virtually to the learner for solution. The practical model will be based on Virtual lab technique. Virtual lab will provide to

the students, the result of the experiment of modeling the physical phenomenon and carrying out simulations to generate the result of a particular real-world experiment [12]. In this kind the practical application of the knowledge along with the conceptual clarity will be tested vigorously.

All these three types of questions will be assigned a general time frame in the model. Taking such time into consideration, time taken and time saved will be decided. And furthermore combining the celerity with the accuracy of such celerity will conclude the efficiency and ultimately the eligibility of the learner for entering to the corresponding institution in corresponding course.

2.3 Algorithm of cognitive prior-knowledge testing

To test whether student have required pre-requisite knowledge or not, implementation of following algorithm is necessary. Model is classified in three components in which objective and practical model will be tested instantly by computer. Inclusive theoretical writing model will be redirected to expert for rigorous testing.

- 1) initially select objective model component weighing of 25% interdependent on time machine of 30 minutes in section adaptive test.
- 2) select subjective model component weighing of 25% separately interlinking with time machine of 30 minutes.
- 3) submit and redirect subjective component to individual experts for testing.
- 4) select last component of section adaptive test - virtual lab based practical model, weighting 50% interlinked with time machine of 60 minutes
- 5) test objective model and practical model of computer based test on the spot and generate result using percentile formula.
- 6) For each expert, test subjective writing model on the basis of language proficiency, accuracy, core content and structure and calculate the result on the scale of language modelling bands out of 5.
- 7) generate result in percentile and select prospective students as per their ranks for higher education studies.

3 Technique of Computing Percentile

In the proposed model of assessment the scores are to be assigned according to the percentile pattern and not the ranking method. percentiles can be defined as: p th percentile of the distribution, states, the percentage of the distribution, that is, less than or equal to p th value. Following stated formula will elaborate the working of the calculation of percentiles pattern.

$$\text{percentile} = \frac{\text{number of values below } x}{n} \times 100 \quad (3)$$

Here the scores of every learner will be computed and will be entered into the database and they are arranged according to the proposed order that is the ascending order. Then for a particular percentile for the corresponding is calculated by dividing the number of values lesser than that particular score by the total number of the students. And the outcome then has to multiplied by 100. Thus the percentile will show the ordinal position of that student.

4 Dependency of prior-knowledge with unemployment rate

Dr A.P.J Abdul Kalam admits: *"It's not about how many engineers we produce, but how many engineers we produce with employability"*. Most engineering graduates are indeed unemployable in various regions of the world. India churns out tens of thousands of graduates each year but less than half of them are "employable" or possess the basic skills necessary for any industrial role, says a report [5]. Youth unemployment and underemployment is prevalent around the world because young people lack skills, work experience, job search abilities and the financial resources to find employment (United Nations, 2003; ILO, 2006; Matsumoto et al., 2012).

The variable of unemployment is directly proportional to the variable of quality of prior-knowledge which may impose the significant cost of national budget [6]. A landmark report on youth unemployment in the UK claims that the 'net present value of the cost to the Treasury, even looking only a decade ahead, is approximately 28 billion (GBP)' (The ACEVO Commission on Youth Unemployment, 2012:4). To impose quality education and better employment, prior-knowledge testing is needed.

5 Conclusions

Improving education system is a serious concern. Ironically, as increase in educational institute will fulfil the dream of 'serving generic education', institutes are making money rather than distributing quality improved education. Knowledge will be tested in this model. Education shouldn't be treated as business, there will be massive a imbalance. Automatically it will sustain employability.

New solutions to the problems of real time knowledge testing on the battlefield were designed. Such major changes need to be adopted by myriad higher educational institutes for a comprehensive superlative education admission process. It is a need to adopt this model in the higher education system, both access, completion, and excellence, are getting the attention they need to test cognitive ability.

The three basic components of cognitive prior-knowledge testing component model is presented. With the help of virtual lab technique real world practical knowledge of students can be tested more efficiently. This model can be implemented with the help of ICT which will also try to minimize the underemployment of the computer graduates.

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