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Knowledge Acquisition Base Learning: An Interactive Learning Approach

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Abstract: The Corona Covid-19 Pandemic revealed a deep deficiency in the current e-learning system. Many of the current e-Learning schemas have pursued their goals in conventional ways, albeit transferring the lecture hall to an online medium presentation. In essence, there had been little innovation above traditional classroom lecturing. In this paper, we propose a novel approach aimed at optimizing the learning outcomes of learning per student. Namely, we propose Iterative and Interactive e-Learning Platform, where the main focus is shifted towards the learner, i.e., the student. The role of the instructor is directed more towards the construction and presentation of interactive education material in a manner to enable the learner to acquire the minimum required knowledge and to achieve the intended outcomes in the most effective manner. Therefore, the proposed model is a knowledge-acquisition based learning management system (KA-LMS). Unlike the traditional ways of classroom or online lecturing, a student using KA-LMS is expected to achieve a quality of learning, never before achieved via standard offline or online pedagogical methodologies. The Iterative and Interactive KA-LMS is sought to enable various academic institutions to achieve quality standards in both online and on premise setup, thus avoiding the calamities of pandemics, such as the one imposed by the Corona Covid-19. The proposed KA-LMS will enable graduates to achieve the required skills and knowledge, which allow them to compete in a more vigorous and competitive marketplace at the local and global levels. The proposed KA-LMS has the inherent capability to monitor and control the progress of the learner entity based on the quantity and quality of the knowledge acquired by the learner. The proposed model will be tested in school and college environments, with real education subjects.

Keywords: Online learning, Iterative learning, Interactive learning, Knowledge acquisition, Covid-19

Introduction

This paper aims at solving several dilemmas faced by learnings in the current conventional and/or electronic learning systems. These dilemmas include:

Dilemma 1

Selection and presentation of education material to meet learning outcomes: This is attributed to wide diversity and availability of teaching materials including textbooks, power-point, audio-visual material, and augmented virtual reality. This dilemma is further complicated by the cost associated with education material, which increases the education divide between developed and under developed countries.

To address this dilemma, the paper provides a methodology to create tools and templates to allow an instructor to structure and present the material in a manner to allow simple learning, and to enable iterative interactive learning process. (Cho et al., 2009).

Dilemma 2

Variation of learning capabilities among student's population, may restrict the rapid progress of the gifted students, while depriving the least gifted ones. Pace adjustment of learning is not readily possible in classical classrooms or in current e-Learning systems, which merely transferred the education from the classroom to remote video presentations. The classical structure of semester based education limits the progress of the gifted and impede the progress of the less gifted.

This paper discusses the means of enabling students to learn at self-pace, in a manner to allow a student to progress in an incremental manner based on his/her capabilities (Meng et al., 2017). Thus providing an environment, where students can choose and select their pace at which they can achieve their learning objectives (Tullis et al., 2011).

Dilemma 3

The delivery process of education material lacks the ability to provoke dynamic engagement and interaction with each and with every learner. Thus it is bound to leave behind dis-involved students, who will eventually lag behind. Current methods of online e-learning methods suffer from serious lack of interactivity between instructor and learners Meng et al. (2017).

In this paper, the author addresses novel methods of delivering the education material in a manner to enforce engagement and interaction, which allows controllability and observability of the learning process Minka et al. (1997) and Barker (1994).

Dilemma 4

The current assessment and evaluation processes rely on assessing the final knowledge acquired by a student, which may not be a true assessment. Furthermore, current systems allow students to fail a subject, to pass with a low threshold, or below an acceptable line. The overwhelming fact is that a graduate with low grades or insufficient knowledge will suffer great deal while looking for a good work; in the end many of such graduates end up changing their careers, accepting low paying jobs, or remain unemployed for a long time. As such the economy of the individual as well as of the state at large suffers great deal, Andrabi et al. (2018).

In this paper, we provide an incremental, iterative, and adaptive evaluation and assessment process in a manner to guarantee the required level of knowledge acquisition. This objective is meant to steer the learning process based on a preset education quality level. For example, it would be possible for an academic department to set a minimum level of achievement for each and every student in a particular discipline, Malkawi et al (2006; 2006; 2007; 2008)

Significance of the Research

The presented research is sought to provide several significant outcomes and results in the field of online e-Learning. Covid-19 pandemic had exposed many of the shortcomings of current system. As a result, many students (both school and higher education students) suffered great deal. The presented research provides a model which aims at restructuring the learning material in a manner, which allows a student to increase the knowledge acquisition through incremental learning and accumulative evaluation and assessment. The progress of learning should be based on both quantity and quality of knowledge acquired by the learner rather than based on time spent studying a certain material and the result of the final and midterm exams results. The new learning model provides a mechanism to enable a given department or instructor to adjust and adapt the learning system to each student individually based on smart adaptive algorithms. In the course of providing the material, it is possible to set and define a standard of knowledge acquisition per student, per department, or per institute. While doing so, each student should be able to learn at own pace, thus allowing to take care of natural differences in students' capabilities. In an education world moving rapidly towards interdisciplinary education, the proposed model provides a well-structured integration of knowledge acquisition within a given discipline as well as across multiple disciplines. The most important part of the proposed novel approach for learning is that it enables both online or offline learning to achieve maximum student interaction with the subject material.

The proposed model is expected to have an impact on the overall quality of education within any given organization. This includes the reduction in the overall cost of the education system, by shifting the center of the learning process to the learning student, and transferring the role of the instructor to preparing, modifying, and perfecting the interactive electronic material.

The model will have a direct impact on the overall education systems in developing countries. It is sought to reduce the education divide between developed and developing countries by allowing students to benefit from state of the art education material without the need of expensive class room setting. The model guarantees the acquisition of minimum level of accepted knowledge in the field of study, thus allowing graduates of different countries irrespective of their economic status to compete in the local, regional, and international market scopes.

The new model will have a direct impact on the advancement of knowledge based economy by producing graduates with proven skills rather than graduates with diplomas and low score transcripts. With this model, it is possible to provide directed education material to enable the creation of required skills in each area (country, region, global world). The presented model will have a direct impact of the education system in several segments including primary education schools, higher education institutions, training centers, continuous training and education.

Related Work

Several e-learning platform systems have been developed over the past few years. Among the most commonly used platforms are:

1- Moodle (https://moodle.org/). Moodle is developed with free source code, thus making it most favorable for education organizations. The major strength of Moodle is the ability to host material in several formats and shapes including word, pdf, excel, images, audio, and video. It also provides tools for examination systems, quiz and assignment assessment. The main deficiency of Moodle in lieu of the proposed project is the lack of the ability to monitor and control the progress of the learner with the acquired knowledge. Also, Moodle does not provide a presentation platform of the material. Recently it has been augmented with video based presentation platforms such as ZOOM.
2- Blackboard (www.blackboard.com). This tool is very much similar to Moodle with the exception that is not free source platform. Similar to Moodle, Blackboard does not provide a tool to monitor and control the advancement of a student in the course with the acquired knowledge.
3- Udemy (https://elearningindustry.com). This platform provides a pool of more than 20000 Subject Matter Experts. Udemy eLearning platform has many content creation tools such as PDF documents, PowerPoint, etc. text and video content. They can be utilized to create and publish courses. It is very much based on video based education. The instructor must provide a high quality video and upload it to the platform. In essence, it is more like a youtube video repository, which provides no added value to the listener or learner. Its services are mostly paid services.
4- Teachable (https://elearningindustry.com/directory/elearning-software/teachable). This is another platform, which allows instructors to upload material in various formats for each course. It hosts more than 20000 courses created by 7500 instructors. It is a paid service
5- Other e- learning systems include: Ruzuku, Educadium, LearnWorlds, Thinkific, Academy Of Mine, CourseCraft, Skillshare, Coursera and many others.

The existing e-learning platforms provide a rich set of features. However, they all suffer several deficiencies such as:
1- The inability to monitor the exam integrity and/or to minimize the cheating and plagiarism.
2- The inability to tightly couple the student's progress with ongoing assessment
3- Do not distinguish between the assessment and the rate of knowledge acquisition,

Method

The proposed adaptive e-learning system is implemented according to the following well defined methodology. The main infrastructure of the model is constructed as an electronic portal system.

1. The portal system provides a portal for the students, teachers, and organization.

2. The proposed system will develop and provide the organization with tools and templates which enable the organization to define and set:
a. Standards of learning including: rate and level of knowledge acquisition
b. Method of calculating and computing the knowledge acquired by a learner student
c. Method for calculating the final grade score of a student. This method includes besides the knowledge, the time it took to acquire the knowledge and the number of repeated attempts to achieve the required knowledge.
d. The hierarchical structure of each discipline, which includes the subjects (courses), the modules per course, units per module and sub units.
3. The proposed system will develop and provide tools and templates for the teacher/instructor to perform the functions:
a. Brake the subject into modules
b. Break each module into units and/or sub units
c. For each unit/sub unit identify the immediate learning outcome and the related module outcome and the subject learning outcome
d. The system will provide a flow mechanism, by which an instructor can set a well-defined flow for the material, while observing parallel paths, dependent paths, and independent paths.
e. The instructor will be able to use the tool to upload trough the portal the unit/sub unit material to the course.
f. The tools and templates will enable the instructor to create questions for each unit/sub unit, and to organize a question bank.
g. The tools will enable the instructor to classify the questions in a given question bank with various indexes such as difficulty index, skill index, proficiency index, etc.
h. The instructor will be able to set the expected time spent on each unit
4. The tools and templates will provide exam, quiz, and pop-up questions delivery mechanism.
5. Ability to advance the learning progress based on achievements and student's own pace.
6. Ability to provide extra learning material to improve learner's performance
7. Method to compute final achievement score based on several criteria including achieved score, time to achieve score, number of attempts to achieve the required score.
8. The system will provide exam monitoring tools using biometrics, photo IDs, real-time photo identification and verification. This is necessary to control the exam taking environment.
9. The system will provide a final certification for the course with full authentication and verification.
10. The system portal can be configured to work online, cloud based, or offline self-learning

Expected Outcomes

The proposed project is sought to provide several significant outcomes and results, such as restructuring the learning material in a manner, which allows a student to increase the knowledge acquisition. It will also provide a tool for incremental learning and accumulative evaluation and assessment, where the learning progress is based on quantity and rate of knowledge acquisition. The system will provide tools to adjust and adapt the learning system to each student based individually based on smart adaptive algorithms, and to set and define a standard of knowledge acquisition per student, per department, or per institute. The system tools will enable students to learn at own pace, and provides a well-structured integration of knowledge acquisition within a given discipline as well as across multiple disciplines. The portal will be able to operate online or offline with maximum interaction with the subject material.

Impacts

The presented model will have an impact on

1. The overall quality of education within the organization
2. Reduce the cost of the overall education system
3. Shift the center of the learning process to the learning student

Impact on the Overall Education Systems in Developing Countries

1. Reduce the education divide between developed and developing countries by allowing students to benefit from state of the art education material without the need of expensive class room setting
2. Guarantee the acquisition of minimum level of accepted knowledge in the field of study, thus allowing graduates to compete in the local, regional, and international market scopes.

Impact on Knowledge Based Economy

1. Producing graduates with proven skills
2. Providing directed education material to enable the creation of requied skills in each area (country, region, global world)

Results and Discussion

A pilot model was created for the proposed knowledge acquisition based learning system. The pilot model was created using different platforms, which were integrated to provide a comprehensive tool. The main components were used from Moodle system, H5P system, SCORM and other.

The platform provides a course building templates as shown in Figure 1.

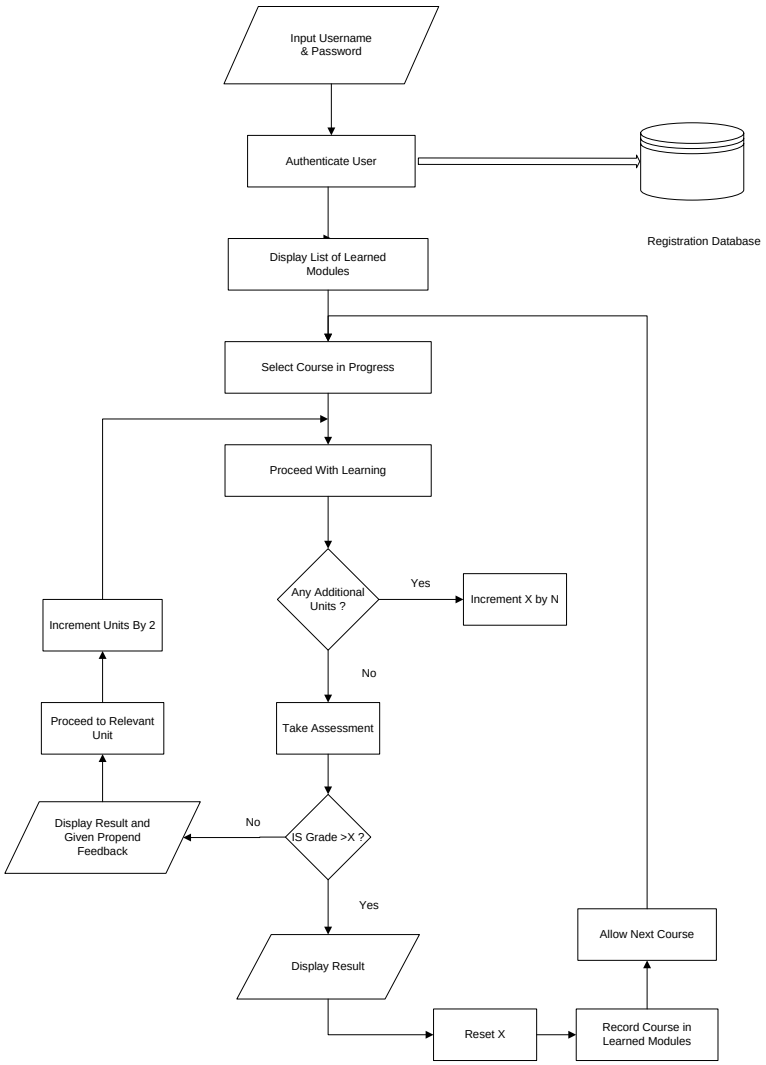

Fig.1 Flowchart Representing the Process of Iterative E-learning

Figure 1. Shows an example of iterative and interactive video, which is part of a course taught by the instructor, and developed by the proposed platform.

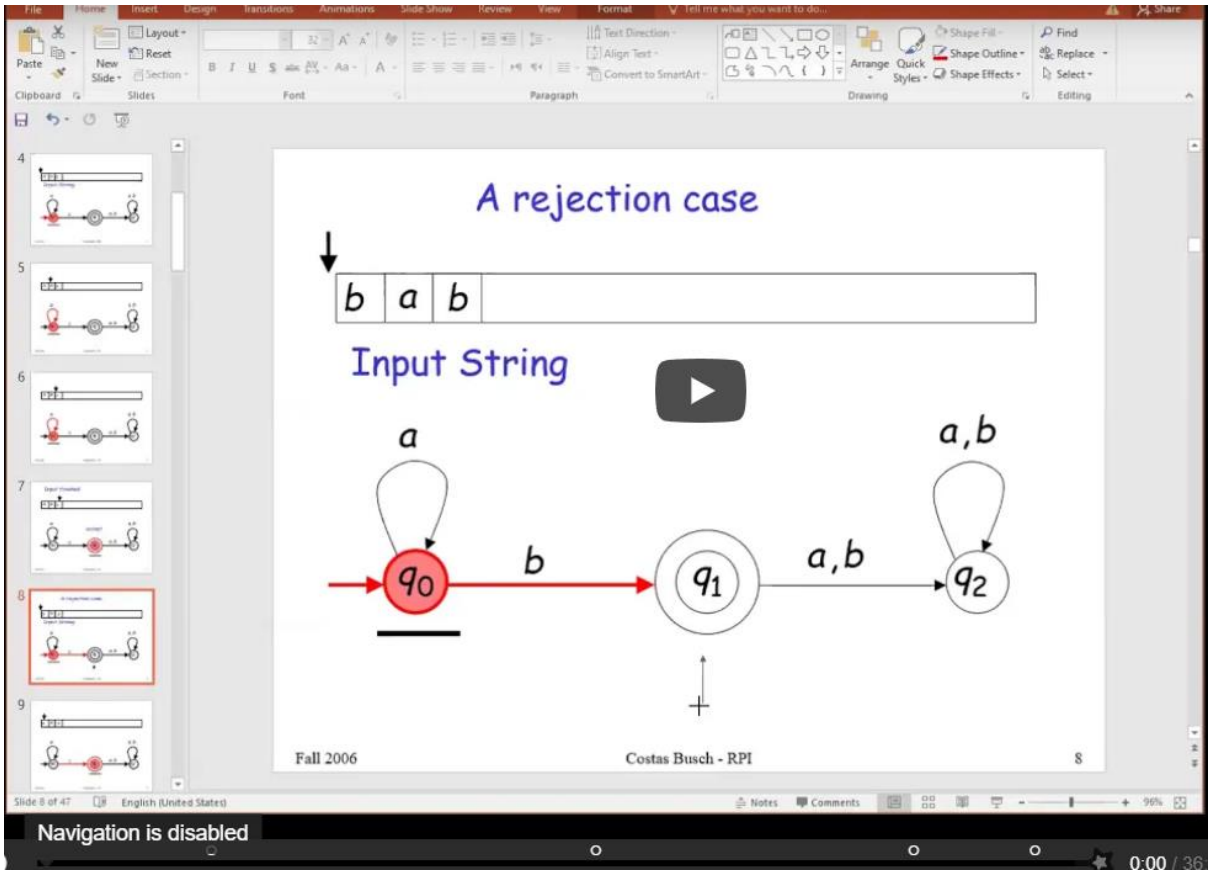

Figure 2. Iterative and interactive video

The interactive video is part of a software engineering course. The course is completely interactive and iterative. A student can watch the video in Figure 2 only if all the preceding material, upon which this video material depends, is completed by a student, and the required score is achieved. The video itself has pop-up questions indicated by the small circles on the lower bar of the video. When the video hits an interactive point, pop-up questions appear and the student must answer the questions correctly (or with a given score). If the student fails to answer or achieve the required score, then he/she is forced to go back to a predetermined time in the vieo. The student can advance past a given circle only if he/she achieves the required score. If the student fails to answer the questions given at one point, he might be directed to another location to study and learn more before he can continue trying to solve the given problems. As indicated at the right bottom of the video, a student cannot fast navigate the video, thus being forced to watch and listen to the material and then to answer questions. The instructor can design the pop-up questions locations, frequency and method of responding to students' answers.

This course was built with 34 interactive videos, with an average of one hour per video; a total of 34 interactive videos. An average of 5 pop-up interactive question breaks, and 3 questions per pop-up. Thus a total of 510 questions are provided for the entire course in an interactive form.

With a class of 40 students, each student spent on the average 30% more time than the video actual time in order to finish the video with the required score. For all the videos, the required score was set at 80% of the total grade. The student's grade for a given video is calculated as a function of the achieved score (which must be $\geq$ 80%) and the percentage of extra time spent watching the video and solving the problems. For example, a student achieved a score of 90% and spent 20% more time on the video. His final grade is calculated as (G = 90-0.2*90) = 78.00. The instructor can build his own grading scale.

Another test was made for this system by comparing the achievement of the students who completed the course using the interactive approach with the students who completed the course with physical face-to-face approach. The average grade for the interactive class was 80.5%, while the average for the classical approach was 71%,

The final observation made for the pilot test is that 2 of the students in the class were able to finish all the class requirements 3 weeks before the rest of the class. Both completed the course with full 100% grade. This

indicates that highly motivated and/or intelligent students can have completed the course at a faster rate than the rest of the students.

Conclusion

This paper presented a new and novel method for enhancing and harvesting the online education platforms, with emphasis on knowledge acquired by the students. The proposed method allows students to learn at their own pace, while making sure that they achieve a minimum level of learning. A pilot project was created and tested in a real education environment, at Jordan University of Science and Technology. The obtained results show that the proposed method achieves good performance for a controlled environment, where 40 students in a class achieved more than 80% of the grade in a given class. More testing and results are required before final conclusions can be made for this method of online learning. The platform is being configured to test primary and high school students using the new methodology.

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Scientific Ethics Declaration

The author declares that the scientific ethical and legal responsibility of this article published in EPSTEM journal belongs to the author.

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