

SYSTEM AND METHOD FOR AUTOMATED PERSONALIZED LEARNING AND ASSESSMENT

FIELD OF THE INVENTION

The present invention relates to a system and method for learning and assessment, in particular, a system and method for providing automated personalized learning and assessment through the recommending and managing of online courses and assessment tests tailored to a user's needs on an on-demand basis.

BACKGROUND ART

Personalized learning may be broadly defined as the tailoring of pedagogy, curriculum and learning environments to meet the needs and aspirations of individual learners, possibly adjusting the pace, adjusting the approach, and connecting to the learner's interests and experiences. Individualization therefore deals primarily with pace of learning and is often diagnostic of learners' problem areas, while differentiation may direct the form of instruction / instructional material (ie. content style and type, presentation formats etc.) that specific groups of learners may prefer.

To enable individualization, there is required a system that could identify problem areas of learners and pace their learning at each learner's individual level and which adapts to the learners' pace of learning and level of understanding while reporting adequately to teachers and educators for intervention.

Personalized diagnosis of each learner should also be accompanied by bespoke learning content prescribed for each learner, based on his/her learning progress, gaps in understanding, deficiency in skills, and is a necessary pre-requisite step to providing an individualized and differentiated learning experience for learners.

While teachers and educators are already trained in assessment analytics and differentiated instruction pedagogies to provide personalized learning, the current process is manual and dependent on the individual competency and experience of each teacher. It is therefore difficult and impractical to consistently provide for personalized learning in each lesson and to survey the competency level of each learner every time for each lesson. It is also quite impossible for any teacher, regardless of experience or expertise, to be able to accurately diagnose the learning gaps of each and every student, in a 1 teacher-to-many students environment. Even in a 1 teacher-to-1 student environment, a teacher may not be able to prescribe the correct diagnosis tools to alleviate the learning challenges of her learners.

The present invention provides an automated personalized learning and assessment system and method that is organized by performance demands and concepts mastered rather than by textbook topics or chapters so that learners worldwide could participate in adaptive learning and demonstrate proof-of-understanding of key concepts in any given curriculum and their placement relative to the pool of students worldwide. The present invention further aims to make local examinations a secondary means of evaluating understanding and mastery; and if local examinations results review cannot be avoided, the present invention further aims to ensure that students who have demonstrated fidelity of usage will do well in these examinations as proof-of-learning.

SUMMARY OF THE INVENTION

Throughout this document, unless otherwise indicated to the contrary, the terms “comprising”, “consisting of”, and the like, are to be construed as non-exhaustive, or in other words, as meaning “including, but not limited to”.

In accordance with a first aspect of the invention there is a system and method for automated personalized learning and assessment where a user selects a course from a list of courses and the system is configured to provide recommendations on other pre-requisite courses that the user can sign up.

Upon completion of the selected course, the system is configured to direct a user to complete an assessment to assess the user's understanding of the three aspects of the selected course – concepts, learning outcome and performance demand considerations.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will now be described, by way of example only, with reference to the accompanying drawings, in which:

Fig. 1 is a chart showing the relationship between a course topic, concept(s) taught by the course topic and performance demand.

Fig. 2 is an illustration of a course offered under the present invention showing the relationship between a course topic, concept(s) taught by the course topic and performance demand.

Fig. 3 is an illustration of the 3-dimensional facets of performance demand, concept(s) and peripheral concepts present in a test item of the present invention.

Fig. 4 is the system architecture of an embodiment of the invention showing how the various parts of the system interact.

Fig. 5 is a process flowchart of an embodiment of the invention showing the self-study and assessment mode of the system.

Fig. 6 is a process flowchart of an embodiment of the invention showing the test delivery mode of the system.

Other arrangements of the invention are possible and, consequently, the accompanying drawing is not to be understood as superseding the generality of the preceding description of the invention.

PREFERRED EMBODIMENT OF THE INVENTION

Particular embodiments of the present invention will now be described with reference to the accompanying drawings. The terminology used herein is for the purpose of describing particular embodiments only and is not intended to limit the scope of the present invention. Additionally, unless defined otherwise, all technical and scientific terms used herein have the same meanings as commonly understood by one of ordinary skill in the art to which this invention belongs.

Figure 1 illustrates the relationship between a course topic, a concept and performance demand wherein each course topic will consist of several concepts; each concept will consist of one or more performance demand, where a user is expected to apply knowledge of that concept in a variety of contexts. Some performance demands may require rudimentary understanding of the concept while others may require a sophisticated application of knowledge of a concept in complex situations.

Figure 2 further illustrates an example of the relationship between a course topic, a learning outcome (typically provided by examination boards), one or more concepts (typically described by textbook and learning resource providers) and one or more performance demands. Each performance demand is therefore a key assessment beacon, where a test item, taking the form of a question, or any form of assessable task, is set around one or more performance demands in order for a learner or student to be able to demonstrate understanding of the one or more concepts. Each performance demand may comprise one or more peripheral concepts and skills tagged to it.

The relationship between a selected course, concept and performance demand is as follows:

- Each course will consist of several concepts;
- Each concept will have one or more performance demand, where a student is expected to apply knowledge of that concept in a variety of contexts;

- Some performance demands may require rudimentary understanding of the concept while others may require a sophisticated application of knowledge of the concept in complex situations. At the same time, each performance demand may encompass an added dimension of peripheral concepts and skills tagged to it.

Each performance demand is therefore a key assessment beacon, where a test item (which could take the form of a question, or any form of assessable task) is set around the performance demand in order for the learner to be able to show understanding in that particular context (as described by the performance demand).

Figure 3 further illustrates the 3-dimensional facets of performance demand, concept(s) and peripheral concepts present in a test item of the present invention. Each test item is prepared with the aim of assessing a user's understanding by providing clarity to (a) the core concept that a user is expected to know; (b) the peripheral skills that a user needs to possess in order to demonstrate understanding of the core concept; and (c) the context, decisions to be made, answers to be provided that will demonstrate understanding of the core concept. The present invention therefore possesses an advantage over the present state of the art in assessing students where learning outcomes and concepts are stated too broadly for actionable assessment of students' understanding, by identifying gaps in understanding through the use of a rigorous process.

Figure 4 illustrates an embodiment of a system 100 for personalized learning and assessment of a user. The system 100 comprises a multi-faceted, web-deliverable, browser-based system configured to provide personalized learning and assessment of users. The system 100 comprises a user portal 101, a teacher's portal 102, an administration manager 104, a report generator module 105 and a database 103.

The system 100 provides the program 110 through a user portal 101 that is designed to allow users to access the program 100 via a communication device 120 connected to a communication network 140. The program 100 is designed to be platform-independent so that it can be delivered over the internet through any communication device 120. The user creates a user account and accesses the program 110 via the user portal 101 using an identifier such as a user identification and password. Further details of the user portal 101 will be described hereinafter. Every aspect of the user's progress, scores and results are recorded upon completion of the program 110 and these can be stored under the user account for further reference and analysis, thereby allowing the user's progress to be monitored. The user's progress, scores and results can be stored on a database 103 and/or an external database 132. The server makes the user's data available for review by the supervising teacher through the teacher's portal 102. The supervising teacher uses the teacher's portal 102 to regularly check on the usage and progress of each user and to provide helpful guidance and coaching remotely or in-person during sessions. The system 100 comprises a report generator that allows a user or a teacher to access the user's account to generate a report of the user's sessions. Access to the user's account is provided to the teacher via the teacher's portal 102. This allows the teacher to monitor the user's progress and to provide recommendations or to adjust the parameters of the program 110 accordingly.

The communication device 101 can comprise a portable computing device such as a laptop, a mobile phone, or any other appropriate storage and/or communication device 120 to exchange data via a web browser and/or communications network 140. The user portal 101 provides access to users via any communication device 120 located anywhere in the world and allows users to access the program 110. Users can work on the program as frequently as their time and schedule permits. Users can also work under the supervision of a teacher who can also be located remotely and can access the program through the teacher's portal 102. The communication device 101 includes one or more processors (not shown) and memory (not shown) for storing applications, modules and other data. In one embodiment, the memory includes

a large number of memory blocks where calculations may be performed. Memory may be any suitable type of computer readable and programmable memory and is preferably a non-transitory, computer readable storage medium. The communication device also includes one or more display interface for viewing content. The display interface permits a user to interact with the system 100 and its components and functions. This may be facilitated by the inclusion of a user input device which can include a mouse, keyboard, or any other peripheral device that allows a user to interact with the system 101 or the communication device 101. It is to be understood that the components and functions of the system 100 may be represented as one or more discrete systems or workstations, or may be integrated as part of a larger system or workstation.

The processor (not shown) executes instructions contained in programs such as the program 110 within the system 100 stored in the memory of the communication device 101 or external database 132. The processor may provide the central processing unit (CPU) functions of a computing device on one or more integrated circuits. As used herein, the term 'processor' broadly refers to and is not limited to single or multi-core general purpose processor, a special purpose processor, a conventional processor, a graphical processing unit, a digital signal processor (DSP), a plurality of microprocessors, one or more microprocessors in association with a DSP core, a controller, a microcontroller, one or more Application Specific Integrated Circuits (ASICs), one or more Field Programmable Gate Array (FPGA) circuits, any other type of integrated circuit, a system on a chip (SOC), and/or a state machine.

The system 100 is communicably operative via a communications network 140 to a server 130. The server 130 may be owned or operated by a different entity such as a private data service provider or by an intermediary company via the communications network 140. An external database 132 is communicatively coupled to the server 130 and is configured for storing of data such as the system and information pertaining to a user, such information comprising at

least one identifier such as name, address, identity card or passport number, age and gender. Alternatively, a database 103 is also provided within the system 100 and is configured for storing of information pertaining to a user, such information comprising at least one identifier such as name, address, identity card or passport number, age and gender. Information pertaining to the scores and results of the user, analysis of such scores and results are also stored in the database 103 or the external database 132.

As used herein, the communication device 120 may exchange information via any communications network 140, such as a Local Area Network (LAN), a Metropolitan Area Network (MAN), a Wide Area Network (WAN), a proprietary network, and/or Internet Protocol (IP) network such as the Internet, an Intranet or an extranet. Each device, module or component within the system may be connected over a network or may be directly connected. A person skilled in the art will recognize that the terms 'network', 'computer network' and 'online' may be used interchangeably and do not imply a particular network embodiment. In general, any type of network may be used to implement the online or computer networked embodiment of the present invention. The network may be maintained by a server or a combination of servers or the network may be serverless. Additionally, any type of protocol (for example, HTTP, FTP, ICMP, UDP, WAP, SIP, H.323, NDMP, TCP/IP) may be used to communicate across the network. The devices as described herein may communicate via one or more such communication networks.

To access the system, the user opens a standard web browser or one or more software applications downloaded on a communication device 101 connected to the communication network 140 and goes to a predetermined web site containing the system. The user then logs into the system via the user portal 101 using a user identification and password. The user portal 101 allows the user to access the system 100 that is designed to be accessed in a computing device in a school or education centre, or over the internet on any communication device 101 that is connected to the communications network

140. Practically any registered user on any communication device 101 located anywhere in the world can access the user portal 101 and can access the programs 110 as frequently as their time and schedule permits, or under the supervision of a teacher who can also be located either physically or remotely.

Figure 5 shows an exemplary computer-implemented method for automated personalized learning and assessment. Once logged in, the user is presented with a Library access which shows a list of courses that the user can choose to self-study and to undergo home testing. The user is prompted to make a selection 210 from the list of courses and this information is updated in the user interface. The user can also request to download the courses. The course contents can be compressed to save space using file formats such as zip file format. The course contents can then be saved by the user on the one or more software applications or on the database 103 or the external database 132. Upon making a selection from the list of courses, the system is configured to provide recommendations on other pre-requisite courses 220 that the user can sign up based on previous selection by other users. The system is further configured to provide a ranking of such other pre-requisite courses (not shown) to aid the user in his selection of such other pre-requisite courses. Alternatively, part of the implementation of the system involves employing an artificial intelligence chatbot to guide the user in the course selection process where the artificial intelligence chatbot is configured to prompt the user to provide certain details to establish the profile and objectives of the user. In recommending a course or courses to the user, the system utilizes a machine learning module that works together with the database 103 or the external database 132.. The machine learning module utilizes machine learning techniques such as predictive modelling techniques using data received from the database 103 or the external database 132., The machine learning module will implement search techniques using potential combinations of pre-processing steps, modeling algorithms, and post-processing steps based on input variables provided by the user. The search techniques may include an initial evaluation of which search technique is likely to provide suitable solutions for the input

variables provided by the user. In some embodiments, the search technique utilizes consistent comparison of data using consistent metrics, for example, by matching the input variables with data from the database 103 or the external database 132.. In some embodiments, the search technique adapts based on results of prior input variables provided by other users with similar user profiles or characteristics, which can improve the effectiveness of the search techniques over time.

If the user rejects the recommendations on other pre-requisite courses 230 and chooses to continue with the selected course, the system will proceed to run the selected course for the user. Alternatively, the user selects a course from the recommendations on other pre-requisite courses 240 and the system proceeds to download the other course instead. Upon completion of the selected course, the system is configured to complete an assessment 250 to assess the user's understanding of the three aspects of the course – concepts, learning outcome and performance demand considerations. The assessment results identify gaps in the user's understanding of the concepts, learning outcome and performance demand considerations of a selected course. The assessment results are stored in the database 103 or the external database 132 and assessed by the user and teacher.

Based on the assessment results, the system is configured to identify and diagnose the problem areas and learning gaps of the user of the selected course and is configured to refer the user for further coaching by a teacher. The coaching may be one teacher to one user or one teacher to two or more users. The coach will assess effectiveness of the self-study process as described above and proceed to engage in further teaching intervention. Upon the completion of the coaching session, the user proceeds to take a follow-up test on the system to review if he has mastered the learning gaps.

An exemplary assessment test format 300 is illustrated in Fig 6. In one mode of the exemplary assessment test format, the assessment test initiates the assessment at medium level (Level 5) 310 and the questions displayed to the

user are focused on a given micro-concept (as per affordances) but organised and tagged to a performance demand, which is an expression of how this micro-concept is applied in a particular context, as a demonstration of understanding of the micro-concept. If the user does not meet the pre-set pass grade at medium level (Level 5) 310, the system is configured to direct the user to a substantially lower level (Level 2) 330 and prompts the user to answer questions on the concept that are tagged to performance demands of a lower skill level on the concept at a substantially lower level. Should the user fail to meet the pre-set pass grade for the substantially lower level (Level 2) 330, the user system is configured to direct the user to lesson remediation mode (Learn Mode 2) 350 for the user to revise his understanding of the concept or micro-concept based on the performance demands not met. Only learning content that is tied to the performance demands not met is recommended to the user. The system is further configured to provide recommendations on other peripheral concepts or skills that the user is recommended to learn in order to master the concept or micro-concept. Upon the completion of the remediation mode (Learn Mode 2) 350, the user is directed back to the substantially lower level (Level 2) 330 and repeats the step of prompting the user to answer questions on the concept or micro-concept at the substantially lower level (Level 2) 330.

Upon meeting the pre-set pass grade for the substantially lower level (Level 2) 330, the system proceeds to direct the user to the next higher level (Level 3) 340 where the user is prompted to answer questions on the same concept substantially lower level (Level 2) 330 at a substantially higher level. If the user does not meet the pre-set pass grade, the system is configured to prompts the user to answer questions on an unrelated concept at the same higher level (Level 3) 360. Should the user fail to meet the pre-set pass grade for questions on an unrelated concept at the same higher level (Level 3) 360, the user system is configured to direct the user to lesson remediation mode (Learn Mode 2) 370 for the user to revise his understanding of the concept or micro-concept. The system is further configured to provide recommendations on other concepts that the user is recommended to learn in order to master the concept or micro-

concept. Upon the completion of the remediation mode (Learn Mode 2) 370, the user is directed back to the higher level (Level 3) 360 and repeats the step of prompting the user to answer questions on the unrelated concept. Upon meeting the pre-set pass grade for the higher level (Level 3) 360, the system proceeds to direct the user back to the higher level (Level 3) 340 and repeats the step of prompting the user to answer questions on the same concept at higher level (Level 3) 340.

Upon meeting the pre-set pass grade for higher level (Level 3) 340, the system proceeds to direct the user to level 380 where the user is prompted to answer questions on an unrelated concept at the original “stuck” medium level (Level 5). Should the user fail to meet the pre-set pass grade for questions at level 380, the user system is configured to direct the user to lesson remediation mode (Learn Mode 2) 390 for the user to revise his understanding of the concept. The system is further configured to provide recommendations on other concepts that the user is recommended to learn in order to master the concept at this level. Upon the completion of the remediation mode (Learn Mode 2) 390, the user is directed back to level 380 and repeats the step of prompting the user to answer questions on the unrelated concept. Upon meeting the pre-set pass grade for level 380, the system proceeds to direct the user back to the initial medium level (Level 5) 310.

If the user successfully answers the questions and achieves a pre-set pass grade at medium level (Level 5) 310, the user is prompted to a harder level (Level 8) 320 comprising questions on the same micro-concept but of a higher level of difficulty. Similarly, If the user successfully answers the questions and achieves a pre-set pass grade at harder level (Level 8) 320, the user is prompted to a harder level (Level 11) comprising questions on the same micro-concept but of a higher level of difficulty.

The system thus provides a diagnostics map and a personalized set of learning resource assigned to the user. Based on the assessment results which is retrievable by the user or teacher, a teacher is able to perform gaps analysis

on the user's understanding of a concept or micro-concept and the teacher can focus on those identified learning gaps via:-

1. Facilitating the user's exploration of the resources assigned;
2. Discussing important clarifying questions (also posed in the learning resources);
3. Clarifying any doubts the user has. A key advantage of the present invention is that the system is configured to handle different students with different needs, each exploring a different set of learning content, with the teacher giving 1-1 or 1-many facilitation.

The system is further configured to collect and collate data related to users to aid coaching and decision-making by teachers, coaches, schools and policy makers such as the Ministry of Education. The data is collected and collated from the database 170, or one or more of the internal databases and can be stored in an internal or external database to the system. A data analytics module is configured to retrieve data from one or more of these databases, to analyse the data and to present the processed data in the form of a graphical user interface or a dashboard for easy reference. A report generation module further allows users to generate customized reports containing the assessment results and learning gaps of each user which will aid coaching and decision-making by teachers, coaches, schools and policy makers.

The above is a description of one embodiment of a system and method for providing automated personalized learning and assessment. It is envisioned that those skilled in the art can and will design an alternative embodiment of this invention that falls within the scope of the invention. In particular, it is to be appreciated that features from various embodiment(s) may be combined to form one or more additional embodiments.