

## **BUILDING INTELLIGENT TUTORING SYSTEMS TO FOSTER THE CAPACITY OF TEACHERS IN VIETNAM**

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### **Abstract**

The 4.0 technology revolution has brought many opportunities as well as challenges to the educational development of many countries around the world. One of the opportunities and challenges is the development of a variety of teaching methods, with many software to support learning activities being applied in many educational institutions to meet lifelong learning learners' requirements. The paper analyzes the intelligent learning support system (Intelligent Tutoring System - ITS) being applied in many educational institutions around the world, from which, proposes some orientations for building ITS in order to improve capacity for teachers in Vietnam.

**Keywords:** Intelligent Tutoring Systems, Learning Support, Software, Self-Study, Education in Viet Nam

### **1. INTRODUCTION**

In the context that the 4.0 Technology Revolution is changing the education system of each country day by day, the participation of computer software is becoming more and more popular. In particular, for the training of teachers - adults involved in learning have specific characteristics, computer software to support learning activities plays an even more important role. Intelligent Tutoring System (ITS) is a computer program (application software) used by many universities and high schools around the world in the form of online and offline teaching.

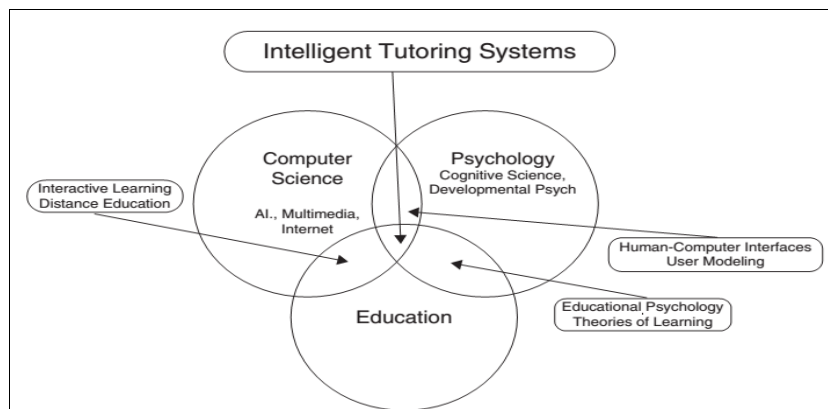
The use of ITS as an adaptive learning tool is increasing significantly across different educational domains (e.g., math, physics, biology, medicine, reading comprehension, languages, programming, database) and for all students, from elementary to university level. According to Chughtai, Zhang and Craig (2015), ITS provides learning instruction tailored to the needs of each learner [7]. Besides, Van Lehn (2011) in his research has shown that: ITS is designed with the ability and effectiveness as an assistant teacher [4]. According to Rivers (2017), ITS can provide personalized feedback to learners automatically [3]. With its advantages, the construction of an ITS in the training of teachers in Vietnam is a practical and effective matter.

### **2. SOME ITS MODELS ARE APPLYING IN THE WORLD TODAY**

Currently, three basic models are being deployed in the world education system as follows:

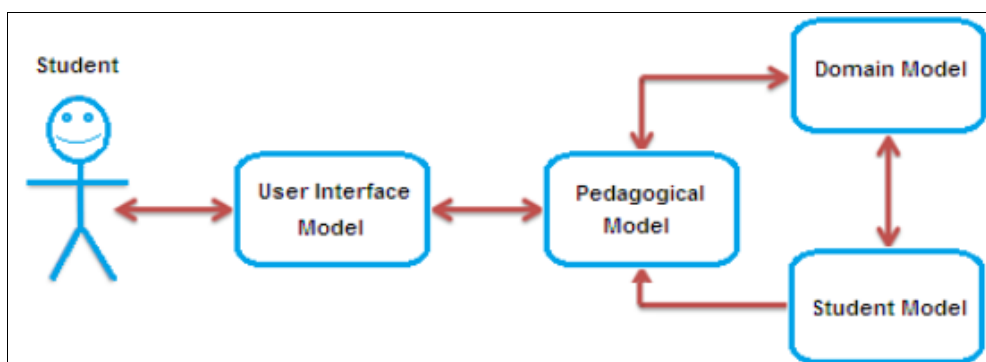
According to Park (2008) [10], ITS is based on three areas: Computer Science, Psychology and Education, as illustrated in Fig 1, where: 1) Computer Science has a very important role in building software and determining the hardware needed to assist learners; 2) Psychology (Cognitive Science) helps to analyze learners' behavior and understand their learning and how

to properly motivate them, and 3) The educational component selects teaching strategies suitable for learners and applies theories of the teaching and learning process.



**Fig 1. ITS Model of Park [9]**

According to Maria and Chen (2015), ITS is a computer system that provides instant and customized instruction or feedback to learners. The classical architecture of ITS consists of four components as shown in Fig 2.



**Fig 2. ITS Model of Maria and Chen [5]**

A domain model that stores the learning content taught to learners includes: The learner interface is a source of comprehensive information about the learner; The support interface, representing teaching strategies that give suggestions when learners have difficulty grasping the correct answer The moderator interface presents methods of interaction between learners and ITS.

Currently, this classical view of ITS is still appreciated by the ITS research community. However, according to Soares and Jorge (2013) [9], recent studies on the stress function on the structure have described the ITS as having 02 main loops: 1) the inner loop and 2) the outer loop (Fig 3). The main task of the outer loop is to evaluate the learner's ability and register it in the learner model. Using the information obtained about the learners, the outer loop performs a task selection.

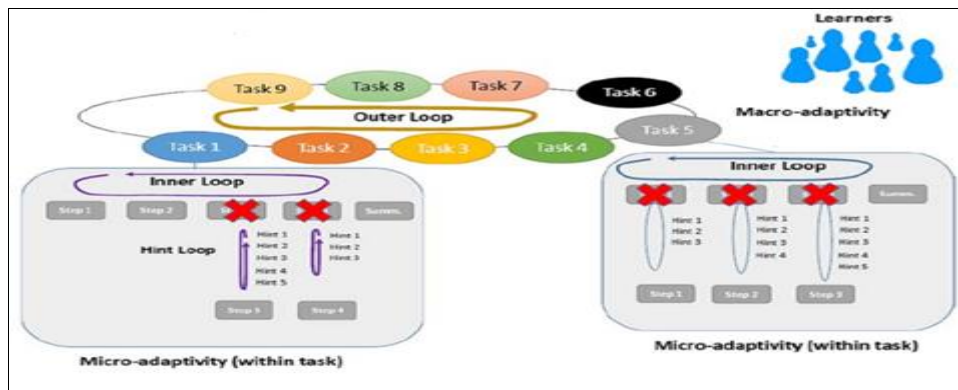


Fig 3. ITS Model of Soares and Jorge [9]

### 3. STRENGTHS OF ITS IN ORGANIZATION OF TRAINING ACTIVITIES

In addition to the strengths of other computer-aided learning software, ITS has outstanding strengths including:

Automatically generate hints for learners: According to Alex et al (2013), ASK-ELLE is an ITS developed to support learners. In this system, teachers or experts designate sample problem-solving strategies, and ASK-ELLE uses this model case to provide step-by-step interactive feedback to learners as they solve their own problems. The main point of this system is to support learners to solve situations based on reference solutions, reference solutions added by teachers, and learners themselves [1].

However, due to different experiences and capacities, people can come up with different ways of dealing with situations. As noted by Irfan and Gudivada (2016), this is an expensive and time-consuming problem, because even in very simple situations there are infinitely many different solutions. Even if we restrict the semantic aspect (i.e. the underlying algorithm or method) to a single aspect, the syntactic variations of the keywords are not easy to generate for learners. For such situations, ITS is data-driven to collect implicit data (source code) given by learners or teachers [6].

According to Rivers and Koedinger (2015), data-driven ITS is a subfield of ITS in which decision making is based on the activities of previous learners rather than a knowledge base built by experts or teachers. Problem-solving strategies that have been working with learners in the past can be used to provide feedback and suggestions to learners in the present, which reduces the need to create a problem-solving approach. Subject according to the standard framework. A data-driven, learner support system can be initiated by experts providing missing data. The data-driven approach has been shown to work well when combined with artificial intelligence and techniques to learn a standard model by demonstration [2].

Automatically build learning resources: For a long time, the development of teaching software has had certain barriers, which is the lack of learning resources. Therefore, digitization and research towards open data will be of great importance. It is developing rapidly in all respects

and dramatically changing the way research is conducted in intelligent education and intelligent e-learning. The growing amount of data that can be collected from different learning environments, as well as devices, offers many opportunities to rethink educational practice and provide innovative approaches for learning and teaching. This kind of data helps investigate new insights into learning, informs individual and group-based learning processes, and contributes to a new type of data-driven education for the twenty-first century.

Firstly, the time spent on fostering activities to improve their capacity is not much and not fixed. Therefore, the form of online learning with the support of ITS computer software still exploits the strength of the centralized form of training with instructors, and at the same time exploits the strength of the online form of training through usually time flexibility.

Secondly, they have knowledge and work experience. They often associate known experience with new knowledge. They learn through the activities of themselves and their peers. Their knowledge is unequal in both theory and practice. Therefore, personalization in the learning process is an advantage of ITS in capacity building activities for teachers.

Thirdly, the teaching staff has the advantage of well-developed thinking but limited memory. Giving them learning tasks that require thinking helps them to absorb knowledge better than giving lectures that force them to memorize. Therefore, their learning resources require rich, practical. ITS addresses this requirement better than pre-built, fixed learning resource-based support software.

Finally, compared to the workforce of other professions, the teaching staff has certain time limits, even after returning home from work, there will and energy still remains. For teachers' work such as preparing lesson plans, preparing teaching materials, marking students' tests... the opportunity to access new knowledge is limited... so ITS will be an effective tool to help they can self-improve their capacity.

#### **4. BUILDING ITS IN CAPACITY BUILDING ACTIVITIES FOR TEACHERS IN VIETNAM**

Stemming from the advantages of ITS and the learning characteristics of teachers in Vietnam as analyzed above, we propose to build ITS in capacity building activities for teachers in Vietnam as follows: The following: Basically a combination of Park's model and Soares and Jorge's model, including the following elements: 1) The identification of training objectives is done in an open direction. ITS offers available goals, learners choose themselves. At the same time, there are empty boxes for learners to define their own personal goals; 2) for each goal, there are corresponding training contents to help learners achieve the identified goals. Based on the personal information provided by the learners, ITS will develop a training plan that best suits the characteristics of the learners. Learners themselves can edit this training plan to be more suitable.

The training content will be built on three approaches:

Firstly, experiential learning. Experiential learning aims to create an environment or context where learners can learn by experience. The challenge is to create a real-world setting or environment when we are in a classroom or virtual room, using video conferencing software like Zoom or Skype. The answer is to create exercises and/or tell stories to visualize and ask learners to perceive and focus on what they “feel” as they go through the exercise. During the exercise or while visualizing the story, the instructor guides the learners and helps them to recognize, record, and understand what they are feeling and thinking about that particular situation. In addition to recognizing and understanding “why”. The key to success is that instructors create their curriculum based on assignments, facilitating a series of exercises that build on previous assignments. Recommended exercises are ten minutes long for reflection at the end of the exercise. The primary goal of reflection time is for the instructor to ensure that learners experience what is expected of the assignment so that they have a building base for the assignments to come. Another important reason to reflect is to build the habit of conducting flashbacks at a regular rhythm.

Upon completion of the course, the learner's experience must be representative of real-world experience. The instructor's goal is to provide the learner with a memorable or impactful experience. When learners are in a similar real-life situation, they will instinctively react in real time based on classroom experiences.

Secondly, teaching is evidence-based. An evidence-based teaching model is used to ensure the social cognitive development of learners as well as their knowledge is enhanced. ITS collects relevant evidence to be presented and discussed in each class. The evidence must be supported by factual facts, the arguments of verified scholars. It will have a significantly higher impact on learner learning and be relevant to the content you are providing. After the ITS provides the content and provides relevant evidence, the ITS checks the learner's understanding before moving on to the next part of the lesson. Techniques such as random sampling and explaining, sharing with class members helps learners check their understanding. Finally, learners need to summarize the content visually with the help of memory maps, flow charts, and Venn diagrams. A summary should include what they have learned and to understand the interrelationships between the many aspects of what ITS has supported them.

Thirdly, reverse learning. The flipped learning method requires learners to participate in research, develop materials before or after the class, through individual learning. This can be done, for example, by reading or viewing online material from instructors or other valuable sources. The concept of classroom inversion and learning style shifts the classroom from passive to active learning. By applying and exploring content, learners find meaning and transform mere information into practical knowledge that is personally relevant to them.

Fourthly, Build open libraries. Introduce the necessary references; an open repository that allows quickly links to other documents/websites quickly. The library includes the following directories: Text: Introduction of regulatory documents of the industry on fostering work for

teachers. Videos and illustrations: Includes videos shot during intensive training or videos illustrating examples in practice.

Fifthly, Feedback/comment box: This is the preeminent of applying information technology in activities for teachers. The mailbox will create a regular interaction environment between teachers and learners, between learners and each other. The recommended source code is NUKEVIET CMS. This is open source (Open Source) completely free and non-piracy software under the license of the open source community. Thus, significantly reducing website copyright costs. Learners will leave comments, opinions, questions, sharing during the training process during and after logging into the website through forums with fixed or open topics. These exchange comments are meaningful to help teachers get back information from colleagues and trainers about the content of the program and the form of presentation to make timely adjustments when necessary. Through the discussion forum, learners will be encouraged to exchange and ask questions about the problems posed in practice; On the other hand, the forum is also a place to share insights and personal views on events and phenomena related to the topic. The discussion, question and answer on the forum has advantages, meeting the learning needs of the majority. In addition, discussion via forums has the advantage of not being limited by time and space like face-to-face exchanges.

Sixthly, a system of exercises to test and evaluate learners through an online form. Students can self-test, assess their ability through theoretical questions and solve real-life situations. Tests can follow each module or during each phase of the refresh process. Test and assessment results help learners self-adjust their learning goals and content. At the same time, managers are also based on that to perfect the training program, according to the needs and abilities of learners.

## 5. CONCLUSION

ITS is a learning support system with two main advantages: Automatically suggesting learners towards personalization; automatically build learning resources from experts, teachers and learners themselves. The advantages of ITS are very suitable for capacity building activities for teachers in Vietnam. Based on basic ITS models currently being used in educational institutions around the world, the article builds on ITS applied to capacity building activities for teachers in Vietnam in order to meet the needs of teachers. This is a demand for education reform in Vietnam in the current context.

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