Development of learning Style Agent for Intelligent Tutoring System

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Abstract

Despite the spread of smart learning systems in the field of training and education around the world, there are many great challenges in making these systems more effective, to provide an intelligent educational system in line with the standards of modern education. So there is a need to study the impact of the dissemination of smart learning methodology in the Libyan context.

This study aimed to develop an intelligent learning system to assist trainees in QACC (Quality Assurance Certification Center) according to Fleming's VAK Model (Visual , Auditory, and Kinesthetic),in the training course using Intelligent Learning System, from which these systems derive from the application of artificial intelligence techniques to educational systems, programs designed to simulate the behavior of trainees and the preferred learning method, they are able to explain the trainees' behavior and preferred learning style so that the system can capture patterns Learning and cognitive skills of trainees, and able to interpret the responses of complex trainees.

The main purpose is to compare the effects of two different methods of training (VAK training, traditional classroom training) on trainees' achievement.

The study was conducted on a sample of 46 trainees, divided into two groups. The first group contains (23) trainees in the maintenance course using the traditional learning method. The second group contains (23) trainees who use intelligent learning technique and do the questionnaire before the trial begins. The results of the study showed that the intelligent learning group's the academic achievement that use the VAK model is higher than the traditional learning group, and noted that the results also indicated that there are statistical differences ($\alpha \leq 0.05$) for the learning types of trainees at QACC in both (VAK, traditional training).

Keywords ITS, Maintenance, Training, Fleming VAK Learning Style.

1.INTRODUCTION

According to previous studies, the focus should not only be on technology, but on the structure of the education process in a way that is in line with the age. Smart learning systems have provided various unexpected methods of learning so that different learning methods can be used to support students and trainees by introducing a private tutoring system to enable students and trainees to learn in different ways. The intelligent tutoring System(ITS) is defined as a system capable of simulating the training of trainees in all aspects, related to the support of trainees as they gain knowledge [1][2].

People have different learning styles and cognitive skills, which may affect the learning contents provided by the system. Any e-learning system should provide a simulated environment so that the trainee can learn as much as possible. The system must be able to capture the learning patterns, cognitive skills of learners to provide a system of personal adjustment lessons. With this system, subjects are taught to students, are presented in audio, visual, and written form [3].

According to the researchers; ITS provides more effective results than traditional classroom instruction. Karaci, Akyuz, Bilgici and Arici (2018) conducted a study to investigate effects of Intelligent Tutoring Systems on academic achievement and retention. As a result of their implementation, they found that the academic achievement'sintelligent tutoring System had higher than the group students who did not use this system [4].

In this study, will discuss how to use smart learning based training using the QACC model to conduct the students. The implementation of a pilot project to develop excellence is a training course using the VAK method and then analyzing the results of the study as well as comparing the results of the intelligent learning method with the traditional learning method.

2.PROBLEM STATEMENT

For classroom based learning tutor can easily identify their student preference ,therefore tutor can adapt learning material in different context ,by providing different type of resources such as graphics and figures , case study , brainstorming ,group activity, peer discussion ,to ensure learner understand the lesson well.

For intelligent tutoring system, it is critical issue to identify learning style of individual learner and adapt or personalize learning content to fit with each learner preference [5]. There is a need to introduce an agent, which can identify learning style and enable intelligent tutoring system to adapt content to meet learner preference, which leads to learner progress.

3.THE OBJECTIVES OF THIS STUDY ARE:

1. Identify a system to determine the trainee's Preference to adapt the educational materials in a different context for raise the educational level and knowledge of the trainee.
2. Assign an educational content to suit each trainee and improve methods of academic learning to the learner.
3. Proposing and developing a system (factor) that can determine the learning method of the learner based on the VAK learning method.
4. Comparison between traditional learning method and smart learning method.

4. Questions and hypotheses study

A. The study tries to identify answers to some questions:

1. Is there an effective impact of smart learning style on the trainee's academic achievement level in the maintenance course?

2. How does the average scores of trainees between the smart learning group and the traditional learning group in the final achievement test?
3. Are there statistically significant differences between the average scores of trainees who received training in traditional classroom and trainees who received training in intelligent learning according to the VAK model (visual, audio, kinetic)?

B. Study hypotheses

There are statistically significant differences at the mean level ($\alpha \leq 0.05$) between the average scores of the two groups (the group taught using intelligent learning method and the other taught usingthe traditional method).

C. Study Sample

The study limited to a group of trainees in the Quality Assurance and Professional Calibration Center in a training maintenance course, consisting of 46 trainees, 23 trainees for the training group using smart learning method, and 23 trainees for the learning group in the traditional way.

D. Aimed Study

The study aimed to measure the impact of intelligent learning using VAK model method in developing the learning skills of the trainees in a maintenance course.

E. Study variables

The independent variable to identify the style of the trainee using the VAK model for the experimental group (smart learning) to produce the proposed solution.The dependent variables represent the trainees' grades for the group:

- Classes are using intelligent learning style (VAK Method).
- Classes are using traditional learning style.

5. LITERATURE REVIEW

A. Intelligent Tutoring System

An intelligent tutoring system is defined as any system which is capable of emulating an instructor's behavior in all aspects relating to supporting students as they acquire knowledge [6, 8]. The teacher is not present and it is the system itself, which guides the student as they learn different concepts.

One of the objectives of intelligent tutoring systems is to adapt hypermedia courses to each individual user by means of [7]: control of the learning level, control of course navigation, adaptation to available information, adaptation of the teaching methodology, explanation of errors, replies to the student's questions, advice, etc.

In other words, the intelligent tutoring system is a model, which enables a student to be evaluated and taught a subject and also for the education to be adapted to the student's performance.

B. Intelligent Tutoring System Components

There is widespread agreement within the ITS community that an ITSconsists of four "expert" modules as shown in Figure 1, [9].

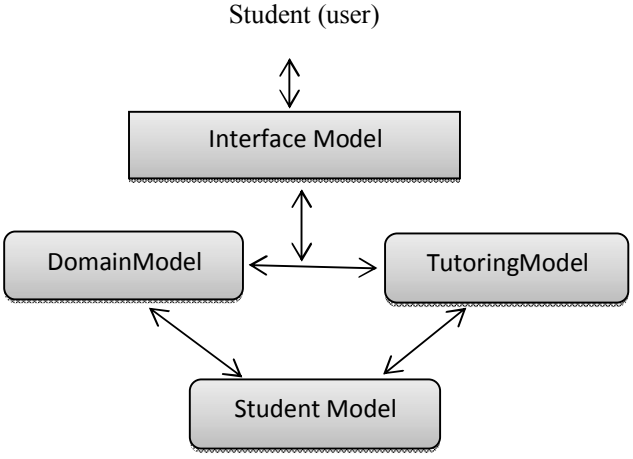

Figure 1: Component of ITS

Interface Model: The model concerned with the representation of the user (user model) and representation of the application (domain model).The main aim of the model is capturing the appropriate raw data of the learner and representing the interface.

Domain Model: which also known as expert model, it stores information about the material being taught. This model contains concepts and relationship between concepts, solutions for the question, lessons and tutorials, and problem solving strategies of the domain. It stands as a backbone of the content of the system.

Student Model- It represents Domain dependent and independent characteristics of each individual user. These characteristics are acquired from user explicit responses, analysis from the interaction data, through assessments etc. It consider as a core component of the ITS system.

Tutoring Model: The teacher model accepts information from field and student models and makes choices about teaching strategies and procedures. At any stage of the problem-solving process, the learner may ask for guidance on what to do next, for his or her current location on the form. In addition, the system recognizes the time of the learner's deviation from the model's production rules and provides timely feedback to the learner, resulting in a shorter period to reach efficiency with targeted skills [10].

6. ADVANTAGES of LEARNING PATTERNS

1. Learning patterns theory states that the amount of learning a person learns depends on the fact that learning experiences are directed more towards his learning style than on the individual's intelligence.
2. Knowledge of learning patterns helps the teacher to prepare classroom situations so that they are meaningful andeffective for students.

3. Knowing the patterns of student learning helps the teacher to choose the appropriate educational learning strategiesthat achieve the objectives of learning effectively.
4. Learning is more successful when the educational method in which the educational task is presented is consistent with the style and pattern of the student's learning.

7. LEARNNING STYLE THEORY

A. Kolb Learning Style

This learning style theory proposed by Kolb (1985) [11] is based on the Experiential Learning Theory and the main styles proposed in this model are as follows:

- The converging learner style (abstract, active).This type includes the learner being good at problem solving and taking decisions. They prefer to deal with technical rather than interpersonal issues.
- The diverging learner style (concrete, reflective). This type includes being imaginative and aware of meanings and values and views concrete situations from many perspectives.
- The assimilating learner style (abstract, reflective). This type prefers abstract conceptualization and reflective observation. They are concerned with ideas and abstract concepts rather than with people.
- The accommodating learner style (concrete, active). This type likes doing things, carries out plans and gets involved in new experiences. They are good at adapting to change and are at ease with people but can seem impatient.

B. Felder and Silverman index of learning styles

The Felder-Silverman (FS) learning styles model (Felder and Silverman, 1988) was developed to describe the learning styles in engineering education and suggest different teaching styles to address learners‟ needs. The FS model defined five dimensions of preferred

learning style: perception (sensory-intuitive), input (visual auditory), organization (inductive-deductive), processing (active-reflective) and understanding (sequential-global).

C. Honey and Mumford's learning style model

A learning style model developed by (Honey and Mumford in 1982) is based on Kolb's work but is somewhat different. It includes four key stages of learning styles:

- Activists enjoy new ideas and tasks and like to be very active in the learning process. Activists learn best when they are involved in new experiences, problems and opportunities. They like to work in groups, work with tasks [12].
- Reflectors are more drawn back than the activist. They prefer standing aside and think what is happening. They learn best by observing someone else, collecting information about it and going through what was learned. They like to produce analyses and reports.
- Theorists prefer analytical and rational thinking over subjectivity and emotions.
- They like complex problems where they can use their skills and knowledge.

D. Anthony Gregorc's model

Anthony Gregorc and Kathleen Butler organized a model describing different learning styles rooted in the way individuals acquire and process information differently. This model posits that an individual's perceptual abilities are the foundation of his or her specific learning strengths, or learning styles [13].

In this model, there are two perceptual qualities: concrete and abstract, and two ordering abilities: random and sequential. Concrete perceptions involve registering information through the five senses, while abstract perceptions involve the understanding of ideas, qualities, and concepts, which cannot be seen. In regard to the two ordering

abilities, sequential ordering involves the organization of information in a linear. The model posits that both of the perceptual qualities and both of the ordering abilities are present in each individual, but some qualities and ordering abilities are more dominant within certain individuals [13].

8. FLEMING VAK LEARNING STYLE MODLE

The VAK model is one of the most popular models used to identify learning styles due to its simplicity. Some however would define the VAK model as a learning preference rather than a style. VAK identifies that learner's process information using the three main sensory receivers:

- Visual
- Auditory
- Kinesthetic

Why VAK learning style Questionnaire?

There are many different learning style methodology have been used but according to the evaluation was conducted by Sampson and Karagianidis[14].The result of evaluation concluded that Fleming's VAK would be a suitable learning style to incorporate within a model offering Personalization and adaptability to the learner. The main reasons for this choice are that the VAK learning style offers a concise questionnaire for a learner to complete comprising of a minimum number of relevant questions and that the learning style categories map clearly to learning object file types[13]. This mapping is in contrast to other learning styles, for example the approach taken by Dunn and Dunn in which the mapping will be more complex.

The research within this paper therefore has selected VAK the type of learning style to be used for the proposed system (Agent), as defined in the hypothesis. Mechanism can be developed to personalize learning materials to an individual learner according to their learning style.

9. THE STUDY PROCEDURES

A. The first procedure

We will use Fleming's VAK questionnaire to produce proposed solution that simulate style preference agent, VAK questionnaire consist of 30 questions with 3 choice for each (A or B or C), and based on learner'sanswers, we will know his/her learner style. Flowchart of proposed solution is shown in figure 2.If answer of any question is A,it means his/her learning style is Visual, or if answer is B, it means is of Kinesthetic or ifanswer is C it means is auditory. After answering of each question we add one to counters (suma or sumb or sumc). Finally we compare summation of all answers, so if suma is greater than sumb and sumc then the learning style is Visual or if sumb is greater than suma and sumc then learning style is kinesthetic, or if sumc is greater than sumb and suma then the learning style is auditory.

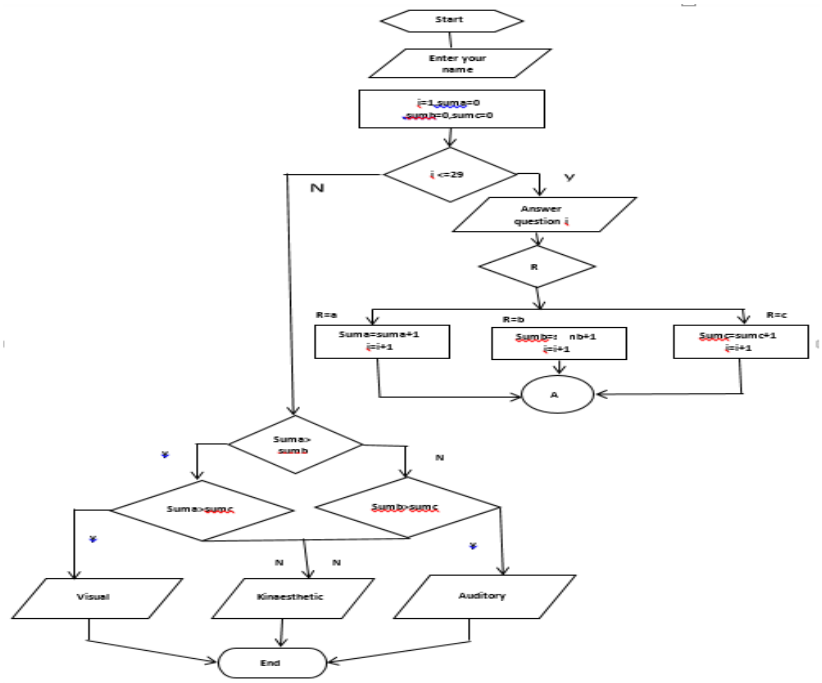

Figure 2: Flowchart of proposed solution

Table 1: used variable

Symbol	Mean
I	Counter
suma	Sum of visual
sumb	Sum of Auditory
sumc	Sum of Kinaesthetic

Based on the learner's answers, Sample group 23 trainees Approximately 9 trainees (39%) are visual methods of learning, about 4 trainees (17%) were audio learning methods, and about 10 trainees (44%) is a kinesthetic learning method as shown in Figure 3.

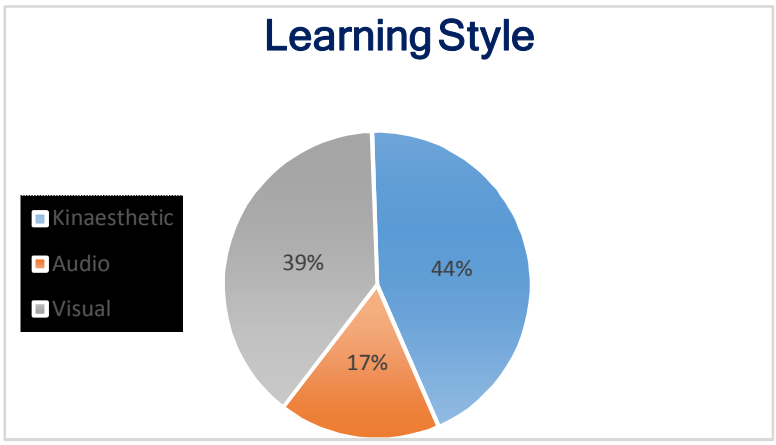

Figure 3: illustrates the distribution of learning styles to the group of trainees in a smart learning way

B. The second procedure

After completion of the training course for both groups, we compared of test results for both groups (Smart Learning Group and Traditional Learning Group) using the SPSS program and using the independent T.test statistical test to find differences of average grades for the two groups. To test the NULL hypothesis of whether there were statistically significant differences between the two samples

10.TEST RESULTS and DISCUSSION

The hypothesis stated that there are no statistically significant differences at($\alpha \leq 0.05$) between the intelligent learning group and the traditional learning group.

To answer this hypothesis, SPSS has been used to find the mathematical averages and standard deviations for trainees score of both groups by figure 4 and by using T.test test to compare the average performance of the two groups to determine if there are Statistically significant differences between the performance of a group of intelligent learning and traditional learning group were the results of the two groups as shown in table 2.

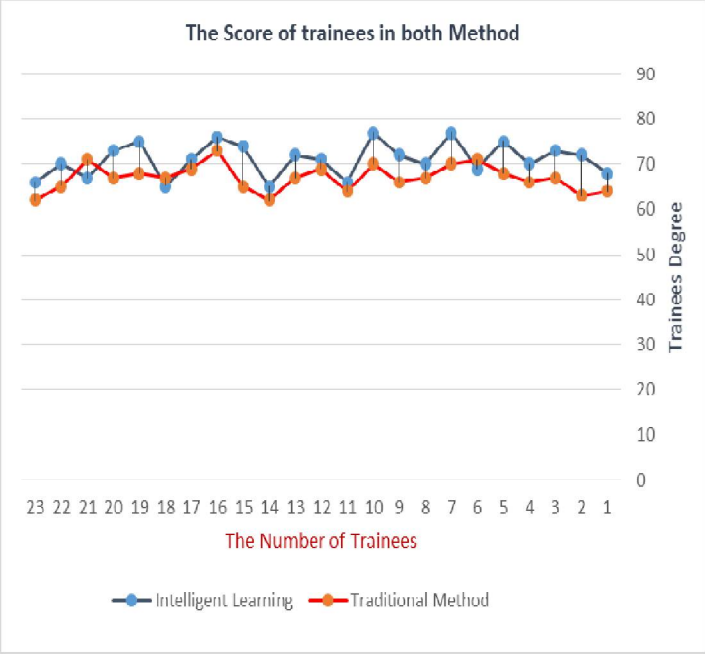

Figure 4: shows the distribution of trainees' scores for both groups

Table 2: The average score of the trainees

Group	Sample Size	Arithmetic Mean	Standard Deviation	Value T	Significance Level
Intelligent learning style	23	71.96	5.56	2.79	0.0423
Traditional learning style	23	68.04	7.04		

Table 2 shows that the average score of the trainees who studied using the intelligent learning style was higher than the average score of the trainees who have studied using the traditional method, where the arithmetic average of the smart learning group was (71.96) and the standard deviation (5.56). The arithmetic average of the traditional learning group was (68.04) and the standard deviation (7.04).This confirms that there is a difference in achievement between the two groups.

To find out whether there are statistically significant differences at the level of($\alpha \leq 0.05$) we conducted T.test. We found that there were statistically significant differences at the level of the dialysis ($\alpha \leq 0.05$) with (T) calculated (2.79) at a level indication (0.0423), which is a non-statistical function at the level of the dialect($\alpha \leq 0.05$). Therefore, the null hypothesis is rejected (there are no statisticallysignificant differences at level ($\alpha \leq 0.05$) between the average trainees of the two groups). This indicates the effectiveness of using the method and technique of intelligent learning.

The results also showed a significant effect in developing the skills of the trainees learning for intelligent learning group using VAK method

and this result is consistent with many previous studies that refer to the use of technology and modern techniques in achieving the best ways of learning among trainees, This is due to the fact that the method of intelligent learning develops the trainee's ability and contributes to the development of the trainee behaviorally and cognitively and provides him with the capabilities to enable him to absorb the data of the modern area, It also helps trainees to prefer the type of learning and encourage them to study the appropriate with each trainee by learning the pattern of each trainee as appose to other learning methods.

11.RECOMMENDATIONS

After reviewing the results of the study, we can come up with a set of suggestions and recommendations that can be performed as follows:

1. Urge officials to benefit from the positive effect of using intelligent learning system and methods.
2. Educating students and trainees about the importance of smart learning system through holding seminars and conferences.
3. Conducting new studies in the impact of using intelligent learning style and involving various topics and different classes' level.
4. Organizing information and educational programs to facilitate knowledge transfer.
5. Change traditional ways of communicating information, so that the learner can better understand the content and maximize knowledge retention.
6. Training trainees on how to use modern methods related to training methods using intelligent learning system.
7. To use Audio, Visual, and Kinesthetic aids that allows the trainee to develop his abilities according to his preferred learning methods.
8. Updating and developing teaching methods to follow the latest scientific trends of trainees.

12.CONCLUSION

The purpose of this study is to identify the impact of using intelligent learning VAK method on the trainees and compare it with traditional classroom training method used in the QAAC courses (in Libya), and to improve the learning process through specializing a learning environment using the smart system based on the basis of identifying the patterns of trainees with the VAK styleBoth groups were significantly improved in learning and improvement in average scores and final achievement tests.

Using the T.test statistical test, we found that there are statistically significant differences in the educational attainment of trainees between the two learning groups.

The results indicated, "The trainees in the VAK group were better than trainees who are in the traditional classroom".

This study concluded that the implementation of training using intelligent learning method develops ability of the trainee and contributes to developing cognitively and behaviorally and enabling him to absorb the data of the modern area.

However, to achieve maximum benefits from smart learning method is to be executed at several different courses, we also need further research for other groups of trainees took the larger in size, and both sexes and on different study levels.

More research should be devoted to ensuring that the most benefits of smart learning applications are gained if training centers and universities can make full use of them.

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