

# INTELLIGENT PERSONALIZED SYSTEM FOR ENHANCING THE QUALITY OF LEARNING

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## ABSTRACT

This study proposes an approach for students' learning style personalization. The study presents both the importance and the theoretical basis of learning styles. One of these perspectives is how self-reported learning style inventories are controversial, while others view learning styles as strategies that can be adjusted to specific tasks and conditions. To determine the efficacy of the proposed approach, an experiment has been applied and a set of Canadian Institute College students have been examined. This study concludes that we need to offer alternative ways to connect various learning styles when teaching the university students which would enable the teaching process to use different learning approaches and activities which would lead eventually to enhancing the learning process.

**Keywords:** *Personalization; Correlations; Learning Style Detection*

## 1. INTRODUCTION

Globalization and immediate access to products, services, have changed the way businesses are conducted [1]. Considering new approaches for learning is one of the main aims that should be focused on [2]. There are different variables that should be considered while discussing the learning outcomes which consequently affect the learning process [3].

The different learning styles theories consider the differences among the students (Idrees & Ibrahim, 2018), in how much knowledge students absorb and how fast they are without counting on the students' abilities [4] [5]. The best methods that enable students to learn are through listening, reading, doing, moving, or by a hands-on environment. Some tasks may seem easier for one student than another because the task styles could be better suited to one student's cognitive style. As a result, it is crucial to consider the learning styles of the students when delivering any learning process (Khedr & Idrees, 2017).

This study highlights the positive impact in personalizing the learning styles. The remaining of this research discusses a background of the topic in section II, previous work criticism is highlighted in section III, a focus on the research scope is presented in section IV, the proposed system is then discussed in details in section V with the experimental study in section V while the main contribution is discussed in section VI, and finally the conclusion and future work is presented in section VII.

## 2. BACKGROUND

Learning styles research has started in the 19<sup>th</sup> century. It has been documented that students have various learning styles (Khedr & Idrees, 2017). Most of the researches were focusing on the relationship between oral or visual teaching methods and the students' memory. There were contradicting results, which were likely because of the learning material, tests or the populations [4]. Lately, researchers realized that persons had dissimilar techniques of processing the information are different [6] (Khedr, Abdel-Fattah, & Nagm-Aldeen, 2015). These differences determine the students' way of thinking, remembering, noticing and solving any problem.

This kind of research helped determining the abilities specially the students' abilities to coordinate the instruction with the style of students [7]. Other research also found that there are not only the cognitive styles but also there are physiological features. A lot of researchers have endeavored to recognize and separate the students' characteristics in each of these areas to be able to illustrate the solely learning processes [8].

Many approaches are presented for extracting knowledge (Othman, Hassan, Moawad, & Idrees, 2018), however, learning styles approaches have produced measurement tools which can be appropriate to classify students and readjust them with approaches that are suitable to their styles of learning. The learning styles research of the college students in different majors has been investigated by many researchers; (Khedr A. E., 2012) declared that there are substantial differences among the students registered in the different majors in the academic settings levels; (Khedr & Borgman, 2006) who tested the learning styles in the field of business found out that accounting and economics/finance majors are different from those whose majors are in marketing and management.; [9] points out that the college students' progress can be enhanced by tutoring a way that matched the students' learning styles.

**3. CLASSIFYING THE LEARNING STYLES**

The investigation of learning styles can be grouped into two models. Cognitive models which underscore on the contrasts between how students process; encode; and recover data in the mind, and the psychosocial models which depend on identity preferences and the relation between the teacher and student [10].

**A. Multiple Intelligence Theory [11]**

Howard Gardener's [11] [12] theory of multiple intelligences is a cognitive model which explains that each learner can process information in eight independent processes. As indicated by this theory, all students deal with the eight perceptions that are shown in fig. 1, however students have their sole arrangement of created scholarly qualities and shortcomings that allude to the profiles of the general intelligence of students. Therefore, the individual contrasts in the learning process are because of the varieties in the particular profiles of the intelligence, which decide how simple or troublesome it is to take in the data when it is especially exhibited. Utilizing various instructing and student appraisal methodologies stimulates a wide grouping of intelligences expected to exchange and apply what

they realize in the classroom to new circumstances. Application-based instructing energizes students about learning and enables the teacher to strengthen [13] a similar material in an assortment of ways.

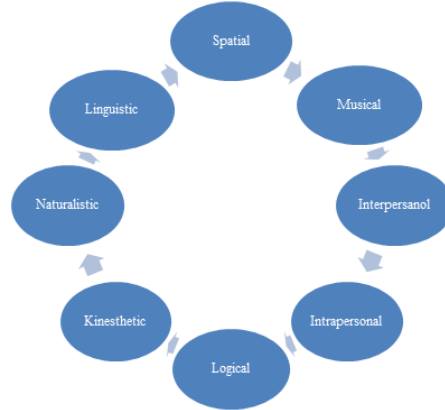


Fig. 1. Multiple Intelligences Learning Style [11]

**B. Kolbs Learning Styles [8]**

In [8], the theory of experiential learning gives four particular learning styles in light of the distinctions in seeing and preparing learning encounters that change, refine, and include to the students' past information base. Starting examination depended on the perception of distress experienced by numerous students whose learning styles appeared to be bungled to their disciplinary majors. The four learning styles are schematically characterized as quadrants that are isolated by vertical and horizontal level as appeared in Fig. 2.

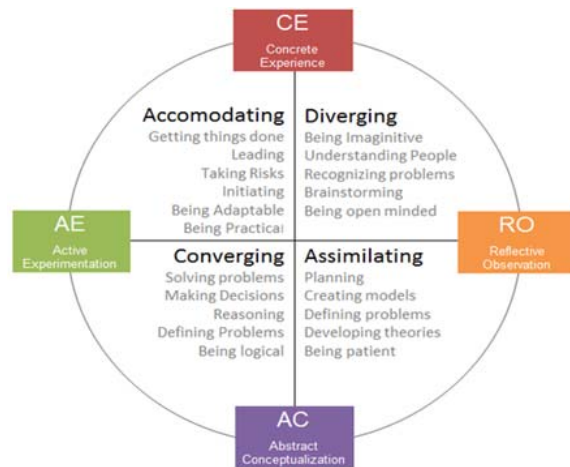


Fig.2. Kolb's Four Learning Styles [8]

**C. Honey Alonso learning styles**

It is a psychosocial personality preference model of learning styles [14], as in fig. 3.



Fig.3. Honey And Mufford Learning Style [14]

D. Grasha learning styles [15]

[15] defines teaching style as the quality of teachers in teaching, including personality and consistent behavioral conduct owned by a teacher amid the educating and learning process in the classroom. Grasha in [15] viewed interaction amongst teachers and students to create six learning styles with relating educating styles. These learning styles are particular circumstance that can be coordinated to an arrangement of instructing styles that best mirror the necessities of associations amongst academics and students inside the instructive condition. The procedure requires the teacher to determine the kind of learning style and change their instructing style to it. The matched association between detected learning styles and instructing styles to best address the requirements of the students is demonstrated in Fig. IV.

E. The VAK and VARK learning styles

Around 53 speculations of learning and around 80 models of learning style have been proposed. In a large portion of them, [16] considered the sensors modalities of data contribution as the determinant of learning style. This model has perceived three learning styles as visual, auditory and Kinesthetic styles (VAK model).

– VAK learning style

The Administration of Federal Aviation defined that VAK learning style depends on students' vision, hearing and touch. Different researchers provided a vision of VAK to be the basic approach to recognize diverse learning styles which can be used to help with fusing different learning systems into classroom

directions and exercises [17] [18]. It alludes to students' perception channels: visualization, hearing and emotion as it is shown in fig. 4. It recommends that students can be partitioned into one of 3 favored learning styles which are visual, auditory or Kinesthetic.

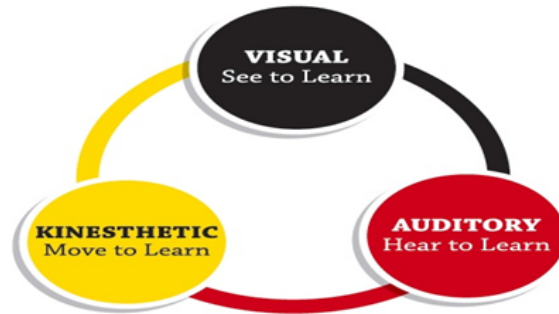


Fig.4. Vak Model [17]

– The VARK

The VARK is the VAK after adding to it write-read style (The VARK model) [17] as a device to classify learning styles as indicated by Visual, Auditory, Read-Write and Kinestheti modes as shown in Fig. 5. As indicated by [17], who is a learning style master and the creator of what is likely the most broadly utilized tangible methodology preference assessment, there are four noteworthy sensory modalities which are: “Visual [V], aural [A], read-write [R], and kinesthetic [K] [17]”.

Despite the fact that there are different methods for categorizing learning Styles, one that is more regularly utilized strategy depends on the tangible methodology or modalities that one likes to utilize while incorporating the information. In the previous decade, the questionnaire has been utilized broadly to assess students' learning styles [19] [20] [21].



Fig. 5. VARK Learning Styles With Appropriate Media [17]

4. LITERATURE REVIEW

This section will examine the related work, which concentrates on wise mentoring frameworks. Intelligent tutoring frameworks have students who

have distinctive information, learning styles, grounds, foundations and preferences [22].

Focusing on personalization has been considered in different fields such as in market (Idrees & Ibrahim, 2015) (Idrees, Ibrahim, & El Seddawy, 2018) [23], agriculture [24], medicine [25] [26], e-business [27] [28], and in social environments [29].

Aplusix is an Intelligent Tutoring System (ITS) for variable based math, looks at whether high-performing students' involvement of effect is not quite the same as that of low-performing students. Students who took the longest time in taking care of the algebra issues experienced disarray the most. Students who utilized the greatest number of steps to solve a problem experienced disarray and weariness the most. This mentoring framework utilizes a group of six observers to perceive full of feeling conditions of the students and framework logs all students' interactions [22].

Simple with Eve [30] is a full of feeling coaching framework in the area of elementary school arithmetic. The framework adjusts to students by means of an exact vivified specialist called Eve, who can distinguish student's feelings through outward appearance investigation, and can show feeling herself. Eve's coaching renditions are guided by a case-based strategy for adjusting to students' states. This strategy utilizes information that was produced by an observational investigation of human coaches.

PATSn has introduced in [31] a model that consolidates learning styles and feeling as two elements to enhance this procedure. In the proposed modal, just two negative feelings, weariness and sadness, are utilized. The exploration recommended that this model can be enhanced by considering different feelings like disgrace, outrage and proposing answers for preclude these feelings amid learning process. This model picks the learning styles which have the most noteworthy point in the survey, yet later on multimodal learning styles can be considered that are a mix of at least two styles.

Detecting learning styles based on the user characteristics is previously discussed in Learning Styles Diagnosis depends on User Interface (Khedr A. E., 2012) (Khedr & El Seddawy, 2015). A Tutoring System is proposed in [32]. Each student has distinctive requirements and preferences. Along these lines, it is exceptionally significant to furnish the distinctive styles of students with various learning conditions that are more favored and more proficient to them. The student's preferences are recognized, and after that the UIs are tweaked in a versatile way to match the preferences [33]. So the different student

preferences are uncovered through students' interactions with the framework. Utilizing this interface, learning styles are determined from student conduct designs on the interface. In this framework, a greater pool of students' information would give more useful results [32].

UALS is User-Centric Adaptive Learning System that utilizes successive pattern mining to develop versatile learning ways based on students' aggregate knowledge and utilize Item Response Theory (IRT) with cooperative voting way to determine the students' capabilities for suggesting balanced materials. Through this study, it has been affirmed the practicability of student driven versatile learning. The UALS that services users' collective insight to deliver versatile learning ways and select materials is equivalent to an experienced teacher. This investigation likewise found that students have more fulfillment and learning viability from student driven versatile learning. UALS just thinks about students' earlier learning, capabilities, and comprehending levels. Other essential qualities like those of preferences, psychological methodology, learning style, and behavior ought to be tended to for e-learning in a future research. Besides, assessing the proposed framework and approach in more instructive projects is required to clear up its capability of speculation and dependence [34].

A Personalized Creativity Learning System is established by [35] that depends on information mining strategy of choice trees to give customized learning ways to raising the performance of creativity. It has been recommended that learning styles connected in a creativity preparing framework can improve the capacity of critical thinking. In this study [35], kinds of learning styles were utilized.

Designing a versatile electronic learning framework concentrates on students' cognitive styles. The framework is made out of a student model and an adjustment one. It gathered students' browsing practices to refresh the students' model for recognizing students' subjective styles through a Multi-Layer Feed-Forward neural system (MLFF). Nevertheless, there are a few limitations of the study. Initially, the example size of the trial was not huge, so the outcomes could not be induced to general cases. What's more, the present study essentially centered around the utilization of learning styles and cognitive styles in giving a customized UI and learning content, while some different elements, for example, the information levels of the students, the difficulties levels of the learning materials and remuneration kind of adaption, were not thought about [36].



Versatile Educational Hypermedia is versatile web frameworks that assist students find related things in a typically extensive data space, by basically including three principle adjustment technologies [37].

Learning Network associates circulated students and suppliers in certain domains. The outline and advancement of learning systems is exceptionally adaptable, student-centre and developing from the base upwards, going past the formal course and program-driven models that are forced from the best downwards. A learning system is populated with numerous students and learning exercises gave by various partners. Each student is permitted to include, erase or assess learning assets whenever (Koper, 2005).

More than 50% of the proposed frameworks still stay at a plan or prototyping phase of advancement; 10 frameworks have been accounted for to be assessed through trials that included students. The frameworks which rely upon students' learning styles did not manage the students who have a multimodal learning styles (Koper, Rusman, & Sloep, 2005).

## 5. RESEARCH SCOPE

Learning is driven by the suitable activities which are followed by the assessment and feedback that reflects the progress towards the objectives [8]. To teach successfully, Most of the learning systems do not consider neither the differences of the students nor to the various requirements of the students [38]. Identifying the students' differences from each other is a main hardship. Consequently, to recognize the students' learning styles is an important main procedure [39]. We need to explore the students' reaction and response of the proposed system. The research problems could be summarized as follows:

1- Higher education institutions should provide methods to support and develop the educational process.

2- The difficulty of teaching students in their own pace in higher education appears in many universities.

3- Little researches and insights existed and implemented for such systems to enhance the educational process.

In this study, the research depends on the students' learning styles to identify their different preferences regarding their mode of learning. Therefore, it is essential to offer a variety of learning methods that consider the differences of the learning styles [40]. Mingling a group of teaching methods

and strategies will allow the teachers to choose the teaching style [41]. There are different instruments that allow teachers to solve this issue. The suitable material design and the successful use of these instruments can produce a learning experience that is suitable for all kinds of students.

## 6. A PROPOSED APPROACH FOR LEARNING PERSONALIZATION

This research will consider three targets of the elements of the learning processes; students, material presentation; and the institution's benefits (e.g., retaining weak students). The framework layers and construction that lead to an enhanced acquisitive model will be shown in fig. 6.

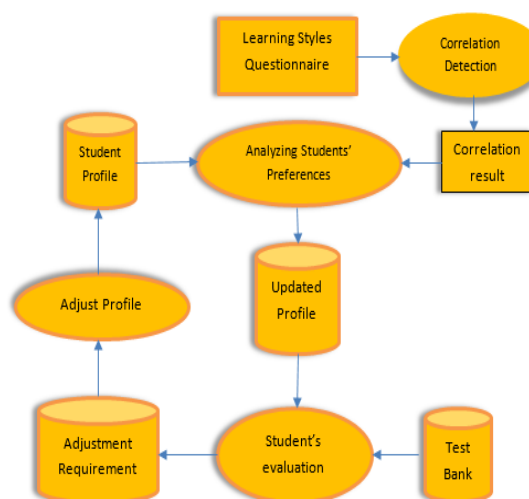


Fig.6. Proposed Framework For Personalized Learning System

The proposed approach aims at enhancing the educational process through giving the chance to develop the courses' methodology hierarchy that backs students to manage these courses. Moreover, it develops the students' profile management that enables students to manage their profiles to recognize the learning styles of students, establishes students' evaluation to ensure the effectiveness of this system as well. The enhanced approach considers the courses and questions styles. The research focuses on two targets: providing the suitable style to the students as well as maintaining the system performance acceptability.

### A. Data Sources

This section includes the sources which would supply the system with the data such as the student main data and the three questionnaires.

- Student Main Data

Different characteristics can describe the main stakeholders which is selected according to the required task such as in [42] [43] (Idrees & Taie, 2016). In this research the included characteristics as the username, gender, date of birth, student's academic identification card number, major and academic year. The learning behavior data is helpful for statistics analysis of the learning performance, including learning time, learning activities, learning resources, examination results.

– Questionnaires

Users' opinion approaches have been successfully applied in different research [44] [45], therefore, considering the students' opinion about their preferences is one of the main essential steps in this research. First, Honey and Mumford's work depended on the first thoughts of [8]. Second, Multiple Intelligences' theory was created by [46], an educator of instruction at Harvard University. It recommends that the conventional thought of intelligence, in view of I.Q. testing. Third, little consideration has been given to the physiological measurement of the examination of learning styles.

– Test Bank

The systems of teaching significantly affect the learning results [47]. Research success mainly depends on the data availability [48], cleanliness [49], and completeness [50]. In this study, the different teaching methodologies are displayed, where the suitable choosing and sequencing of the teaching techniques from an advanced repository are adjusted by the students' profile to control the learning session. The instructive module is designed for setting the fundamental parts of the selected content and teaching preparation. The content choice relies upon a group of teaching strategies according to the learning style. The learning material is isolated into segments and showed in a list of chapters as indicated by the syllabus. The addresses of pertinent course materials are introduced in one coordinated learning condition. The teaching sessions; incorporate sound, video-based lectures, and power point slides.

If a learner disagrees with the result, he/she can retake the test. According to the result, the most suitable learning objects and activities are chosen from the learning environment. Then, the material is shown using the appropriate learning environment which matches the learner's learning style. If the student did not pass the test, he/she would have to try another learning style and so on.

## B. Main Phases of the Proposed Approach

In the system of this study, the student will conduct the exam according to his preference which is examined to be updated according to his progress.

– Learning Styles Approaches Correlation

Correlation Analysis finds out what satisfies the learners. Correlation is a strategy by which the connection between two factors is ascertained. Correlation has been successfully applied in previous research (Khedr, El Seddawy, & Idrees, 2014) (Khedr, Idrees, & Elseddawy, 2016). The coefficient of a correlation is a numerical measurement of the connection between combined perceptions. Relationship does not mean causality. A solid relationship between two factors does not really infer that one variable makes another one happens. The correlation is a decent marker of how two factors are connected. It is a decent metric to take a gander within the early periods of research or examination.

Measurement: Usually correlation is described in terms of its direction and strength.

Strength: Correlation can be any number between -1 to 1. A correlation coefficient of under zero would imply that the expansion of one variable for the most part prompts the reduction of the other variable. A coefficient more noteworthy than zero suggests that an increment of one variable prompts an increment in the other variable. Higher values mean strong connections that could be positive or negative, and values nearer to zero indicate weak connections [1].

Direction: if the correlation value is 1.00, that means that the two variables are positively correlated while if the correlation value is -1.00, that means that they are negatively correlated, but while if the correlation value is 0.00, that means that there is no connection between the two variables.

In this study, a correlation will be conducted after students answer the three questionnaires to determine the relationship among the different learning styles approaches which the three questionnaires measure. The Learning Styles Approaches Correlation step can be summarized as follows:

Input: Questionnaire replies are determined

Process: correlation is determined for determining his skills relations.

Output: learning styles relations.

– Analysis of Student Preference

This step focuses on applying analysis to the students' preference which have been previously

highlighted. Analyzing the users' input by intelligent techniques has been applied previously and these techniques have been followed in this research (Hassan & Idrees, 2010) [51] (Idrees, 2015). After students answer the three questionnaires related to the above learning styles, the correlation between the students' learning styles could be determined. The learning preferences will be kept in the student's profile. (Knowledge of Learners) Students' cognitive traits and former knowledge that can specify the presentation of certain lectures. The data of a complete session is saved in 'Student updated profile' as a past interaction for the students. This module evaluates each student enactment through sets of haphazardly created multiple choice questions (MCQs), true or false (T/F) questions, complete and (T/F) questions, complete and essay questions. The responses are utilized to compute the scores of the test to decide if the student passes. The precise information of each student is stored in the 'Student's Evaluation'.

The Analysis of Student Preference step can be summarized as follows:

Input: Student profile, correlation, test bank

The Student Profile: Covers the student's personal data as ID number, password, name, email, major; and the data that are taken out directly from the student. This profile is important as the student's learning style will be saved in it.

The correlation: the learner performs the questionnaire and correlations are determined. These relations stated the student preferences to use in learning and what kind of a learner he/she could be as was shown in the three questionnaires and the correlation before.

Test Bank: It includes a variety of the questions which match the different learning styles. The students will go through the tests that matches the learning style they are having after passing through the questionnaires.

Process: To determine the student's learning styles so as to provide the suitable test questions

Output: Updated Profile

The information characterized in this module is utilized to figure out what lectures will be illustrated to the students, and how to evaluate the students' answers to decide their Knowledge. It stores the lecture name, succession of the lecture, the objective of the lecture and various media frames for the lecture.

– Student's Evaluation

This process is divided to the input which includes the student's updated profile after the student answers the three questionnaires and measuring the correlation between the student's learning styles if there is any. Then, the process as shown in figure VI which contains the module and the tests that would be presented to the student according to his/her correlated learning styles. Eventually, the student's best learning style will be stored in the student's adjusted profile.

The Student's Evaluation step can be summarized as follows:

Input: Updated Profile

Process: To decide the student's best ways of learning

This process is divided as follows:

After the correlation, learning style for the students is then examined, it could be satisfying or not. If the student did not pass the first test, the system will keep the student's highest score question type in the first test. Then, the system will repeat the same lesson with new different style of learning which is based on the students' profile. If the student passes the second test, he/she will be able to move to the second module with the same learning style.

3. If the student does not pass the third test, the system will offer the student a fourth test for the same lesson after changing the style, which depends on the student's profile. Passing the level ensure upgrading his level.

4. If the student fails to pass the fourth test, the system will keep the highest score question. Then, the system will offer the student a fifth test with highest learning style and the highest score type of question in the previous four tests in the same lesson. If student passes, the student will turn to module two with the same learning styles and type of question.

5. If student failed in the fifth test, the system will offer and repeat the lesson with the student's learning styles randomly.

6. Students have the chance to answer five different exams for each module. The five exams are designed to be a good evaluation of the students' answer of the course work sheet with their preferred style which depends on their profile on the system. Once students finish the course work sheets, students get their scores straightaway. The degrees of the student will be calculated by the strategy the instructor chooses.

Output: The Student adjustment requirements:

It includes the techniques and methods that customize the course content. The course content is the prepared to be adjusted to fit students' prompt needs, where the proposed framework provided more precise information in regard to the students' experience of learning and his learning style. The course material and the information base are searched for the learning objects and choose the required or the suggested adapting learning item for the dynamic students.

– Adjust

Adjusting Course Materials: consolidate course-sequencing methods. The versatile material content is exhibited following randomized, adjusted, and well-chosen tests. The framework praises the learning object according to the student's performance which is decided earlier and the testing scores. These tests are produced by the framework utilizing a database of inquiries utilizing students' and domain modules that are controlled by intelligent reasoning engine.

Adjusting Learning Resources: change the course material as indicated by the student's performance and the necessities of the learning atmosphere.

The adjust step can be summarized as follows:

Input: Adjustment requirements

Process: The best methods of learning for the student

Output: Modified student's profile.

According to the result of the test, we can label the learners. The student could be labeled "kinesthetic/pragmatic" or "auditory/musical" and so on.

The student's learning skills make a difference to learning effect. The student profile will include the learning skills of the student so as to be used with him/her afterwards.

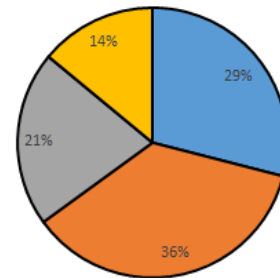
## 7. EXPERIMENTAL STUDY

This section discusses the implementation of the proposed intelligent personalized approach to confirm that that it can support and develop the educational process. This task requires sufficient and relevant information about the student's primary and secondary learning preferences.

The population of this study was students from Canadian International College, Business school in Egypt. The participants in this study were 200 undergraduate students from various business disciplines including Business administration and

Business information technology. Most students were 19 or 20 years old. 120 students were males while the rest of the students were females. The students would go through two phases. The first one is before implementing the system and the second one is after implementing system.

Before implementing the system, a question has been populated to the students considering their preferred learning style. The students' response to the question is shown in Fig. 7 which reveals that all the students had one preference.



■ doing ■ seeing ■ listening ■ readir

Fig.7. The Students' Preferences' Percentage

The students then performed a test according to their selected preference. A sample of the test for each style is as follows:

1- Listening: Watch and listen to the video and then fill in the gaps: The claim is -----  
--

2- Reading: Read the following paragraph and then complete the following questions: The writer opinion is placed in the -----of the paragraph.

3- Doing: Read the essay and then write the sentences below (T) or (F): The writer introduced his claim in the second paragraph. ( )

4- Seeing: Read the paragraph and then answer the questions below: What is the hook?

As shown in fig. 8, out of the 35% students whose learning preference is visual, 50% of them passed the test. Out of the 10% students, whose learning preference is reading, 40% of them passed the test. Out of 15% students, whose preference is listening, 20% of them passed the test. Out of the 20% students whose preference is doing, 30% of them passed too.

### A. Questionnaires' Responses

The students answered the questionnaires including the three questionnaires' questions Each



group of questions measures a certain learning skill as follows:

The VARK questionnaire consists of 16 multiple-choice questions. The students choose the choices that suit their preferences [52]. The four learning skills which VARK measures are represented in the multiple choice of each question, we decide the student’s learning skill according to the number of answers he/she chooses in each one. The skill which has the highest number of choices is considered the student’s learning style.

The Multiple Intelligences questionnaire would tell where the student’s intelligence lies. It consists of 30 statements. The student read each one and jot down “T” if it expresses some of the student’s characteristics. If it does not, student would mark an “F”.

The Honey and Mufford questionnaire include 40 statements. The students read each one and write “T” if the statement expresses one of the student’s characteristics, but if it does not, the student marks an “F”.

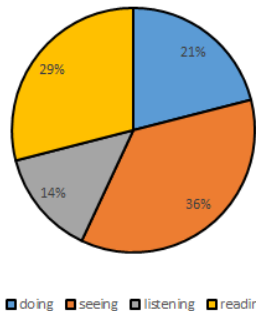


Fig. 8. The Students' Test Result Percentages

The questionnaires’ charts were applied to analyze the results of the questionnaires [53].

B. The correlation of the students’ response

The students’ responses were collected in a table which showed the students’ choices per each questionnaire. Table 1 shows a sample of 16 students’ answers to the questionnaires.

A correlation was conducted to find out which skill is affected by the other skills in the other questionnaires and the results are illustrated in table II. The correlation shows that the relationship among the learning skills of the three questionnaires. It is shown in table I the results of the three questionnaires which we got as explained before. St. # Visual,

Auditory, Reading, Kinesthetic, Linguistic, Logical, and Musical.

As shown in table 2, there is a positive strong relationship between Kinesthetic from the VARK questionnaire and the Pragmatist from the Honey and Mufford questionnaire. It means that the student who is kinesthetic is also pragmatist and can use the same activities and methods to teach them. According to VARK, the kinesthetic students can learn through performing. Their preference is for hands-on experience. They are often high energy and like to touch, move or interact with others [32]. The VARK definition of Kinesthetic resembles the Multiple Intelligences’ one. Consequently, the student who is having one or more of the previous three, he/she can be labeled with the other two.

Table 1. A Sample Of The Three Questionnaires Results

St. #	Visual	Auditory	Reading	Kinesthetic.	Linguistic	Logical	Musical	Spatial	Bodily Kinesthetic	Intrapersonal	Interpersonal	Activist	Reflector	Theorist	Pragmatist
1	4	2	2	6	2	3	2	2	5	0	2	7	7	6	6
2	2	7	4	3	3	2	5		2	1	3	8	10	9	9
3	4	7	4	6	4	2	4	2	3	2	3	2	8	9	7
4	4	7	5	9	3	3	4	1	2	2	1	4	9	6	7
5	4	5	2	7	4	4		2	4	2	2	7	5	7	7
6	3	7	1	9	4	4	4		4	1	3	5	7	6	7

There are other positive relationships between other learning styles for which we can apply the same activities as follows:

a- Reading from VARK has a positive strong relationship with linguistic from Multiple Intelligences.

b- Spatial and intrapersonal from Multiple Intelligence has a strong positive relationship with theorist from Honey and Mufford.

1- The auditory from the VARK is having a strong positive relationship with musical from the Multiple Intelligence.

2- Visual and logical are related while logical and reflector are also related. So we can conclude that the visual from the VARK is having a strong relationship with the reflector from Honey and Muford.

3- The activist from Honey and Muford is having a strong positive relationship with interpersonal from

Multiple Intelligences. Analysis of the correlation results

The 200 students did the questionnaires. 190 students showed that they have certain learning styles. The correlation reveals that there are styles that have positive strong, weak or no positive or negative strong, weak relationship as in table 2.

It was found out that the learning styles that have been correlated positively have similar definition in the three questionnaires, which resulted in that they share the same activities, and questions. The research concludes that if a student has any of the correlated learning styles or all, he/ she would have a unimodal learning style, which means that we can deal with them as if they are one. For example, there was a strong positive relationship between the pragmatist from Honey and Mufford, the kinesthetic from the VARK and bodily Kinesthetic from the multiple intelligence, which mean that the three affect each other positively. According to the definition of previous three learning styles, the three learning styles use the similar definition as shown in chapter 3. A pragmatist student, in Mofford learning styles, is the one who learns best through practical tips or paired discussion while a kinesthetic student, in VARK learning styles, is the one who learns best by doing .There was also a moderate positive relationship between bodily, kinesthetic from the multiple intelligences, and kinesthetic, from VARK, which leads us to conclude that we can use the same

learning activities and questions with any of them, so, the three of them would learn and receive the information the same way. 10 students of the 70 did have multiple learning styles, so they took a multiple learning skills test to decide which learning skills they tended to have. Then, they did all modules 1.

C. The results of the evaluation process

The student’s profile had been updated with the student’s learning styles whether the student learning style was unimodal or multimodal so as to be able to pass through the other phases. As a result, the students with the unimodal learning styles have learning styles that are having strong positive relationship as explained before, so they are considered as if they are having one type of learning styles (unimodal). The students with the unimodal learning styles were taught through a group of activities that matched their learning styles. The students with unimodal were exposed to activities which serve the different learning styles.

For example, the student who are Kinesthetic, Pragmatist, or Bodily/Kinesthetic, a reproducible has been distributed, Student worked with a partner. Each partner listed on one of the profile pages what she or he considers her or his own talents and best qualities, and on the second profile page, the partner’s talents and best qualities. Then Partners exchange partner pages, skim to compare them with their own self-profile pages, and then discuss their work.

Table 2. A Sample Of The Correlation Results

Learning Styles	Theorist	Intrapersonal	Spatial	Kinesthetic	Bodily Kinesthetic	Pragmatist	Reading	Linguistic
Theorist	1							
Intrapersonal	0.5	1						
Spatial	0.6	0.1	1					
Kinesthetic	0.2	-0.1	-0.2	1				
Body Kinesthetic	0.1	0.0	-0.1	0.5	1			
Pragmatist	0.3	-0.1	-0.1	0.7	0.4	1		
Reading	-0.1	0.2	-0.1	-0.2	-0.1	0.0	1	
Linguistic	0.0	0.1	0.0	-0.2	-0.2	-0.1	0.6	1
Auditory	0.1	0.0	-0.4	0.0	0.0	0.1	0.1	-0.2
Musical	0.0	-0.1	-0.2	0.1	0.0	0.1	0.0	0.2
Visual	-0.1	-0.2	0.1	-0.2	0.0	-0.1	-0.1	0.0
Logical	0.3	0.1	-0.1	-0.1	-0.1	0.1	0.1	0.1
Reflector	0.2	0.1	-0.1	0.0	0.1	0.1	0.1	0.1
Interpersonal	0.2	0.0	0.0	0.0	0.1	0.2	0.1	0.1
Activist	0.1	0.0	-0.1	0.1	0.0	0.1	0.0	0.0

After passing through activities, activities 1 that matched their learning styles, as mentioned, the students went through test one for module one which contained an exercise that matches the students' learning styles when the students passed the first test, they would be moved to module 2 which would be presented to them by the same learning styles they had in module one. The research highlighted that most of the students could not recognize their suitable style. Comparing the system results with the previous method, it was found that identifying the suitable learning style for the student raised the success percentage by 50% of the total passed students.

In addition, before implementing the system, students did not show that they have any secondary preference, but when they answered the questionnaire, it was shown that the students did not have one learning style, but the students had either multiple learning styles, primary and secondary, or unimodal learning style.

As a result, implementing this system would help us recognize the students' learning styles better than the students who could not know the real learning style(s) they are having, and it would help the teachers to design material that matches every student real learning styles.

## 8. APPROACH CONTRIBUTION AND LIMITATION

The motivation of this study is enhancing the learning process and eliminate the constraints that are imposed on students when they are taught by "one-way fits all". We need the students to be aware of their learning styles so as to be able to learn and even teach themselves effectively. Knowing the students' learning styles would lead to enhancing the education process and benefit all the partners in the educational organization especially the students whom we think that they are having a learning difficulty, but actually, they are taught the wrong way which doesn't match their learning styles. In addition to the students' benefit, recognizing the students' learning styles would advantage the educational as they would be able to retain the students and provide them with the key to success, which consequently will achieve their objectives.

The present study showed that 50% or more of the students failed to tell their right learning style(s). Additionally, the students answer about their learning style did not show the multimodal type. Consequently, we can conclude that the steps that was applied revealed two points; 1) students should pass through the questionnaires which would reveal

their actual learning style(s), and we shouldn't depend on the students' opinion about themselves; 2) students tend to have not only one learning style, but also multi-learning styles.

This study did not only depend on the students' response to the questionnaires, but also it attempted to find out the relationship between the different questionnaires through the correlation process which revealed that students did have more than one learning style. Even students with the unimodal of learning style did have a set of learning styles which correlated together so we called them unimodal as they were sharing the same activities. The proposed model obviously proved that most students are likely multimodal learners, so we have to change the learning strategies to help the students learn effectively and to better both of the student and the education system.

According to the study findings, it is valid to claim that presenting the material to students using different activities is definitely advantageous to the learning process. It has been pointed out that both low and average achievers earn higher scores when they are taught within the realm of their learning styles. From this study, it is also noted that low achievers were able to learn and pass the tests when we used their secondary learning style which indicates that there is not a weak learner, but there is an inappropriate way of learning. The present study findings show that there is a positive relationship between learning styles and academic achievement amongst all the students.

Several limitations should be considered when explaining the findings of this study.

1- The present study considered only one batch of students. The other students from different majors or schools weren't evaluated.

2- This study didn't pay attention to the gender of the students to find out are males' learning styles different from the females.

3- This study did not explore the teaching styles of the instructors and how the mismatch between the teaching style of the instructors and learning styles of the students would have an impact on enhancing the learning process.

## 9. CONCLUSION, FUTURE RESEARCH AND RECOMMENDATIONS

The research proposes a personalized system for detecting the student's learning style. The study presents an improved educational framework that can be used in higher education, which depends on

activating the ways that will satisfy the student's learning needs through using three learning styles inventories.

The framework of this study can be applied either in face to face education or in online education. Therefore, it would be effective if another research applied this framework on online learning or created a system, which would use the same framework. The framework of this study was applied on only one major in one college while it could be applied to other majors in different colleges to check the correlation between the different learning styles.

In conclusion, to this study, it has been found out that instructors or the educational organizations should be encouraged to using learning style information to expand the range of their students' learning potentials by using a diversity of activities so as to enhance their learning process. Knowing that the student can't achieve progress if there is a mismatch between the teaching approach and his/her learning style would solve the problem of having weak students who can't pass the course's tests. When tailoring the learning process to match the student's need, it would help basically the student not to feel frustrated or depressed when feeling they can't do well. Secondly, it would help the educational organizations to keep their students satisfied and achieve success to both of the students and the organization.

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