



## Development of E-Modality: A Learning Style Assessment Tool

King David J. Agreda<sup>1</sup>, Ma. Ian P. De Los Trinos<sup>2</sup>, Maria Carmela F. Francisco<sup>2</sup>

<sup>1</sup>Cavite State University, Cavite, Philippines, [kjagreda@cvsu.edu.ph](mailto:kjagreda@cvsu.edu.ph)

<sup>2</sup>Technological University of the Philippines, Manila, Philippines, [maian\\_delostrinos@tup.edu.ph](mailto:maian_delostrinos@tup.edu.ph)

<sup>2</sup>Technological University of the Philippines, Manila, Philippines, [marix1161@yahoo.com](mailto:marix1161@yahoo.com)

### ABSTRACT

The learning style determines how learning can be optimized in content delivery. Learning style is deemed crucial for different types of age groups. It is essential, especially for individual learning achievement in different avenues of learning such as academic and in carrying tasks during employment. When learning styles are considered, the time it takes to learn is maximized, however, there are limited resources that are accessible to educators to apply identification of learning style in each class handled. This study designed an application that implements the Visual, Aural, Readiness and Kinesthetic (VARK) modality in a courseware called - E-Modality: Learning Style Assessment Tool (E-LAT). The developed courseware is intended to understand and further check the preferred learning styles of Grade 5 pupils from VARK exam to Core-Subjects of English, Math and Science. It includes different types of examinations that would determine whether the student has a bigger percentage to be a Visual, Aural, Read-based, or Kinesthetic learner. The system runs in a network-based environment and can be installed on personal computers or laptop. The functionality and accuracy tests were conducted to examine the overall system suitability and precision which proved that the system provided a similar interpretation as compared to the manual use of learning style inventory. Further, the application was evaluated by 27 experts using ISO 25010 which yields an overall mean rating of 4.67 with descriptive rating of "Excellent". The evaluation result implies that the application has attained its primary purpose to provide a learning style tool assessment.

**Key words:** e-learning, learning style, VARK, learning modality, courseware, assessment tool

### 1. INTRODUCTION

Students learn best when their learning style is considered in the teaching-learning process[1][2][3]. Learning style is deemed crucial for different types of age groups[4]. It is essential, especially for individual learning achievement in different avenues of learning such as academic and in

carrying tasks during employment. The learning styles should be in accordance to the subjects, concepts, tasks and needs and requirements of the learners[5]. When learning styles are considered, the time it takes to learn is maximized to the potential free time that is not utilized[6][7][8][9].

The inclusion of technology in the sector of education, opportunities for improvement of teaching methodologies. It reduced the way teachers facilitate in conducting examinations that promote effective and efficient learning that tests student's range of knowledge and understanding[10].

Bodmann proposed that technologies and its application more specifically tech-based assessment tool would even give chances to quantify the complexity to different information and cognitive that is way far through the measures of traditional methods. Moreover, Visual, Auditory, Reading and Kinesthetic (VARK)[11] is constructed on a person's inclination for certain types of stimulating senses that could help someone learn[12]. These modalities are used for learning information that seemed to reflect the experiences of the students and teachers. The system is used in the education setting; however, the manual process is time consuming. There are existing studies that provides basis on the effectiveness of VARK implemented in automation[13] such as the design of learning patterns to identify learning styles[14][15]. It offers learner various ways on how to adapt and eventually pick the most suited learning strategy available. The learners are being classified based on the methods of interaction with the input motivation and output performance[2].

Existing researches points to the improvement of delivery of teaching and learning process by considering the different learning styles or learning modes[16]. This study addresses the need for better ways to address classroom problems in terms of gauging the student's comprehension and learning capabilities, in acquiring academic knowledge thru the best fit learning style a student has. The study implements VARK in a courseware that generates assessment feedback with Learning Style evaluator based on the gathered scores and answered questions.

## 2. SCOPE

The courseware includes different types of examinations that would determine whether the student has a bigger percentage to be a Visual, Aural, Read-based, or Kinesthetic learner based on the questions formulated by the Master teachers under the Division Office of Dasmariñas City, Cavite for determining the assessment skills of Grade 5 pupils.

The developed system is designed to cater two user levels, the administrator which is the Guidance Counselor and Assessors. The administrator can navigate the eight modules. Register Assessor, this is the form for adding teacher or adviser's information. The View Assessor and View Students Module allows the administrator to monitor the assessors and students' listing. This displays information based on the credentials of the users. Another module that the administrator can use is the Generate Report Module, this is one of the most important modules under the administrator level, and this is where reports are monitored. It could be printing of students' list who have already finished the assessment, individual reports per student and printing per section that is based on the selection of VARK result or Core Subjects, Sex, and Modality Value. To complete the administrator function Archive Student, Archive Assessor, Edit Assessors Info, and Add Section Modules can also be navigated.

## 3. RELATED STUDIES

### 3.1. VARK Modalities

People learn differently. Theories and discussions have been in competition contesting the results of these philosophies towards the variety of individual learning styles and modalities. It has a foundation of keeping track of the learning associated to a person according to the category if its style[17]. This often leads to the question of how someone learns things. Sensory modalities could be learned by analyzing the factors that directly affect the learning from the culture, mentality awareness, age, readiness and psychosomatic condition. Different fields have been devoted and steadfast in creating path towards the answer to this question. They have used different medical and theoretical approaches to obtain information ensuing that learning could be affected by its environment, curricular background, and different teaching methods employed by teachers and educators[18]. By this mean, teaching methods should be well organized independently in line with individuals' unique characteristics considering the inclusions of processing learners from saving, recalling the methods employed efficiently and effectively[19][20].

VARK Learning Style[3] is an instrument which could help educators in determining one's learning style. This instrument is based from three principles. Academic issues

could be learned by anyone, otherwise someone has its unique styles. The second is when learners are being motivated it increases the development of different learning styles. The last principle is educational learning's and concepts are being learned though senses utilization and perceptions. These different perspectives can be learned from the environmental knowledge with the used of the four learning/sensory modalities.

The normal way of conducting the assessment for learning style inventory is through giving the participants questionnaires which has 13 to 16 situational questions depending on the version to be taken. These are short queries to avoid the students' lethargy for surveys. VARK refers to the senses from Visual, Aural or Auditory, Reading or Readiness and Kinesthetic strategies for teaching. This chance of knowing the best approach for students would accommodate educators to fully assess the capabilities to how learners acquire information.

Over the years, different classroom pedagogical approaches have taken place to set the standard of learnings [21]. These are all common to schools, where creativity sets the effectivity and appropriateness to each unique learner. It may vary and depends on a specific subject or topic given to students. Different theories support this researches[22], from the understanding of the classroom or educational institution's need to diverse thinking of what do students need. This basically discusses that careful utilization of this approaches will increase the capacity of students[20].

### 3.2. Learning Styles in Teaching Process

The prime important of learning the ways to map the learning styles in effective yet scientific way in individualizing various instructions that would benefit both students and educators then. It resulted to leveraging the analyzation, motivation, of teachers to students that would be another avenue to have a modern pedagogy method to the sector of education. Powerful leverage and its availability can be given to educators and mentors to examine, inspire, and to assist learners in school and be a foundation of truly modern and up-to-date approach to the education [7]. The different classroom education styles and its part in learning process as indeed real key in teaching. The proper knowledge in matching learning styles with teaching strategies will result to proper utilization of both student and teacher learning mechanism in classroom. Thus, it is being right with different studies that knowing the student's learning style would immensely affect in magnetizing student's education experiences[23].

Added to this, the field of Information Technology (IT) has this difficulty in exploiting extensive problem solving in professional working environment due to lack of abilities in kinesthetic learning style. Individuals pursuing careers in information technology (IT) typically encounter a

professional work environment that exploits extensive problem solving which draws upon their abilities with a kinesthetic learning style[10].

### 3.3. Differentiated Instruction in Improving the Academic Performance

Diversity inside student’s classroom contests teachers in creating a focused learning environment. Differentiation of instructions if being part of the classroom diversity would result to facilitating individual learning. Application of different teaching methodologies in classroom setup would even give a better and higher percentage of students getting a passing score since different instructional approaches were used to utilize the learning style of each student related to various subjects, in this case it is deployed to Filipino subject[23]. Grasha-Riechmann Scale is the Student Learning Style scale used in designing activities in Filipino subject that is focused on experimental and control groups receiving traditional instructions for teaching. Therefore, knowing someone’s modality would improve the assessment of the educator in terms of the proper and justified application of the teaching methods deployed on each classroom setting. When teachers know someone’s preferred modality it can impressively augment communications. Sharing information in array of ways that could avoid a lot of misunderstandings, mostly in teaching.

### 4. METHODS

This study designs the conceptual framework depicted in figure 1. The components include the students, the E-Modality: Learning Style Assessment Tool (E-LAT), and the generated report for the teacher. The courseware component of the E-LAT is composed of learning materials and assessment tools for the fifth grade lessons in Mathematics, English and Science. Students access the courseware by studying the lessons and answering end of lesson assessments. The application collects all information and generates the learning style of the students.

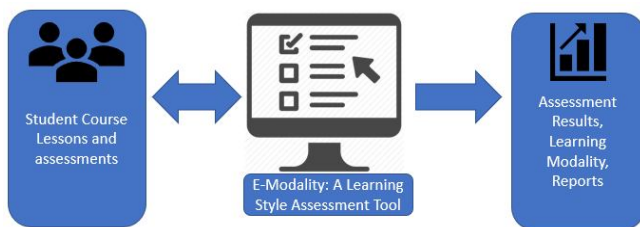


Figure 1: Conceptual Framework

The application runs on a network environment where the class simultaneously access the courseware and take the examination.



Figure 2: Assessor Module

The Assessor’s Module is composed of a trigger assessment process, view students and generate report as shown in Figure 2. This is intended for students taking the two forms of examination. The VARK assessment and the lesson assessment. VARK of 13 unique questions that assess the students on how to cope up with the best learning style to fit in with the best possible solution of teaching and learning technique.

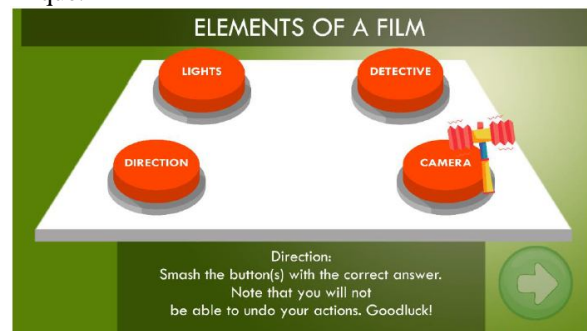


Figure 3: Sample Question

The second part is course exams in Math, Science and English with 20 questions for each. Figure 3 shows a sample question for the English course. For the Report Module, both under Administrator and Assessor, its function is to generate reports based on the given choices. From individual printing, per section printing or per learning modality printing.

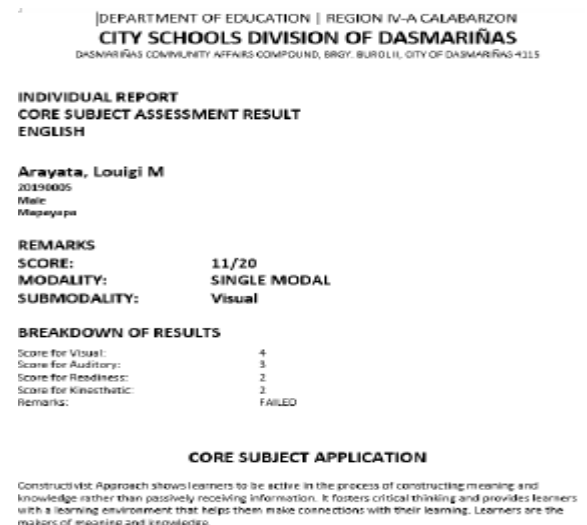


Figure 4: Sample Report

Figure 4 shows the information of the student together with the result of the examination under English – Core Subject. As observed, it has its scoring remarks with a passing percentage of 70% for the score based on the correctness for each question.

## 5. RESULTS

To ensure the functionality of the system, operation and testing procedure was performed. There is one type of test for this study that is in accordance to criteria that matches the objective of achieving the entirety of the courseware's usage; the functionality test. For the full operational checking through modular testing, test cases have been executed to further support the reliability of each function.

The study adopted the ISO 25010 model as instrument for software evaluation. The evaluation procedure is divided into Project Demonstration and the Final Evaluation. It evaluates the application using the given evaluation instrument by the twenty seven selected (27) respondents categorized as follows: three staffs of Resource and Learning Center from Division Office of Dasmariñas City, Cavite, 20 IT experts, one Psychometrician, one Psychology – General Psychology Major, two Grade 5 teachers, and 20 Grade 5 pupils for the direct system observation.

After evaluating the results of each test case, test results were compiled and summarized at the end of the testing. Eleven test cases were performed and executed where a 100% passing mark was achieved.

Table 1 shows the results of the E-LAT software evaluation using ISO 25010.

**Table 1: ISO 25010 Results**

Criteria	Mean	Qualitative Interpretation
Functionality	4.79	Excellent
Reliability	4.64	Excellent
Portability	4.70	Excellent
Usability	4.66	Excellent
Performance Efficiency	4.70	Excellent
Security	4.71	Excellent
Compatibility	4.70	Excellent
Maintainability	4.49	Very Good
Grand Mean	4.67	Excellent

\*Range of values: 4.20 – 5.00 = Excellent; 3.40 – 4.19 = Very Good; 2.60 – 3.39 = Good; 1.80 – 2.59 = Fair; 1.00 – 1.79 = Poor

The functionality of the system had obtained an excellent rating from the respondents. It denotes that the system satisfied the objectives in every module and all functionalities were implemented properly. Based on the functionality evaluation conducted, appropriateness has the highest mean

score. It means that the system facilitates the accomplishment of specified tasks.

The system garnered a mean of 4.64 for its reliability which means that the system is operational when needed. The highest among the Reliability indicators is the Maturity while the lowest is the Availability considering that the system is a new technology application. The system obtained an average of 4.70 for its portability having a verbal interpretation of excellent. This clearly explains that adaptation of this system with regards to the hardware requirements is easy considering it is a plug-and-play application once installed.

Performance Efficiency together with Compatibility got a high weighted mean of 4.70 with verbal interpretation of "Excellent". This defines that the system runs smoothly on the chosen hardware specification, chosen database and proper programming language engine that breaks the gap of any compatibility issues during the entire development of the system.

The security on the other hand had obtained a mean of 4.71 which signifies "Excellent". It means that the system's security is assured and well defined by its security login features. One of the ISO 25010 quality standard is Usability, the result based on the evaluation garnered 4.66 which means that the users find the system effective, efficient and has great performance in terms of ease-of-use. Maintainability on the other hand garnered a mean of 4.49 with a qualitative interpretation of "Excellent".

After the consolidation of all the indicators, grand mean was computed with numerical value of 4.67 with verbal interpretation of "Excellent". This clearly signifies that it is flexible to system modification to both source codes, and modular features.

## 6. CONCLUSIONS AND FUTURE WORKS

The developed courseware is intended to understand and further check the preferred learning styles of Grade 5 pupils through a series of examinations from VARK exam to Core-Subjects of English, Math and Science. The system runs in a network-based environment and can be installed on personal computers or laptop, with a preferred software specification of at least Windows 10. For better result, the defined system has joystick for real-time experience during the core-subject exams. It includes different types of examinations that would determine whether the student has a bigger percentage to be a Visual, Aural, Read-based, or Kinesthetic Learner based the questions formulated by the Master teachers under the Division Office of Dasmariñas City, Cavite for determining the assessment skills of Grade 5 pupils. The developed system is designed to cater two hierarchical user levels, the administrator which is the Guidance Counselor and Assessor(s), this could be teacher or adviser assigned by the Guidance Counselor to facilitate the students in taking the assessments.

The functionality and accuracy tests were conducted to examine the overall system suitability and precision which proved that the system provided a similar interpretation as compared to the manual use of learning style inventory.

Further, the application was evaluated by 27 experts which yielded to an overall mean rating of 4.67 with descriptive rating of “Excellent”. The evaluation result implies that the application has attained its primary purpose to provide a learning style tool assessment for Grade 5 pupils.

The next phase of this research is the design and inclusion of an inference engine that will adapt the series of questions to the learning style of the students. The satisfaction of students on the use of the courseware will also be included.

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