VARK Learning Styles and Online Education: Case Study

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VARK Learning Styles and Online Education: Case Study

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Abstract— in this paper we seek to understand the outcomes of online education by observing the role of learning styles. Under the assumption that the behaviors that maximize learning are dependent on the delivery method, we compared learning outcomes of students participating in two classes set up on an interactive e-learning platform. Our results show that learning styles are variables worthy of consideration in online settings, even though the correlation among learning styles and test results does not indicate a significant association. Specifically, we argue that online education demands a particular set of behavioral patterns (i.e., low companionship, achievement orientation) necessary to navigate the eccentricity of online education (e.g., social isolation, schedule flexibility). We discuss the theoretical implications of our results in the context of online education and offer practical suggestions for online teaching design.

Keywords — *Quality of Experience; VARK; Online Education.*

I. INTRODUCTION

Online education is commonly considered a form of distance education because students are physically separated from each other and the instructor. This teaching approach features electronic learning or e-learning, which relies on computer network technology, often via the Internet, to transfer information from instructors to participants and vice versa and is a widely spread teaching approach in higher education institutions.

Significant research has followed the increasing academic interest in online education, with particular attention to understanding the efficiency of the online teaching approach compared to classroom teaching [1][2]. The student experience in online classes is a different one from traditional face-to-face classes, and patterns of engagement seem to differ between the two. For example, in online classes students felt more detached from their peers and professors, more compelled to be self-sufficient in their studies, and less assisted by their professor, than their professors believe them to be. Students can also feel overwhelmed by the technological assumption of online study, particularly if they start off without enough technical knowledge or support. Researchers have recommended that unlike the faster, real-time speed of face-to-face classes, the additional time available for online activities might allow students to think about the course material more critically and reflectively, leading to deeper understanding of the course content. Others have suggested that the less challenging or personal nature of e-learning might give confidence to shyer students to engage more, or to feel less pressure than in face-to-face interactions.

The perceived usefulness and the user's attitude are used to predict the intention of the students to use the system. The relationship between Quality of Service (QoS), Quality of Experience (QoE) and online learning tools, have been investigated in [3][4]. Deeper understanding of factors influencing QoE in higher education should be investigated in order to create better utilization of the resources in the distance learning environment [5][6]

A better understanding of how student's learning styles affect their academic performance during online classes would lead to better adapting, designing and evaluating online classes and so the students grasp of QoE would increase leading to increased satisfaction with online education. The focus of this paper is to determine how learning styles affect student's academic performance, and how this differs when comparing traditional classes with online classes. The method of investigating how learning styles influence the quality of achieved learning results using different media presentations and delivery styles is presented. We performed a quality of experience (QoE) study including 70 students from the Faculty of Computer Science and Engineering that enrolled two distance learning courses from the computer science study program, both set up on the faculty's Moodle interactive e-learning platform. In the study we introduce the subjective Learning Style (VARK) variable. The results analysis shows how the subjective learning style correlate to the delivery method offered for following the online course.

II. CHARACTERISTICS OF ONLINE EDUCATION

Online education offers a variety of advantages for students and education institutions, while changing the scheme of education. Flexible schedules seem to be one of the most appealing attributes of online education. The broad accessibility to technology enables online students to do class work anytime anywhere.

Consequently, the measure of learning in online courses heavily relies on the students, who can choose convenient times

to concentrate on learning. This feature has proven to be of great value, especially to students facing irregular schedules. Other advantages ascribed to online learning include reduced travel time and expenses [7].

Online learning mostly consists of blended learning and fully online courses. Blended learning primarily employs face-to-face sessions, including distance learning/lecturing sessions, and online materials that are also provided to students. Fully online learning has no face-to-face sessions, and most learning processes are provided through an online environment. Therefore, this type of instruction can present students with freedom from learning restrictions.

The new concept for online education known as Massive Open Online Courses (MOOCs) is available for both blended and fully online courses and is attracting the interest of both educators and students. Though institutes of higher education recognize some potential benefits, the impact on teaching and learning is still being discussed. On the other hand, it has often been suggested that a great deal of these participants have difficulty with continuing their education online, leading to aggravating drop-out rates [8]. While the world-wide use of MOOCs as fully online courses has increased rapidly, the course completion rate is still one of the most serious problems impacting their success.

Based on these features of online learning in addition to the quality of the online program, personality and learning styles play a tremendous aspect on student's academic performance since online learning methods differ from traditional classrooms.

III. Learning styles VARK

Learning is a complex process of achieving knowledge or skills involving a learner's biological characteristics/senses (physiological dimension); personality characteristics such as attention, emotion, motivation, (affective dimension); cognitive dimension; and psychological/individual differences (psychological dimension). In this paper we analyze the physiological dimension of learning styles focusing on what senses are used [9]. The popular typology for the physiological dimension of the learning styles is VARK (Visual, Aural, Read/Write, and Kinesthetic):

- **Visual**: visual learners like to be provided with demonstrations and can learn through descriptions. They are distracted by movement or action but not by noise.

- **Aural:** aural learners learn by listening. They like to be provided with aural instructions and they appreciate aural discussions. They are easily distracted by noise.

- **Read/write:** read/write learners take notes. They often draw things to remember them. They do well with hands-on projects or tasks.

- **Kinesthetic:** kinesthetic learners learn best by doing. Their preference is for hands-on experiences. They prefer not to watch or listen and generally do not do well in the classroom.

We assume that the set of learning styles are differently apportioned in an online course than in a face-to-face course.

Typically, online learning systems include less sound or oral segments than traditional face-to-face courses and these online learning systems have more capacity of read/write assignment components [10]. Students with visual learning styles and read/write learning styles may do better in online courses than their complement in face-to-face courses [11].

IV. Methodology

The main goal of this paper is to determine if learning styles are influential in the participation of students who are enrolled in online or more traditional courses [12]. This study used a field experiment to empirically test our belief that different types of education materials delivery combined with learning styles and character traits affect student's academic performance [13].

A. Participants

For this study the sample populations were students enrolled in two courses Search Engine (C1) and Dynamic Websites (C2) at the Faculty of Computer Science and Engineering, Ss. Cyril and Methodius University in Skopje, R. Macedonia. The two distance learning courses "Search Engines" and "Designing Dynamic Web Sites" were set up on the faculty's MOODLE interactive e-learning platform.

Students were informed about the experiment before the beginning of the course. A few of them decided not to participate in this experiment, some discarded the experiment. Thus, the total number of participants which took part in this experiment was 70 (40 females and 30 males)..The mean age of participants was 21 ranging from 19 to 22. Participants were divided randomly into two groups of 35 students (group A and B). For the duration of one semester the selected students attended both courses. Their learning results were tested at the final exam. For motivating students to participate seriously they gained an extra credit for their course grade based on their individual performance. This study tried to determine how character traits and learning styles affect student's academic performance especially while taking online classes.

B. Course delivery

As introduced earlier, for the purpose of this research we have created two experimental courses (C1 and C2) with two groups of students (group A and group B). The first course (C1 course) can be considered as slightly less advanced course on introduction to computer science, while the second (C2 course) is a more advanced course that requires some previous knowledge in computer science. The participants were randomly chosen from students enrolled on both courses. In order to experiment with the character traits and preferred student learning styles, we used different presentation types, for delivering the educational content of each course:

- **Offline document content** - PDF documents, presentations and url links with related content were designed and spread to students. This makes it possible for students to independently manage their time and learn at their own selected pace.

- **Offline video content** - video presentations were recorded and delivered to the students in the form of a streaming video. This gives the opportunity for students

to watch the material presented in a more animated fashion but still create their own learning schedule.

- ***Online video conferencing*** - live video conferences were prepared with the professor of each course. The lectures were scheduled at fixed time, and students needed to be enrolled for the appropriate course in order to be able to participate in the video conference. This delivery method requires that students attend classes at fixed times, so it differs from the previous delivery methods were students had the freedom of organizing their time at their own. But, at the end of the lecture, students have the opportunity to cooperate with the professor and among themselves.

For each course, students were divided into two groups (A and B). The A group of students that attended the C1 course, were asked to choose their preferred content delivery type (one of the three educational contents described above). According to their choice, they were divided into three stereotypes, and to each stereotype the lectures were presented according to their preference, the other group of students that attended the C1 course, had no chance to choose the preferred content delivery type. The choice of the type of education materials delivery (one of the three types described above) was made by the professor, without taking into deliberation the student's preferences.

For the C2 course, students from B group choose their preferred content delivery type; while students from A group were given the content delivery type choose by the professor. At the end of both courses (C1 and C2), a survey was carried out with the participants in order to gather feedback results about the students' observation for the quality of experience during those two courses.

C. Procedures

This experiment was conducted at the Faculty of Computer Science and Engineering, Ss. Cyril and Methodius University in Skopje. Two significant groups of students (A and B), each containing three subgroups, as described in the previous section were organized for comparison purposes. The Moodle interactive interface was used for management of the student-content during the experiment, as well as for the teacher-content interaction. None of the students had accessed the material previous of the experiment.

All participants attended both courses during one semester. At the beginning of the semester the participants received a short explanation about the way the experiment will be carried out together with their required duties. During the experiment students were asked to complete questionnaires: personality questionnaire (character traits), questionnaires about their preferred learning styles, questionnaire indicating their intentions to continuously use various educational content delivery types as well as questionnaire for assessing the students' QoE. The experiment was completed with a final exam, through which students' learning outcomes were tested.

For the purposes of this study we processed and analyzed the data collected from the final exam, their preferred learning styles and their character traits, and also the data from QoE survey. We compared the final test results in terms of correlation coefficient of test results and character traits, correlation coefficient of test results and learning styles for groups A and B. We also analyzed the character traits and learning styles preference influences on the test outcomes for both groups of students.

V. RESULT ANALYSIS AND DISCUSSION

Learning outcome relates to the degree of knowledge gathered by a person after studying certain material. We analyzed how learning styles affect the learning results during those courses and their exam scores of the two groups of students on both courses, after study sessions. And at the end we analyzed the Quality of Experience students experienced during this experiment.

A. Correlation Coefficient for Learning styles

The VARK questionnaire was used to determine learning styles of students who participated in two online courses. The VARK instrument positions each student against the four distinct learning styles: visual (V); aural (A); reading/writing (R) and kinesthetic (K). These four ranges are used to analyze the suitability of online learning structures.
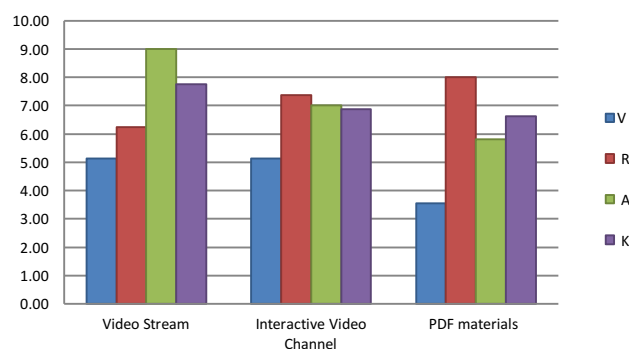

Fig. 1. Average VARK indicators against the students preferred learning method – C1

In Fig. 1 and Fig. 2, the averaged results from the VARK questionnaire are presented in groups based on the students preferred learning method for both courses C1 and C2. On the x axis are shown the preferred way of materials delivered, and on the y axis are shown the average of each learning style based on the preferred way of materials delivered on the scale from 0 to 10 which corresponds to the questionnaire where 0 represents no relation between the learning style and the way of delivered materials, and 10 represents a strong relation of the given learning style and the preferred content delivery type.

As expected, the more visual and aural inclined students prefer video streaming or video conference, while the reading oriented are more inclined on using PDF materials. It is interesting to note that many of the students consider themselves as kinesthetic learners across all offered learning methods.
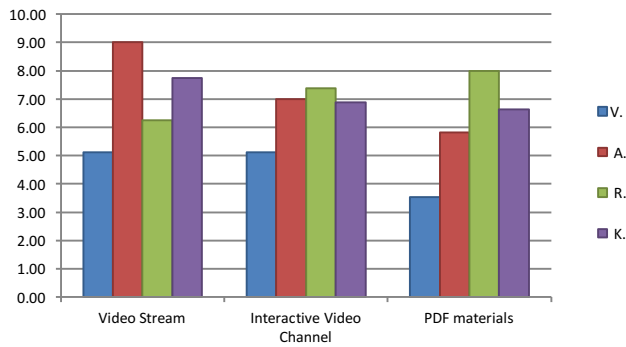
Fig. 2. Average VARK indicators against the students preferred learning method - C2

We have compared the two sample groups, based on the correlation coefficient of how test results and learning styles correlate. To find the correlation coefficient we used the proper excel function, which returns the correlation coefficient of the arrays of cell ranges. The equation for the correlation coefficient is:

$$Correl(X,Y) = \frac{\Sigma(x - \overline{x})(y - \overline{y})}{\sqrt{\Sigma(x - \overline{x})^2 \Sigma(y - \overline{y})^2}}$$

where x and y are the sample means AVERAGE (array1) and AVERAGE (array2).

Based on this formula we have examined the correlation coefficient on how learning styles are related with the test results taken by the students enrolled on the courses, see Fig. 3. For the first course Group A of students who had the opportunity to choose the preferred way of delivered materials the correlation coefficient is in the higher positive range *(V=0.5; A= 0.29; R= 0.14; K=0.19)* than that for the second sample Group B *(V=0.24; A=-0.17; R= 0.25; K=0.53)*.

It is worth noting that for the first course "Search Engines" even though for the first group the correlation coefficient has a more positive trend still the difference varies a lot for the different learning styles, as we can observe Kinesthetic has the highest correlation coefficient for the second group probably based on what type of learning materials students were handed out and how they interacted with them, while students see this learning style as a favorite since they desire to make more hand on tasks rather than only listening in classes.
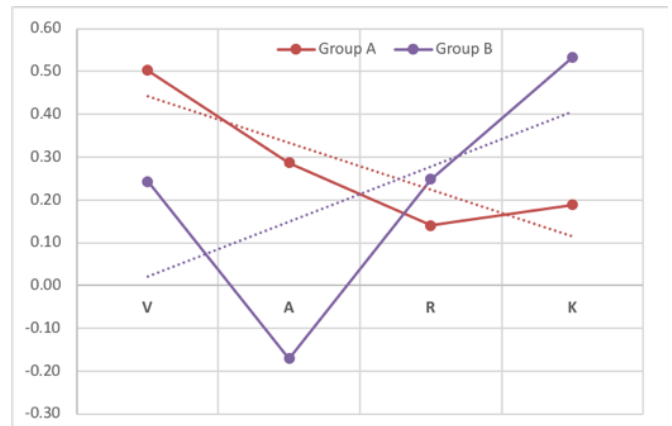

Fig. 3. Correlation coefficient of two sample groups for the first course, for the VARK learning style traits-C1
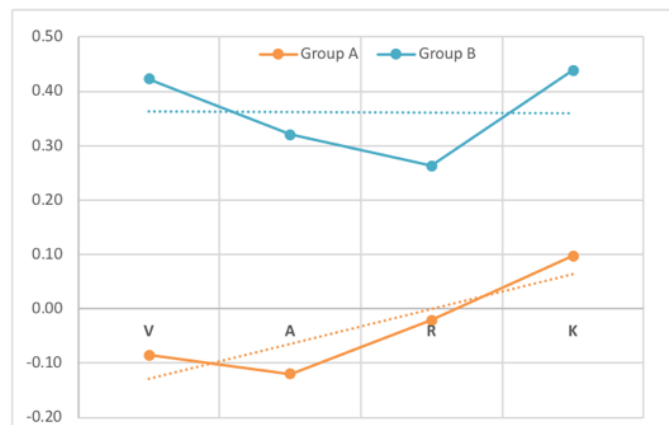

Fig. 1. Correlation coefficient of two sample groups for the second course, for the VARK learning style-C2

For the second course C2, see Fig. 4., the difference is far more significant where we can conclude on how learning styles do affect the test outcomes. In this case the first sample Group A the VARK strategy *(V=-0.08; A=-0.12; R= -0.02; K=0.10)* has values of the correlation coefficient which demonstrate a negative correlation. For the second group B the correlation coefficient is in a far higher positive range *(V=0.42; A=0.32; R= 0.26; K=0.44)*.

The data analysis of the correlation coefficient implies that the achievement of online learning has no significant relation with learning styles. The values of the coefficients are to small-scaled so that we can identify a telling correlation between VARK learning styles and test results. Nevertheless, it is important to consider that, even if a specific student learns best in a certain way, he or she should be adopted to a variety of learning experiences to become a more adaptable online learner.
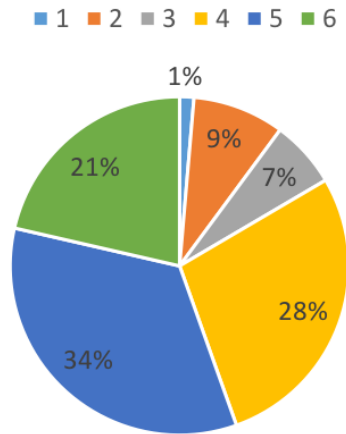
B. QoE of the two classes

Fig. 5. Combined QoE distribution for the two online courses

Quality of Experience is the measurements of how students felt and was satisfied during the online classes. Based on the study flow students had to declare how they agreed with the overall experience they underwent during the two online courses (6 – absolutely agree – to 1 – absolutely disagree).

The percentage presented in fig. 5 shows that students had an overall good experience during this experiment. Unrelated to the test results, the students overall experience with the two online courses was satisfying.

VI. DISCUSSION AND CONCLUSION

This paper is a pursuit to better understand the online teaching approach through the inquiry of learning styles. Our achieved results indicate that learning styles are not significantly related with the achieved test results how students attend and finalize online courses. More exactly we found that learning styles differ while attending online classes and based on our findings students prefer kinesthetic as the most favorite learning style.

The role of learning styles in education should be considered in the aspect of teaching delivery preferences and examination the ability to explain learning outcomes in online environments. The correlation coefficients for almost all our analyses were positively related with the sample groups which had the opportunity to choose the preferred way of delivering, but even though the value of the coefficient in all cases was in a range which shows up not a compelling role on test results. In our view, as technology matures, online education will experience important changes with respect to the type of electronic interactions between learners and instructors, further rising the difficulty of this delivery method. Such advances in complexity propose different sets of behaviors from learners to exploit results.

We view this research attempt as a potential area for more investigations and as a crucial part to make online education a more impressionable environment for the significant growth of student's shifting to these settings.

Finally, these results could help to better adapt and consolidate online classes, so that teachers are more aware of what students are looking in for while attending online classes, and so adjust to their needs and preferences to achieve the highest results. Based on the results of the QoE it proves that students do like online classes and their experience is positively related with the quality of those classes attended.

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