Using Multimedia Resources in an Online Course with respect to Students' Learning Preferences

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Abstract: - In this paper we present a research on students’ learning styles and their learning preferences in a virtual learning environment within an online course. The content of the course is offered in the form of Moodle lessons containing three different types of multimedia resources: textual, pictorial resources accompanied by text and video resources. By analyzing the results of a VARK questionnaire, which label the students’ learning styles as visual, aural, read/write and kinesthetic, and matching them with the results of students’ feedback responses indicating what type of resources the students have been using, we determine on relationship between learning styles and preferences. Students with stressed visual learning style show lesser preferences towards usage of textual resources. Students with stressed read/write learning style show lesser preferences towards the usage of video resources. Understanding the learners’ preferences leads to more effective instructional design in an online learning environment.

Key-Words: - multimedia resources, learning styles, learning preferences, online course, VARK

1 Introduction
Multimedia has a great potential to foster individualized learning in a virtual environment. The main focus of this paper is to research on the overlap of students’ learning styles and their preferences in using different multimedia educational resources in an online learning environment in order to improve instructional design, teaching and learning.

1.1 Multimedia Learning
Multimedia means using more than one delivery device in delivering information. Using multimedia resources in education refers to conveying instructional message in to two main formats – words and pictures [1]. Words include speech and printed text; pictures include static graphics (such as illustrations and photos) and dynamic graphics (such as animation and video). Different people learn differently. Multimedia learning opens up space for people to learn in a way that suits them best and easily master the material.

According to Mayer [1] there are seven multimedia principles designer must have in mind when designing multimedia instructional message. These are Multimedia Principle, Spatial Contiguity Principle, Temporal Contiguity Principle, Coherence Principle, Modality Principle, Redundancy Principle and Individual Differences Principle. According to Multimedia Principle, students learn better from words and pictures than from words alone. Contiguity Principles aim at students learning better when corresponding words and pictures are presented near rather than far from each other on the page or screen, as well as simultaneously rather than successively. Coherence principle implies that pictures and words are semantically related as Schnotz interprets [2].

1.2 Learning Styles
A person’s learning style is affected by individual traits such as personality, cognitive styles, temperaments, sensory processes and age [3]. There are many interpretations and definitions of learning styles. Kolb defines learning style as an individual’s inherited foundation, particular past life experience and the demands of the present environment that emphasise some learning abilities over others [4]. Learning style designates the composite of characteristic cognitive, affective, and psychological factors that serve as relatively stable indicators of how a learner perceives, interacts with, and responds to the learning environment [5]. Felder and Silverman postulate that when there is a mismatch between the learning environment and the learning
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style of the student, the students will become inattentive, discouraged, and discontent with the course [6].

VARK – Visual, Aural, Read/Write and Kinesthetic – is a learning style model developed by Neil Fleming (1987). It’s complimentary learning style identification instrument, the VARK questionnaire, classifies learners by their preferred mode of interaction with others based on input stimulus and output performance [6]. It provides users with a profile of their learning styles as visual, aural, read/write, kinesthetic or multimodal, for the users with more than one preference, who are bimodal, trimodal, or VARK (all four modes). These preferences are about the ways that they want to take-in and give-out information [7]. The four main categories of learning styles are described as following:

Visual – refers to learners that prefer graphical forms of information; presented in pictures, diagrams, maps, symbolic arrows, circles, etc. Visual learners learn best by seeing the material from visual displays.

Aural – refers to learners who prefer information that is heard or spoken; participating in discussions, listening to lectures, recordings, etc. Aural learners learn best when processing the information by listening.

Read/Write – refers to learners who prefer information displayed as words; reading information presented in textbooks, writing essays, etc. Verbal learners learn best by reading and/or writing.

Kinesthetic – refers to learners who prefer to experience information; by concrete examples, case studies, filed trips, labs, demonstrations, simulations, videos, etc. Kinesthetic learners learn best by touching, feeling, holding, experiencing the reality, etc. Wehrwein et al. [8] report male and female students having significantly different learning styles and stress that it is the responsibility of the teacher to address this diversity of learning styles and develop appropriate learning approaches. Heidi at all. [9] reports that most students preferred multiple modes (2 modes, 3 modes or 4 modes of information presentation). Knowing the students preferred modes can help provide instruction tailored to a student’s individual preference and overcome the predisposition to treat all the students in a similar way. Byrne at al. [10] elaborated that students will prefer learning with some types of online multimedia better than others, depending on their individual learning style as identified by the VARK questionnaire. Ramayah at all. [11] reports on technology in the classroom being only relevant to the Read/Write learning style.

Sha [12] found nine student preferences while they use the course online learning resources. It could help teacher to design better online learning resources in order to meet the learners preferences and needs, motivate student involvement, and enhance learning. Graf at al. [13] investigated the relationship between learning styles and working memory capacity in order to develop more adaptive educational systems in Moodle. Sinkey at all. [14] presents the findings of an experiment to measure the impact of multiple representations on learning outcomes, where sstudents reported very favorably on their use of the multimodal learning elements. In our previous research we have reported on usage of online resources in a fully online course attended by students with different knowledge background who obtained same learning outcome [15]. In order to improve learning process and considering that most people learn best by combined methods, and their preference can be referred to as multimodal, we develop multimodal learning resources for an online course.

2 Research and methodology
The research was performed using survey data analysis. One survey was conducted by means of the VARK questionnaire, and other surveys were conducted by means of weekly feedback questionnaires regarding the students’ usage of resources during the course. These surveys are completed by the students attending an Information Science course at the Faculty of Humanities and Social Sciences, the University of Zagreb. The course is elective for all students at the University on a graduate level and it is conducted as a fully online course via Moodle, the content management system. It covers advanced MS Office techniques for text and language processing.

2.1 Virtual Multimedia Resources
The content of the course is conveyed through ten weekly lessons in a Moodle format, each including assignments and different types of resources. The same content within each of the lessons was presented in three different types of multimedia resources: textual resources, pictorial resources accompanied by text and video resources. The usage of the resources indicates students’ preferences. By combining pictures with corresponding text we especially addressed coherence and contiguity principles implying that corresponding text and pictures should appear simultaneously and semantically related. Theoretical knowledge about basic language processing was implicitly given through practice-oriented assignments. The research involved a total sample of 72 students (62 female, i.e. 81%; 10 male, i.e. 19%) attending the course.
during the winter term in the Academic Year 2011-2012. According to students’ feedback responses on the usage of resources, we bring the percentages on the usage: textual resources – 21%, pictorial resources accompanied by text – 72% and video resources – 7%.

3 Data analysis and results
Our aim was to establish the level of correlation between the students’ learning styles detected by the VARK questionnaire and their preferences indicated by the usage of multimedia resources. Data analysis showed that the students preferred learning with some types of multimedia resources better than the others, depending on their individual learning style identified by the VARK questionnaire.

The survey data analysis is performed on the following indicators for each participant:
- Number of pictorial resources accompanied by text used during the course
- Number of textual resources used during the course
- Number of video resources used during the course
- Number assigned for visual learning style variable in VARK questionnaire
- Number assigned for read/write learning style variable in VARK questionnaire
- Number assigned for kinesthetic learning style variable in VARK questionnaire

The number of using each of the resources is expressed by values 0 to 8 considering number of course multimedia lessons. For every student’s learning style, each of the four dimensions is expressed by values from 0 to 14. The students with a single aural preference were excluded from our sample, since we did not find the aural dimension comparable to any of our resources.

The following questions were used to guide the research:
- **Question 1**: Is there association between the value assigned for visual learning style and the usage of pictorial resources accompanied by text?
- **Question 2**: Is there association between the value assigned for read/write learning style and the usage of textual resources?
- **Question 3**: Is there association between the value assigned for kinesthetic learning style and the usage of video resources?
- **Question 4**: Is there association between the value assigned for visual learning style and the usage of textual resources?
- **Question 5**: Is there association between the value assigned for visual learning style and the usage of video resources?
- **Question 6**: Is there association between the value assigned for read/write learning style and the usage of video resources?
and the usage of pictorial resources accompanied by text?

- **Question 7**: Is there association between the value assigned for read/write learning style and the usage of video resources?
- **Question 8**: Is there association between the value assigned for kinesthetic learning style and the usage of textual resources?
- **Question 9**: Is there association between the value assigned for kinesthetic learning style and the usage of pictorial resources accompanied by text?

Since the distribution of the compiled data is skewed, the analysis is based on nonparametric statistics. Therefore, the Spearman's rank correlation coefficient is used to answer the above mentioned questions. These correlations were tested to a significance level of 95% (p < 0.05).

The Spearman's rank correlation coefficient measures how one variable varies as the other does and it is applied to the ranks of the data. The data was calculated using SPSS software for statistical computing.

- **Research answer 1**: The Spearman’s coefficient (ρ=0.146) shows that the correlation between the value assigned for visual learning style and the usage of pictorial resources accompanied by text is low. However, the correlation is not significant (p=0.221).
- **Research answer 2**: The Spearman’s coefficient (ρ=0.016) shows that there is no correlation between the value assigned for read/write learning style and the usage of textual resources.
- **Research answer 3**: The Spearman’s coefficient (ρ=-0.059) shows that there is no correlation between the value assigned for kinesthetic learning style and the usage of video resources.
- **Research answer 4**: The Spearman’s coefficient (ρ=-0.237) shows that the correlation between the value assigned for visual learning style and the usage of textual resources is negative and low.
- **Research answer 5**: The Spearman’s coefficient (ρ=-0.016) shows that there is no correlation between the value assigned for visual learning style and the usage of video resources.
- **Research answer 6**: The Spearman’s coefficient (ρ=-0.090) shows that there is no correlation between the value assigned for read/write learning style and the usage of pictorial resources accompanied by text.

**Research answer 7**: The Spearman’s coefficient (ρ=-0.280) shows that the correlation between the value assigned for read/write learning style and the number of video resources used is low.

**Research answer 8**: The Spearman’s coefficient (ρ=-0.055) shows that there is no correlation between the value assigned for kinesthetic learning style and the usage of textual resources.

**Research answer 9**: The Spearman’s coefficient (ρ=-0.0119) shows that there is no correlation between the value assigned for kinesthetic learning style and the usage of pictorial resources accompanied by text.

### 4 Discussion

As shown in Table 1, there are two significant correlations between values assigned for specific learning styles, obtained by VARK, and the usage of different resources indicating the students’ preferences obtained by their feedback responses. The correlation between the value for visual learning style and the usage of textual resources is negative and low: -0.280. The second correlation between values assigned for read/write learning style and the usage of video resources is negative and low: -0.280.

By conducting a log file data analysis in further research, we will investigate on the reliability of our results, measuring both accessing to specific resources and the time spent on certain resources.

For future work, pictorial resources need to be re-designed, with a higher focus on the picture itself, reducing the amount of text. Following these guidelines, we expect to obtain more explicit preferences of visual type learners towards the usage of pictorial resources. Furthermore, interactivity including drill and practice components, needs to be added to our video resource in order to make it more appealing to kinesthetic learners.

**Table 1. Correlations between learning styles and learning preferences**

<table>
<thead>
<tr>
<th>VARK Resources</th>
<th>Visual</th>
<th>Read/Write</th>
<th>Kinesthetic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Textual</td>
<td>ρ=-0.237</td>
<td>ρ=0.016</td>
<td>ρ=-0.055</td>
</tr>
<tr>
<td></td>
<td>p=0.045</td>
<td>p=0.892</td>
<td>p=0.654</td>
</tr>
<tr>
<td>Pictorial-textual (P_t)</td>
<td>ρ=0.146</td>
<td>ρ=0.090</td>
<td>ρ=-0.012</td>
</tr>
<tr>
<td></td>
<td>p=0.221</td>
<td>p=0.450</td>
<td>p=0.319</td>
</tr>
<tr>
<td>Video</td>
<td>ρ=0.016</td>
<td>ρ=-0.280</td>
<td>ρ=-0.059</td>
</tr>
<tr>
<td></td>
<td>p=0.894</td>
<td>p=0.017</td>
<td>p=0.623</td>
</tr>
</tbody>
</table>
5 Conclusion
The correlation between the value for visual learning style and the usage of textual resources indicates that the students with visual learning style tend to show lower preferences towards usage of textual resources. The correlation between values assigned for read/write learning style and the usage of video resources indicates that the students with read/write learning style had lower preferences towards the usage of video resources. The two significant correlations between values assigned for specific learning styles and the values indicating the students’ preferences in usage of different resources, showed that students with extremely distinguished learning styles will prefer resources that do not match their learning style less.

References