

The Relationship Between Performance in a Virtual Course and Thinking Styles, Gender, and ICT Experience

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This study examines the relationship between students' performance in a virtual course and three factors: thinking style, gender, and prior experience in information and communications technology (ICT). The research focused on three categories of dependent variables: the use of communication channels (electronic mail, bulletin boards, forums, and surveys); scholastic performance (measured by grades, successful Web searches, and completion of assignments), and the students' attitudes and level of satisfaction (extrapolated from questionnaires). Independent variables included the student's thinking styles (according to Sternberg's classification), gender, and ICT experience. Subjects consisted of 110 eighth and ninth graders who were enrolled in a three-month virtual course on the retrieval and use of on-line information (see the virtual school's site, in Hebrew, at <http://aviv.org.il/info/home.htm>). Learners with the "liberal" thinking style clearly outperformed the other students in the course. The results of the research suggest that virtual courses provide opportunities for different kinds of learners, though such opportunities may be greater for some kinds of learners than for others.

Keywords: **Thinking styles, virtual course**

1 Introduction

The Internet's penetration of our lives and of both formal and informal education has created a need to examine the various aspects of this new way of learning and to explore how it fits in with different learners' needs. Which students can be expected to function better in this new learning environment? To what extent is this environment accessible to students with particular styles of thinking, and compatible with their needs? Can one predict success in a virtual course on the basis of students' thinking styles or other characteristics? Our study attempts to shed light on these questions, which take on even greater significance given the increasing computerization of schools throughout the world and their connection to the Internet.

In many schools, the World Wide Web serves as an instrument for teaching and learning, be it in classroom activities, research projects, or virtual courses. A virtual course is a Web-based learning environment in which communication occurs by means of computers. Such courses make use of the Web and its many resources to create a meaningful educational environment that facilitates and supports learning. Typically, a virtual course consists of on-line classes in which elements such as hypertext, graphics, audio, video, and animation are supported by a graphic interface that is easy to use and helps arouse interest. This Web-based environment offers access to a wide variety of resources, including libraries, museums, archives, and databases. In most cases, a virtual course employs two types of media: asynchronous, such as class bulletin boards, forums that promote cooperative learning, and electronic mail for correspondence among teachers, students, content experts, and fellow Internet users; and synchronous, such as text-based chat rooms and video conference calls, which enable students who are separated geographically to engage in discussions and brainstorming. The various media support active, independent learning at an individual pace, as well as cooperation among students, between the student and teacher, among teachers, and between the class and other communities [2] [8]. Thus, models of Internet-related instruction and learning emphasize challenging activities that provide students with relevant learning experiences,

promote cultural awareness, and foster information-gathering skills. Students take responsibility for the processes of learning and teaching, largely as a result of opportunities provided by computers and telecommunications. With the Internet, students have access to up-to-date information; join virtual communities; and navigate through sites as they follow links. These features offered by the Web facilitate the acquisition of higher-level—analytical and critical—thinking skills and take the students from the curricular objectives to active learning environments [5] [7].

Virtual courses have the potential to provide new solutions to the constant search for teaching tools that will address the needs of different kinds of students. These needs derive from the differences in the way people acquire knowledge, formulate ideas, feel, and behave—in other words, differences in their "style" [1]. A "style" is a way of thinking. It is not an ability; it is the preferred way of using the abilities that one has. Thinking styles do not fall in the domain of either abilities or personality traits but, rather, in the area of interface between them [9]. Each of us has not one thinking style but a profile of styles. Although we "prefer" certain styles, we are not locked into any single one, as the thinking style is likely to change according to the task and the situation. An awareness of thinking styles can help people better understand why certain activities are appropriate for them and others are not and, consequently, why one person is suited to a particular activity whereas another person is not.

Researchers have proposed a variety of theories about thinking and learning styles, all of which attempt to describe how people think and learn. In the classroom, these theories are important in terms of the teacher, the student, and the institution. Almost without exception, the way in which a person teaches tends to be most effective for students whose thinking style is similar to that person's. Moreover, teachers are more likely to value students whose learning and thinking styles resemble their own [10]. Maoz and Barlev [3] observed that the use of teaching methods that were compatible with the individual learning styles of the students raised their levels of achievement and improved their self-confidence. Through various approaches to learning and thinking, educators are now actively engaged in attempting to understand and identify individual differences, and the knowledge that is accumulating will constitute a significant new tool for teachers and schools.

A virtual course is appropriate for different kinds of students because of its flexibility, its ability to handle various kinds of information, its collaborative value, and the high degree of control that it gives students over their own learning process. Quintana [6] offers examples of different styles of learning and features of the Internet that are compatible with each style, such as the following:

- Visual and spatial styles: Images, three-dimensional models such as those created through Virtual Reality Modeling Language (VRML), and all the other typical Internet features
- Musical and auditory styles: The transmission of audio and video sequences
- Intrapersonal communication (one's ability to understand one's own feelings, motives, and goals): Interactive questionnaires
- Interpersonal communication: Electronic mail, forums (in audio and video formats), and distribution lists

Various models exist for virtual courses. One example is a course in which students study completely independently, in their own free time, and all interactions with peers and the on-line instructor take place by means of telecommunications. In contrast, our study concerns a virtual course that is conducted in a classroom setting with a live teacher; in addition, students communicate with another teacher via the computer.

2 The goal of the study

This study seeks to determine whether a relationship might exist between students' performance in a virtual course and the students' thinking styles, gender, and prior experience with information and communications technology (ICT).

3 Method

This section describes the variables that were examined in the study, the subjects who participated, and the procedure that was followed.

3.1 Variables

The students' performance is represented by the dependent variables, which fall into three categories:

- Use of asynchronous communication channels—the extent to which students communicated with the on-line teacher via electronic mail and participated in bulletin boards, forums, and surveys. Each instance of such use was documented, and then all the instances were tallied.
- Scholastic performance—grades, successful Web searches, and completion of assignments as instructed. By "successful Web searches" we refer to the number of sites that a student found that satisfied the needs of the assignment.
- Attitudes and satisfaction—the students' attitudes toward studying in a virtual course and their level of satisfaction from this course. We ascertained the students' attitudes from the answers that they provided in questionnaires. The students were asked whether they prefer virtual courses or traditional instructional media; whether they would be willing to study with an on-line instructor only, in the absence of a classroom teacher; whether they felt the virtual course enabled them to study at their own pace; and whether they were satisfied with and enjoyed the course.

The independent variables consist of thinking style, gender, and prior experience with ICT.

The term *thinking style* is described by Sternberg [9] in reference to his theory of mental self-government. The types of thinking styles that our study examines are as follows:

- **Global:** Prefers to deal with relatively large, abstract issues
- **Local:** Likes concrete problems that involve working with details
- **Internal:** Is concerned with inner worlds, is task oriented, and prefers to work alone
- **External:** Tends to be extroverted, people-oriented, and outgoing
- **Liberal:** Likes to go beyond existing rules and procedures, to maximize change, and to seek out situations that are somewhat ambiguous
- **Conservative:** Prefers to keep to existing rules and procedures, to refrain from change, and to avoid ambiguous situations where possible

3.2 Subjects and procedure

The subjects consisted of eighth- and ninth-grade students (N=110) in two Israeli schools that are part of the ORT network, a group of schools that specialize in technology and science. One school is in the Tel Aviv metropolitan area, and the other, in a city in the southern part of the country. The students took a virtual course on the retrieval and use of on-line information, a course given by Aviv, a virtual school based in Israel (see Aviv's Web site, in Hebrew, at <http://aviv.org.il/info/home.htm>). Conducted in the students' own school computer laboratory, the course consisted of 12 weekly sessions of two hours each. Two teachers were involved—one in the classroom and one who communicated with the students by means of the computer. In this paper, we refer to the latter as the "virtual" teacher.

During the course, we monitored and recorded student participation in interactive, asynchronous communication (electronic mail, bulletin boards, and forums) and observed three randomly chosen class sessions. Toward the end

of the course, the students filled in three questionnaires, whose objectives were, respectively, to obtain relevant personal information, to ascertain the students' thinking styles [9], and to gauge how the students performed in the course, their attitudes, and the degree of their satisfaction. In addition, we interviewed the teacher and held a discussion with the classes to find out more about the students' attitudes toward studying in a virtual course, their level of interest, and the aspects of the course that they considered positive and negative. When the students finished the course, we recorded their grades. Quantitative methods were used to analyze the data.

4 Results

Table 1 presents the degrees of correlation between the students' performance in the virtual course and their thinking styles, gender, and prior experience with ICT.

Category of Variable	Variable	Thinking Style ¹						Gender	ICT Experience
		Glo	Loc	Int	Ext	Lib	Con		
Use of asynchronous communication channels	Bulletin board								0.2*
	Forums					0.21*			0.32*
	E-mail messages to virtual teacher								0.21*
	Surveys		0.2*			0.25**			
Scholastic performance	Grades								0.5*
	Successful Web searches		0.25*	0.25*	0.23*	0.3*			
	Completion of assignments as instructed	0.23*		0.22*		0.23*			0.36*
Attitudes and level of satisfaction (as expressed in questionnaires)	Preference for virtual course (as opposed to traditional course)								
	Willingness to study with virtual teacher only (without classroom teacher)		0.19*	0.23*		0.29*			0.3*
	Belief that virtual course facilitates individually-paced study			0.31**	0.21*	0.31**			0.23*
	Satisfaction with virtual course					0.33*			
Total number of variables	11	1	3	4	2	7	0	0	7

Table 1. Correlation between performance in a virtual course and the factors of thinking style, gender, and prior ICT experience

¹ Legend: **Glo:** Global style **Int:** Internal style **Lib:** Liberal style
 Loc: Local style **Ext:** External style **Con:** Conservative style

* p<0.05

** p<0.01

As seen in the table, performance in the virtual course is positively correlated with a number of thinking styles, some of which show a stronger correlation than others. The liberal style is correlated with seven of the eleven variables, whereas the conservative style is correlated with none. A greater correlation with performance is demonstrated by the internal style (four variables) than the external style (two), and, similarly, the local style shows a stronger correlation with performance than the global style (three variables as opposed to one). Prior ICT experience is found to be correlated with seven of the variables. The table indicates that the r values of the correlations are low, and no correlation exists at all between the students' gender and any of the variables.

5 Discussion

Students with the liberal thinking style clearly outperformed the other students in the study. We can also see that students with the external style performed better than those with the internal style, and, similarly, students whose learning style is local functioned better in the course than those whose style is global. These results suggest that virtual education can provide opportunities for different kinds of learners, though such opportunities may be greater for some kinds of learners than for others. Students with a liberal thinking style might well become active users of asynchronous communication channels, while students whose thinking styles are global, local, internal, or external are likely to perform well in tasks related to searching for information and integrating various pieces of information in their work.

The students who completed the course most successfully (as measured by their grades) were those who had prior experience in ICT. The amount of experience is correlated with almost all the aspects of performance that the study examined. Similarly, these students were the most active users of asynchronous communication channels (bulletin boards, forums, and electronic mail), which constitute a major component of virtual courses. In general, the degree to which the subjects of the study used asynchronous communication was smaller than expected.

No differences were observed between the performance of the female students and that of the male students in any of the variables examined in the study.

6 Conclusions and Implications

Our research suggests that virtual education can provide a learning environment that is compatible with a wide range of personalities and needs, and hence such courses would be appropriate for the general school population. By assessing students' thinking styles, educators may be able to predict which students can be expected to perform better in virtual courses. McIsaac and Gunwardena have found that some combination of thinking style, personality characteristics, and self-expectations can be predictors of success in distance education programs. Those students who are most successful in distance-learning situations tend to be independent and prefer to control their own learning situations [4].

Furthermore, the results of our study indicate that schools should provide training in computer literacy and computer-based communications to improve the students' chances for success in an on-line learning environment.

The planning and development of virtual courses will necessarily benefit from investigations of students' behavior, their learning patterns, and the degree to which they are suited to virtual education. Similarly, the various technological options for constructing such learning environments should be examined. Such research will enable educators to exercise an informed use of technology; to apply this knowledge to the development of tools that will enhance the teaching and learning processes; and to offer virtual courses that conform to the needs of the broadest range of students.

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