Synchronous vs. Asynchronous Tutorials: Factors Affecting Students' Preferences and Choices

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Abstract

This study aimed to determine the factors that affect students' preferences regarding tutorial modes. A learning-habit inclinations questionnaire (LHIQ) was constructed and administered to 288 students. Factor analysis revealed four factors: "time management," "ease of access" to learning materials, "positive aspects of interaction," and "negative aspects of interaction." Seven satellite-based synchronous tutorials were delivered to 92 students in a Research Methods course. The following semester, 73 other students taking the same course received the same seven tutorials with the same tutor but in a mixed mode of delivery: three similar satellite-based synchronous tutorials and four satellite-based asynchronous videocassettes containing the recorded tutorials of the previous semester. Attitudes toward different components of the learning environments were measured and the LHIQ was administered. Results revealed that preferences of tutorial mode were determined by students' learning-habit inclinations: Those who prefer the satellite-based synchronous tutorials have stronger views toward the positive aspects of interactions and score lower on the need for autonomy and access to learning materials than those who prefer the satellite-based asynchronous tutorials. Methodological (lessons on field research), theoretical (significance of learning styles in effective teaching and learning), and practical (flexibility in teaching practices) implications are discussed. (Keywords: Learning styles, synchronous vs. asynchronous learning, learning autonomy, individual differences, distance learning.)

INTRODUCTION

Information technologies (IT) in general—and learning technologies in particular—allow for the individualization of learning. In contrast to traditional, teacher-led learning programs, IT enables more innovative, learner-centered programs that rely on a combination of high-quality, interactive learningware, asynchronous and synchronous communications, and individualized mentoring. IT enables flexibility in nearly every aspect of teaching and learning (in kinds of materials, means of delivery, time and place of learning, etc.), thus potentially allowing for a better match between the kind of pedagogy and the student's preferences regarding the learning environment (where, when, how, with whom, what pace, etc.). The main goal of this research is to examine the relations between learning preference or learning style and technology-based delivery methods.

The trend toward the individualization of learning can be seen in the research shift of recent years regarding the effectiveness of technology-mediated instruction. For more than two decades, hundreds of studies were conducted that compared conventional face-to-face instructional environments with different technology assisted instructional environments. Although their purpose was mainly to prove the effectiveness of learning technologies, this goal was not achieved. A

frequent research result was "no significant difference was found" (for a review, see Russell, 1999). Recently, this line of research has been under heavy attack in terms of its purpose and methodologies. Regarding its purpose, it was claimed that pedagogy is the key factor in learning effectiveness whereas technology is only a delivery medium (Clark, 1994). Moreover, the effectiveness of a certain pedagogy or instructional method depends heavily on the student—his or her learning habits, learning styles, preferences, and characteristics are intervening variables that need to be taken into account. That is, there are no instructional methods nor educational technologies that are effective for all. One of the intervening variables often mentioned in the literature is the student's learning style.

Learning styles

The concept of learning styles has been defined in various ways (see for example, Sternberg, 1997). In very general terms, it relates to the cognitive strategies that individuals use to acquire and use knowledge: the individual preferential strategies for gathering, interpreting, organizing, and thinking about new information (Gentry & Helgesen, 1999). Numerous models of learning styles have been postulated over the last twenty years, on which many scales and questionnaires have been based: the "learning style inventory" (based on Kolb's 1984 work), "What is your personal learning style?" (Kanar, 1995), "Multiple intelligences" (e.g., Joyce, 2003; Teele, 1992 and others, all based on Gardener's 1993 theory of multiple intelligences), the Gregorec's Style Delineator (Gregorc, 1984), the Canfield Learning Styles Instrument (Canfield & Knight, 1983), and the Myers-Briggs Type Indicator (Myers & McCaulley, 1985), to mention but a few.

Curry (1983) suggested the analogy of an "onion" to represent the various "learning style" constructs; her style onion consisted of three layers. In the outermost layer she included "instructional preferences" theories, which focus on environmental factors such as class size, learning groups, or presence of authority figures. These factors influence the individual's ability to interact with and respond to the learning environment. Theories that are concerned with an individual's intellectual approach to processing information were encompassed in the middle layer. Theories of this type deal with different types of learners' ways of processing information (e.g., converger, accommodator, diverger, and assimilator in Kolb's 1984 theory; concrete sequential, concrete random, abstract sequential, and abstract random in Gregorc's 1984 theory). In the inner layer, Curry placed theories that perceive learning styles as personality traits. The Myers-Briggs Type Indicator (Myers & McCaulley, 1985) is a representative example, in which learners are characterized along four dimensions of personality (extraversion/introversion, sensing/intuition, thinking/feeling, and judging/perceiving). As will be shown below, the two questionnaires that were developed for the purpose of the current research relate to the three layers.

Learning styles in distance education environments were not frequently studied. Gee (1990) compared in-class students' learning style to teleconference distance learners who were taught simultaneously by the same instructor. This study showed that successful distance learners preferred an independent learning environment, while successful on-campus students preferred collaborative

work. Similarly, Diaz and Cartnal (1999) found that online students were more independent than on-campus class students, which favored collaborative learning. Dille and Mezack (1991) used learning styles to identify predictors of high risk among community college telecourse students. They found that successful students had lower scores on their preferences for concrete experiences than did non-successful students. Students who need concrete experience are expected to require more interactions with peers and teachers. Presumably, distance education is an inadequate learning environment for those who need concrete experience. Gunawardena and Boverie (1992) conducted a study that examined the interaction of learning styles, media, method of instruction, and group functioning in distance learning classes that used audiographics conferencing as the predominant delivery medium. They found that learning styles did not influence the ways students interact with media, their instructor, or other learners. However, learning styles did affect satisfaction with activities involving class discussions and group activities.

The technology used by Childress and Overbaugh (2001) is of special interest for the current research. Childress and Overbaugh investigated the relationships between learning styles and performance among preservice teacher taking a one-way video, two-way audio computer literacy course. They found a relationship between learning style and achievement, as measured by final exam performance, but no relations when achievement was measured by final course grade. Field-independent learners (students who can provide their own structure of learning, do not need much social support or activity, and are intrinsically motivated) scored significantly higher on the course final exam than field-dependent learners.

The above findings, along with hundreds of learning style studies done on in-class populations of students, suggest that students should no longer be perceived as a homogenous group but as individuals. Rather than maintaining a fixed view of what all students want or what all students need, we have an obligation to find out what their preferences and choices are. Moreover, instructional designers need to be flexible and create learning environments that enable greater choice for students. They shall think more creatively about how to develop course designs that respond to a greater variety of learning styles. It seems that advances in distance education technologies afford fulfillment of these recommendations. The purpose of the current study was to examine the influence of learning style on learning by two educational delivery methods: Satellite-based synchronous tutorial and satellite-based asynchronous videocassettes. The practical needs for this research and the difference between these two methods follow.

Satellite-based synchronous tutorials vs. satellite-based asynchronous videocassettes

The Open University of Israel (OUI) is a distance learning university that serves students all over Israel. Learning is based mainly on specially written textbooks and tutorial sessions (once a week or once in three weeks) held in classrooms in study centers throughout the country. Indeed, meetings with tutors at study centers bring the university closer to the students and allow for face-to-

face interaction between tutors and learners and among the learners themselves. However, sometimes such sessions cannot be organized, as it is difficult to find enough expert tutors for all the groups of students, or because students are so dispersed that although many are registered for a course, there are not enough students in each region to justify hiring a tutor.

As a solution to these problems, synchronous virtual tutorials—using satellite communication (given by the best tutor) from a studio at the university to classrooms throughout the country—have been conducted during the last five years. The communication between the tutor and the students is visual-, audio-, and data-based. The visual communication is unidirectional from the studio to the classrooms (where the tutor is seen on a large TV screen). Audio information is bidirectional (from the studio to the classrooms and from each classroom to the studio and other classrooms using special satellite phones). The lecturer and the other students can hear the student who has been given the floor by the tutor. With respect to data communication, the lecturer can present multiple-choice questions to the students, ask them to answer the questions by pressing an appropriate button on the satellite phone, and immediately present the distribution of answers to the students.

Seven such two-hour satellite tutorials during a 15-week semester were conducted in a "Basic Research Methods" course for social science students over five semesters. A number of factors gave rise to second thoughts about the choice of synchronous satellite-based tutorials as the ultimate solution: (a) only 25% of the registered students attended the tutorial sessions; (b) most students who attended the tutorials did not participate actively in the interactions initiated by the tutor nor did they initiate any interaction themselves; and (c) the satellite technology proved to be extremely costly.

Each satellite-based synchronous tutorial is recorded on a videocassette. These cassettes can be sent to students as asynchronous tutorials. Table 1 compares satellite-based synchronous tutorials to similar tutorials delivered on videocassettes.

Table 1: Factors Differentiating Between Satellite-Based Synchronous Tutorials vs. Satellite-Based Asynchronous Videocassettes

Dimension	Satellite-based synchronous tutorials	Satellite-based asynchronous videocassettes
1. Location of tutorial	In a classroom	At home
2. Time of tutorial	Specific: tutor and students at the same time	Flexible: at students' convenience
3. Accessibility of materials	Not accessible after the end of the lesson	Accessible at any time
4. Interaction with the tutor during the tutorial	Possible	Impossible
5. Interaction with other students during the tutorial	Possible	Impossible
6. Cost of technology	High	Low

As can be seen from Table 1, the two types of tutorials differ in the amount of *control* the student has over the learning process (the first three dimensions) and in the amount of *synchronous interaction* between tutor and students (dimensions 4 and 5). Learner control is known to be associated with active learning and student-centered learning (Doherty, 1998). Interactions between the student and the tutor and among the students themselves are one way of increasing instructional immediacy and social presence, which are positively related to students' satisfaction and motivation in learning (Christophel, 1990; Swan, 2001).

In light of students' lack of attendance and participation in the synchronous tutorials and the above comparison, we decided to study students' preferences regarding the mode of tutorial. The three research questions were:

1. What are students' attitudes towards the tutorial modes and their dimensions? This question reflects the outer layer of Curry's "onion" model—that is, attitudes towards the learning environment.
2. When choosing between tutorial modes, what are the relevant learning habit inclinations? This question manifests the inner layer of Curry's model—that is, aspects of students' personality.
3. Are students' attitudes and preferences related to their inclinations in terms of learning habits? This question aims to examine the relationships between the outer and the inner layer of the "onion" model.

METHOD

Participants

Two groups of students taking the Research Methods course took part in the study. Both groups had similar learning material, similar tutorial content, and a similar tutor. However, they differed in the tutorial delivery technology:

The synchronous learning group (Group 1) consisted of 92 students who took the course in the fall semester of 2000. This group had seven two-hour satellite-based synchronous tutorials with their tutor.

The mixed learning group (Group 2) consisted of 73 students who took the course in the spring semester of 2001. They received four satellite-based asynchronous videocassettes (based on the satellite-based synchronous tutorials recorded during the previous semester) and three satellite-based synchronous tutorials with the same tutor (similar to those in the previous semester).

Questionnaires

A feedback questionnaire was constructed for each group. Regarding the synchronous satellite-based tutorials, both questionnaires contained items relating to: (a) rate of attendance, (b) attitudes towards the tutor and the tutorials, (c) attitudes regarding the advantages and disadvantages of meeting and interacting with peers, and (d) comparisons between face-to-face tutorials and satellite-based synchronous tutorials. The synchronous learning group (Group 1) was also asked about their attitudes toward a hypothetical satellite-based asynchronous mode of tutorial on videocassettes.

For the mixed learning group (Group 2) in addition to the above (a–d) items, the feedback questionnaire contained items on the four satellite-based asynchronous videocassettes. These were similar to those relating to the synchronous tutorials but with reference to the asynchronous videocassettes. Students in the mixed group were also given items that asked them to compare the three modes of tutorials: satellite-based synchronous, satellite-based asynchronous, and face-to-face.

A Learning-Habit Inclinations Questionnaire (LHIQ) was constructed that included items on four dimensions, based on the differences between the two kind of tutorials as presented in Table 1: (a) the importance of autonomy in management of learning time, (b) the importance of ease of accessibility to all learning materials, (c) the importance of synchronous interactions with the tutor, and (d) the importance of synchronous interactions with other students. For each of the four dimensions, a number of statements were formulated that differed in the kind of influence (affective or cognitive) and the direction of that influence (positive or negative). For example, with regard to time management:

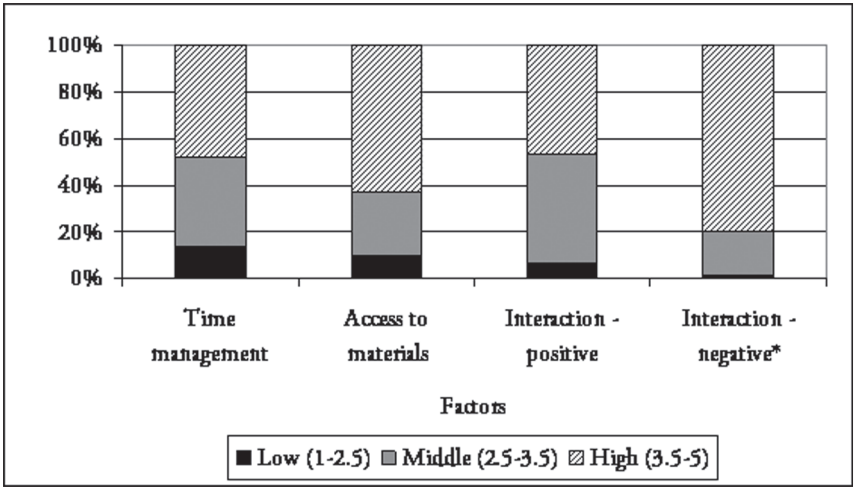
1. When I am responsible for my pace of learning, I feel I have control (positive, affective)
2. When I am responsible for my pace of learning, I feel helpless (negative, affective)
3. My learning is more efficient when I am responsible for my pace of learning (positive, cognitive)
4. My learning is more efficient when the timetable of the course is determined by the teaching team (negative-no autonomy, cognitive).

The questionnaire included 56 statements (in random order) on a Likert scale from 1 ("doesn't describe me at all") to 5 ("describes me very well").

Testing the Learning Habit Inclination Questionnaire (LIHQ) reliability

The LHIQ was administered to 288 students taking the same Research Methods course, but not taking part in the main part of the study. Factor analysis was performed on the data. The first analysis revealed no differences between cognitive and affective components. A second factor analysis was performed after excluding nine items that did not significantly contribute to any of the factors, revealing four independent factors (scales): (1) Time management (high score indicates learning autonomy), (2) Ease of accessibility to learning materials (high score indicates the student's need to "possess" all materials), (3) Positive aspects of interaction (high score indicates that the student holds strong views regarding the positive aspects of interactions—with the tutor and with other students) and (4) Negative aspects of interaction (high score indicates that the student holds weak views regarding the negative aspects on interactions). Although there was no differentiation between "Interaction with the tutor" and "Interaction with other students," there was differentiation between "positive" and "negative" aspects of interaction[1]. Thus, four scores were con-

[1] Contrary to the intuitive perception that views the two extremes of a dimension (e.g., high and low) as negatively correlated, research in psychology on attitudes demonstrates that often the end points of a dimension are two independent factors (Eagly & Chaiken, 1998).



** A high score indicates that the student holds weak views regarding the negative aspects of the interaction*

Figure 1: Distribution of Learning-Habit Factors (n=288)

structed for each student, one for each factor. No correlation was found for any of the scores and the following variables: gender, age, and how veteran the student was (i.e., the number of credits accumulated at the OUI). Reliability scores for each of the scales (Cronbach's alpha) was greater than 0.9.

Figure 1 presents the distribution of the 288 students on each factor according to the following categories: low agreement with the statements (1–2.5), middle agreement (above 2.5 and up to 3.5), high agreement (above 3.5).

Close to half of the students (48.1%) agreed strongly with statements indicating a preference to manage their learning time themselves, while most of the rest expressed no strong views on these items. Most students felt strongly about possessing all learning materials. Students were divided between the "middle" and "high" categories in their responses to the statements regarding the positive aspects of interaction (e.g., "the presence of other students in class increases my motivation"). A large majority of students (79.2%) disagreed with statements regarding the negative aspects of interaction (e.g., "questions by students disrupt the tutorial").

Table 2 presents the correlations between the factors. These can give an indication of discriminant validity: Low correlations indicate distinctive dimensions.

The only high correlation is between the first two factors: The more the students prefer to manage their learning time, the more they prefer to have all the

Table 2 Intercorrelations Between Factors (n=288)

Factors	1	2	3	4
1. Time management	--	.51**	- .13*	.07
2. Access to materials		--	.09	.12*
3. Interaction—positive			--	.28*
4. Interaction—negative				--

**p< .05 **p< .01*

materials at hand. Though the two interaction factors are significantly correlated (.28), the correlation is low, indicating that the two factors are independent and are not the opposite sides of one factor. Statements regarding the possible positive effects of interactions refer to different dimensions than those regarding the possible negative effects.

Procedure

At the end of their semester of studies students in both groups got the feedback questionnaire and the LHIQ questionnaire: The synchronous learning group (Group 1) at the end of the fall semester and the mixed learning group (Group 2) at the end of the spring semester. They were instructed to answer the feedback questionnaire first and the LHIQ questionnaire second.

Forty-three of the 92 students (46.7%) in Group 1, and 31 of the 73 students (42.7%) in Group 2 responded. Heberline and Baumgartner (1978) found that the average response rate when a mail survey is used is 48%, with a large standard deviation (almost 20%) depending on survey subject, sample, reward, and so on. Thus, the current study's response rate is not an exception in behavioral science research.

RESULTS

Students' attitudes towards the two tutorial modes and their dimensions

On average, Group 1 students participated in 2.9 of the 7 satellite-based synchronous meetings (41.4% of respondents). Group 2 students participated on average in only 1.1 of the 3 similar meetings (36.7% of respondents). This difference is not significant. All the audio and visual characteristics of the two technologies used were perceived to have high quality by all students. From reports of Group 2, the students seem to have created a learning environment at home in which others did not disturb them while they were watching the tutorial.

With regard to the activities associated with the satellite-based asynchronous videocassettes, 41.9% of the responding students in Group 2 reported that they watched all four lessons; of these, 91.7% stated that they watched them only once, 56% used the back and forward option, 66.7% summarized while watching (most by stopping the video) and most of those who summarized (81.2%) indicated that they would read the summary before the final examination.

Group comparisons. Groups 1 and 2 did not differ significantly in gender (males: 58.5% and 57.6% in the two groups, respectively) and age (mean age: 29.6 and 30.0, respectively). There were no significant differences between the groups on academic achievement prior to the course (mean GPA: 78.8 out of a possible 100 in Group 1, 79.8 in Group 2), and on final course grade (mean score: 71.2 for Group 1, 72.8 for Group 2). No significant difference were found for any of the learning-habits inclinations variables (time management: 4.5 vs. 3.4, access to materials: 4.0 vs. 3.9, interaction-positive: 3.1 vs. 3.2, and interaction-negative: 3.8 vs. 3.9 for Groups 1 and 2, respectively). Both groups received the same learning materials (books and tutorials) and the same tutor taught both groups. As all these variables were controlled, they cannot be considered an alter-

native explanation for any of the results reported below concerning differences in the students' attitudes towards the different learning technologies used and their preferences (The Institute for Higher Education Policy, 1999).

Groups 1 and 2 evaluated the tutor and the satellite-based synchronous tutorials. Students were asked about the tutor's expertise, teaching pace, attentiveness to students, and ability to arouse interest and clarify the material as well as his command of the technology. They were also asked to rate the synchronous tutorials on a number of dimensions (how significant, interesting, and organized they were, as well as the extent to which they contributed to students' knowledge and understanding of the material). On average, the tutor and the satellite-based synchronous tutorials were rated high on different aspects (such as interest, clarity, organization) with no significant differences between Group 1 and Group 2. Group 2 students were asked to evaluate the tutor and the satellite-based asynchronous videocassettes in a similar manner (not including questions regarding the tutor's attentiveness to students and command of technology, which were not relevant in the asynchronous mode of tutorials). Students' ratings of the tutor and the synchronous tutorials were compared to their ratings of asynchronous videocassettes (t-test for dependent variables). No significant differences were detected. Thus, we can conclude that when the same tutor gives the same tutorials to similar students, the evaluation of the tutor and the lessons are independent of the technological setting (synchronous vs. asynchronous). This result is in line with Clark's (1994) notion that pedagogy, not technology, is the key factor in learning effectiveness.

Attitudes toward interaction components. In both groups, students were asked to indicate whether the tutor devoted (1) too much time, (2) enough time, or (3) too little time to interaction with students. With regard to the synchronous tutorials, 73% of respondents were satisfied with the amount of interaction (no significant difference between the groups). Respondents in Group 2 were asked the same question twice—once for the synchronous lessons and once for the asynchronous lessons. Most of them indicated that there was enough time allocated to interactions in both types of tutorials and the difference in response to the two questions was not significant. Most respondents in both groups (82.7%) indicated that they participated less in synchronous satellite tutorials than in face-to-face tutorials. Table 3 describes the results concerning the interaction components in the satellite-based synchronous tutorials in Groups 1 and 2. All questions were Likert-type items on a scale of 1 to 5.

None of the differences are significant, indicating that having fewer satellite-based synchronous tutorials (three instead of seven) does not affect students' attitudes toward the interaction components of the tutorials.

Table 4 compares students' attitudes towards the interaction components of satellite-based synchronous tutorials to parallel components of the satellite-based asynchronous videocassettes. The numbers given to questions in Table 4 stem from those in Table 3. None of the differences (for identical or similar questions) were significant (t tests for two dependent variables). That is, the presence of other students was not perceived as important irrespective of the opportunity to communicate with them in real time.

Table 3: Mean Ratings of Interaction Components of Satellite-Based Synchronous Tutorials (Groups 1 and 2)*

Questions	Group 1 M	Group 1 SD	Group 2 M	Group 2 SD
During the satellite lesson, to what extent…				
1. when you wanted to ask a question or respond, were you given the floor?	4.32	0.86	4.14	0.57
2. are you disturbed by the fact that the tutor can't see you?	2.53	1.34	2.38	1.36
Other students in my class…				
3. are important to me from a social perspective	2.66	1.10	2.24	1.09
4. are important to me from a learning perspective	2.72	1.20	2.76	1.09
5. disturb me during the lesson	1.69	0.97	1.57	0.87
Students in other classrooms…				
6. are important to me from a social perspective	1.38	0.75	1.38	0.87
7. are important to me from a learning perspective	1.69	0.97	1.86	1.01
8. disturb me during the lesson	1.31	0.59	1.33	0.48
Questions by other students and the tutor's answers…				
9. contribute to my learning	3.34	0.86	3.35	0.93
10. disturb my learning	2.28	0.99	2.19	1.08

** Scale: 1 - "none at all"; 5 - "very much"*

Are there any correlations between the different responses regarding the benefit and the possible harm of interactions? Correlation coefficients were calculated between the different interaction questions (in the synchronous tutorials) for the combined group (Groups 1 and 2). There are significant positive correlations between the perceived academic contribution of other students and the perceived social contribution of other students. This is true regarding both students within the class (0.79), and students in other classes (0.52). Moreover, the perceived contribution of the students' questions and tutor's answers correlates with the perceived academic and perceived social contribution of other students (in the student's class and in other classes). These correlations indicate that students did not distinguish between the kind of interactions (academic or social) or between the sources of interactions (in-class vs. out-of-class) as factors affecting the importance of interactions.

Preferences for different learning methods. Participants in Groups 1 and 2 were asked the following question: "Below are two types of tutorials with which you are acquainted: face-to-face tutorials and satellite-based classroom tutorials. On the assumption that the same tutor teaches the tutorials, mark with an X the method that you believe is best for learning with respect to the dimensions below." Eleven dimensions were listed:

Table 4: Students' Attitudes towards Interaction Components in Satellite-Based Synchronous Tutorials and Satellited-Based Asynchronous Videocassettes (Group 2)

Questions	Group 2 Synchronous [a] M	SD	Group 2 Asynchronous M	SD
3a. Are other students in my classroom important for me from a social perspective?	2.06	0.83		
3b. Do I miss the presence of other students from a social perspective?			1.94	1.08
4a. Are other students in my classroom important to me from a learning perspective?	2.53	1.01		
4b. Do I miss the presence of other students from a learning perspective?			2.00	1.12
4a. Are other students in my classroom important to me from a learning perspective?	2.53	1.01		
4c. Are other students in the recorded lesson important to me from a learning perspective?			2.35	1.06
5a. Do other students in the classroom disturb me during the lesson?	1.59	0.94		
5b. Do other students in the recorded lesson disturb me during the lesson?			2.06	1.00
9. Do questions by other students and the tutor's answers contribute to my learning?	3.13	0.81	2.81	0.75
10. Do questions by other students and the tutor's answers disturb my learning?	2.35	1.11	2.41	1.18

[a] *The results in the first two columns of this table are not the same as those in the last two columns of Table 3 because not all students in Group 2 answered both kinds of questions, as necessary for a within-students comparison.*

1. I understand the tutor better
2. I concentrate better
3. It is easier for me to summarize the tutorial
4. I ask more questions
5. I answer more questions
6. I enjoy the lesson more
7. I understand the material better
8. The questions I ask get more responses
9. I feel that I have better control of the situation
10. I feel more obligated to attend the tutorial
11. I prepare myself better for the tutorial

For each dimension, the proportion of face-to-face choices was calculated (for each group) and a Chi-Square test for two independent groups was performed to identify differences. None of the results were significant, thus reinforcing the conclusion that having fewer synchronous tutorials does not affect the students' attitudes towards this type of teaching/learning. Face-to-face tutorials were consid-

ered advantageous with respect to 10 of the 11 cognitive and affective dimensions (for most dimensions, face-to-face tutorials were chosen by more than 70% of the respondents). On the last dimension (I prepare myself better for the tutorial), only 48% in Group 1 and 66.7% in Group 3 chose the face-to-face tutorial as better.

Group 2 students were asked an additional question but with respect to three types of tutorials: face-to-face tutorials, satellite-based synchronous tutorials and satellite-based asynchronous videocassettes. In addition to the 11 dimensions listed above, five more were added (I remember more, It is more convenient, I prepare a written summary, I control my learning pace, and Overall). For most dimensions most students chose face-to-face tutorials. For three dimensions ("It is more convenient," "it is easier for me to summarize," and "I control my learning pace"), students chose asynchronous videocassettes over the other types of tutorials (for convenience, easy to summarize, and control, 51.9%, 57.1%, and 77.8%, respectively). When asked to make an overall choice between satellite-based synchronous tutorials and satellite-based asynchronous videocassettes, 60.7% chose the asynchronous mode while only 32.1% chose the synchronous mode.

Group 1 students were also given a hypothetical choice between satellite-based synchronous tutorials and satellite-based asynchronous videocassettes (hypothetical, as they didn't experience the latter). On most dimensions, the dominant choice was satellite-based asynchronous videocassettes (except for "I am more involved in the learning process" and "I am more active"). When asked to make an overall choice between the two, 76.3% chose the asynchronous mode and only 23.7% chose the synchronous mode.

Learning habits, attitudes toward interaction components and preferences of tutorial modes

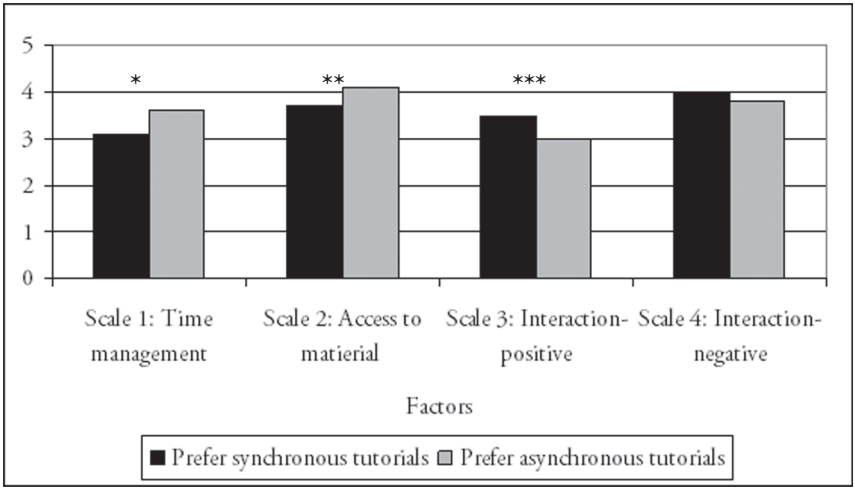
Learning habits and attitudes towards interaction components. Do learning-habit inclinations, as measured in the questionnaire, correlate with students' responses to the interaction questions regarding the different technologies? Table 5 presents correlation coefficients that were computed for each of the questions presented in Tables 3 and 4 with two of the interaction factors (positive and negative) derived from the learning-habit inclinations questionnaire. The bold correlations with the Positive Interaction factor are expected to be positive. This is because students who hold strong views regarding the positive aspects of interaction—with tutor and students—are at the same time expected to appreciate more the contribution of others. The bold correlations with the Negative Interaction factor are expected to be negative, because students who have a high score on the negative aspects of interaction are expected to have a low score on the interaction questions in the feedback questionnaire, holding the view that interactions with others do not disturb their learning. The results in Table 5 strengthen the validity of the learning-habit inclinations questionnaire.

Learning habits and preferences of tutorial modes. Do learning-habit inclinations, as measured in our questionnaire, correlate with students' choices of different types of tutorials? Students in both groups were divided according to their overall choice between the satellite-based synchronous tutorials and the satellite-based asynchronous videocassettes. The two groups were compared on the four learning-habit factors. Figure 2 presents these comparisons.

Table 5: Correlation Between Answers to Interaction Questions (in Questionnaires 1 and 2) and Interaction Factors (derived from Questionnaire 3)

Question	Positive interaction	Negative interaction
3a	**0.43****	0.02
3b	**0.41***	0.03
4a	**0.27**	- 0.12
4b	**0.31**	- 0.02
4c	**0.51***	- 0.11
5a	- 0.14	**- 0.08**
5b	- 0.07	**- 0.54****
9a	**0.52*****	0.12
9b	**0.48***	0.03
10a	- 0.38**	**- 0.51*****
10b	- 0.26	**- 0.45***

*$p < .05$ **$p < .01$ ***$p < .001$



* $t(60)=2.36$, $p < 0.05$; ** $t(59)=2.4$, $p < 0.05$; *** $t(59)=2.4$, $p < 0.05$

Figure 2: Differences in Learning-Habit Inclinations Between Students Who Preferred Satellite-Based Synchronous Tutorials and Students Who Preferred Satellite-Based Asynchronous Videocassettes

The two groups of students differ in three of the four learning habit scores. Those who prefer satellite-based synchronous tutorials were significantly higher on scale 3 (believing in the positive aspects of interactions) and significantly lower on scale 1 (learning autonomy) and scale 2 (the need to "possess" all the materials).

DISCUSSION

When choosing between face-to-face tutorials and satellite-based synchronous tutorials, most students prefer the former, replicating a previous study done at the OUI (Beyth-Marom, Yafe, Privman, & Razy-Harpaz, 2000). Because in

both learning environments, the interaction component with other students is similar (the satellite-based and face-to-face tutorials both take place in classrooms), the key difference is the possible interaction with a real tutor vs. virtual one. When choosing between satellite-based synchronous tutorials and satellite-based asynchronous videocassettes, two thirds of students prefer the latter. The differential preferences of the three mentioned learning environments give an answer to our first research question regarding the outer layer in Curry's model: Having to choose between two learning environments (all other things being equal), most students prefer a face-to-face environment over a virtual one. Moreover, when the tutor is virtual, two thirds prefer the flexibility of an asynchronous home environment over a synchronous in-class environment.

Students were further asked about their attitudes toward the different components of interaction. In both synchronous and asynchronous groups, students rated the interaction components (either in the synchronous and the asynchronous modes) as not very important or contributing. There are significant correlations between the perceived academic contribution of other students, the perceived social contribution of other students and the perceived contribution of the students' questions and the tutor's answers. Thus, students have the same general attitude towards the interaction components without significantly differentiating among its various dimensions. From students' responses, it is also clear that students do not perceive the interaction component as having any substantial negative effects.

Interaction among students and between the teacher and students is a major feature of the constructivist approach to teaching/learning (Perkins, 1991; Kanuka & Anderson, 1999; Vygotsky, 1978). The fact that students in the present study did not perceive it as such may be related to their past learning habits or to the tutor's teaching style. The two learning environments with which they had some experience (satellite-based synchronous tutorials and satellite-based asynchronous videocassettes) and presumably also the face-to-face sessions they had earlier, apparently did not encourage interactions among students and between the tutor and students.

The current study revealed a discrepancy between educational theories and academic reality. The results suggest that interactions between student and instructors (above and beyond the lecture itself) as well as among students don't seem very important for students. The importance of these kinds of interactions may be context-dependent: they may operate in a specific environment (defined by type of tutor, type of students, etc.) and be irrelevant in others.

The change of the learning environment may also change the way some elements of the environment are perceived. A synchronous satellite tutorial may be perceived as a Learner-Instructor interaction, while the same tutorial transmitted using a videocassette may be perceived as a Learner-Information interaction. As Learner-Information interaction has the highest score in terms of frequency of use and perception of its usefulness compared with other types of interaction (with tutor and students) (Sarby & Baldwin, 2003), it is not surprising that 70% of the current sample preferred the asynchronous mode.

Regarding our second research question four factors were found: Time management, Access to material, Interaction (positive), and Interaction (negative).

The more the students prefer to manage their learning time, the more they prefer all materials at hand. Time management and access to material manifest a need for control, which has been shown to successfully predict learning behavior (Patrick, Skinner, & Connell, 1993). With regards to learning styles, there is evidence that there are individuals who perform better when externally controlled, while others perform better when they control the learning process (Yoon, 1993).

To answer the third research question, all students responded to a questionnaire about their learning-habit inclinations. Students with a high score on the positive interaction factor (those who hold strong views regarding the positive aspects of interactions with the tutor and students) believe more than others in the social contribution of other students and in their contribution to learning. Students with a high score on the negative interaction factor (those who hold weak views regarding the negative aspects of interaction) perceive students' interactions in class as less disturbing.

Students who preferred the satellite-based synchronous tutorials were compared to those who preferred the satellite-based asynchronous videocassettes on the four factors of the learning-habit inclinations questionnaire. Those who preferred the synchronous mode were significantly higher in their belief in the positive aspects of interactions (factor 3) and significantly lower on learning autonomy (factor 1) and the need to "possess" all the materials (factor 2) than those who preferred the asynchronous mode. Thus, students' instructional preferences are at least partly determined by their learning habit inclinations as measured on the Likert-type questionnaire. Their preferences are determined by their attitudes toward the control of learning and the possible contribution of the interactions. This strong association between students' preference of learning environment and their learning habit inclinations manifests a relationship between the outer and the inner layers of Curry's "onion" model. It is one specific indication of the general well-established correlation between personality traits, attitudes, and behavior (e.g., Snyder, 1979).

Implications

Implications of this study are discussed from methodological and pedagogical points of view. From a methodological point of view, the present study exemplifies how field research can be relatively controlled to ensure the validity of its findings. Comparisons between groups that differed in their technological settings were justified because much care was taken to ensure their similarity on many relevant pedagogical variables (e.g., tutor and material received). Thus, these variables cannot explain students' inclinations and preferences. Data were collected regarding other variables that cannot be externally manipulated and controlled (e.g., background and academic variables). The groups did not differ in these variables, thus, they also cannot threaten the internal validity of the study.

From a pedagogical point of view, the results of the present study strengthen the belief in the individualization of teaching/learning. People differ in their preferences regarding learning/teaching styles. Some prefer autonomy and control of learning over synchronous interactions, others have opposite preferences.

Learning environments that suit some students do not satisfy others. This is true of a regular population of students but, even more, of specific populations such as the learning disabled or the gifted (Yong & McIntyre, 1992). The large variety of learning technologies and learning pedagogies available today may help to offer different students different learning environments. After its synchronous delivery, a satellite-based tutorial could be posted on an Internet site as an asynchronous tutorial—thus allowing all students to take advantage of a learning/teaching style that suits their inclinations. Moreover, online discussion groups could allow students who prefer asynchronous tutorials to interact with other students and with their tutor through the Internet, thus enabling them to enjoy both worlds.

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References

Beyth-Marom, R., Yafe, E., Privman, M. & Razy-Harpaz, H. (2000). *Satellite home tutorials vs. satellite classroom tutorials.* Paper presented at the annual meeting of Ed-Media, Finland.

Canfield, A., & Knight, W. (1983). *Learning styles inventory.* Los Angeles: Western Psychological Services.

Childress, M. D., & Overbaugh, R. C. (2001). The relationship between learning style and achievement in a one-way video, two-way audio preservice teacher education computer literacy course. *International Journal of Educational Telecommunications 7*(1), 57–71. Available: http://www.aace.org/dl/files/IJET/Ijet-07-01-57.pdf

Christopher, C. (1990). The relationship among teacher immediacy behaviors, student motivation, and learning. *Communication Education, 39*(4), 323–240.

Clark, R. E. (1994). Media and methods. *Educational-Technology-Research and Development, 42*, 7–10.

Curry, L. (1983). *Learning styles in continuing medical education.* Ottawa, ON: Canadian Medical Association.

Diaz, D. P., & Cartnal, R. B. (1999). Students' learning styles in two classes: Online distance learning and equivalent on-campus. *College Teaching, 47*(4), 130–135.

Dille, B., & Mezack, M. (1991). Identifying predictors of high risk among community college telecourse students. *American Journal of Distance Education, 5*(1), 24–35.

Doherty, P. B. (1998). Learner control in asynchronous learning environments. *ALN Magazine, 2*(2). Available: http://www.aln.org/alnweb/magazine/vol2_issue2/ doherty.htm

Eagly, L. H., & Chaiken, S. (1998). Attitudes, structure and function. In D. T. Gilbert, S. T. Fiske, & G. Lindzey (Eds.), *The handbook of social psychology* (pp. 269–322). New York: McGraw Hill.

Gardner, H. (1993). *Frames of mind: The theory of multiple intelligences.* New York: Basic Books.

Gee, D. G. (1990). *The impact of students' preferred learning style variables in a distance education course: A case study.* ERIC Document Reproduction Service No. ED 358 836.

Gentry, J., & Helgesen, M. (1999). Using learning style information to improve the core financial management course. *Financial Practice and Education, (Spring/Summer)*, 59–69.

Gregorc, A. F. (1984). *Gregorc style delineator: Development, technical and administrative manual.* Maynard, MA: Gabrial Systems, Inc.

Gunawardena, C. N., & Boverie, P. E. (1992). *Interaction of learning style and media, method of instruction, and group functioning in distance learning. Proceedings of the eighth annual conference on distance teaching and learning* (pp. 65–69). Madison, WI: University of Wisconsin, Madison.

Heberlien, T.A., & Baumgartner, R. (1978). Factors affecting response rates to mailed questionnaires: A qualitative analysis of the published literature. *American Sociological Review, 43*(4), 447–462.

Kanar, C. C. (1995). *The confident student.* Boston: Houghton Mifflin.

Kanuka, H., & Anderson, T. (1999). Using constructivism in technology mediated learning: Constructing order out of the chaos in the literature. *Radical Pedagogy, 1*(2). Available: http://radicalpedagogy.icaap.org/content/vol1.1999/issue2/02kanuka1_2.html

Kolb, D. A. (1984). *Experiential learning: Experience as the source of learning and development.* Englewood Cliffs, NJ: Prentice-Hall, Inc.

Kolb, D. (1985). *Learning style inventory.* Boston: McBer.

Joyce, M. (2003). Multiple intelligences and business diversity. *Journal of Career Assesment, 11*(2), 187–203.

Myers, I., & McCaulley, M. (1985). *A guide to the development and use of the Myers-Briggs type indicator.* Palo Alto, CA: Consulting Psychologists Press.

Patrick, B. C., Skinner, E. A., & Connell, J. P. (1993). What motivates children's behavior and emotion? Joint effects of perceived control and autonomy in the academic domain. *Journal of Personality and Social Psychology, 65*, 781–791.

Perkins, D. N. (1991). What constructivism demands of the learner. *Educational Technology, 31*(10), 19–21.

Russell, T. L. (1999). *The "no significant difference phenomenon".* Available: http://teleeducation.nb.ca/nosignificantdifference/.

Sarby, K., & Baldwin, L. (2003). Web-based learning interaction and learning styles. *British Journal of Educational Technology, 34*(4), 443–454.

Snyder, M. (1979). Self-monitoring processes. In L. Berkowitz (Ed.), *Advances in experimental social psychology Vol. 12* (pp. 85–128). New York: Academic Press.

Sternberg, R. J. (1997). *Thinking styles.* New York: Cambridge University Press.

Swan, K. (2001). *Building learning communities in online courses: The importance of interaction.* Paper presented at the 7th Sloan-C International Conference on Online Learning, Orlando, FL.

Teele, S. (1992). *Teele inventory of multiple intelligences.* Redlands, CA: Sue Teele and Associates.

The Institute for Higher Education Policy (1999, April). *What's the difference?* Available: http://www.ihep.com/Pubs/PDF/Difference.pdf

Vygotsky, L. (1978). *Mind in society.* Cambridge, MA: MIT Press.

Yong, F. L., & McIntyre, J. D. (1992). A comparative study of the learning style preferences of students with learning disabilities and students who are gifted. *Journal of Learning Disabilities, 25*, 124–132.

Yoon, G. S. (1993). The effects of instructional control, cognitive style and prior knowledge on learning of computer-assisted instruction. *Journal of Educational Technology Systems, 22*(4), 357–370.

1. Contrary to the intuitive perception that views the two extremes of a dimension (e.g., high and low) as negatively correlated, research in psychology on attitudes demonstrates that often the end points of a dimension are two independent factors (Eagly & Chaiken, 1998).