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Teaching as Persuasion, Online? Transferring the Pedagogy to Online Settings

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Abstract

This study investigated the viability of the teaching as persuasion (TAP) metaphor for use in online learning environments it also improved on previous investigations of (TAP) in a number of ways. Data was collected from 170 students in college-level education courses. Students by class were randomly assigned to one of four lesson conditions (face-to-face persuasive, face-to-face expository, online persuasive, online expository). Measures assessing participants' beliefs, knowledge, and interest relative to the lesson topic (i.e., intelligence) were completed prior to the lesson and immediately following. Participants also completed a lesson reaction measure at post test. Multiple analysis of covariance (MANCOVA) was used to examine differences at post test among participants in the different learning conditions. Results indicated that interactions exist between learning environment (online and face-to-face) and lesson pedagogy (persuasive and expository). For instance, participants receiving the online persuasive lesson exhibited greater changes in belief than participants receiving the persuasion lesson in a face-to-face environment. Other significant results were also found. The manuscript offers a discussion of the results and implications for future research.

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Introduction

Well-designed instruction methods spark students' emotional responses to encourage a reevaluation of beliefs, knowledge, and interest are necessary in effective teaching and learning (Murphy & Alexander, 2004). Teaching as persuasion (TAP) provides teachers with a metaphor to frame, plan, and implement such well-designed learning activities. Previous investigations examining the use of TAP in middle-level and college settings have found it to be an influential pedagogical approach that engages learners in reflective thinking, connects to their emotions, and helps learners construct knowledge (Alexander, Fives, Buehl, & Mulhern, 2002; Fives, Alexander, & Buehl, 2001).

Given the large increases in the number of online courses offered at most colleges and universities and the standardization of platforms for online instruction the field of research on online teaching must move to an examination of specific pedagogical approaches and their fruitfulness when applied to online settings (Glahn & Gen, 2002). The previous research on TAP indicates that this is an adaptable teaching metaphor that has yielded differing results related to its implementation (i.e., student-centered vs. teacher-led – Alexander et al., 2002). The flexibility and success of the TAP metaphor in previous research suggests that this approach may be particularly suited to online instruction. The purpose of the present study was to investigate the use of the TAP metaphor in both online and face-to-face settings.

Teaching as Persuasion

Defining the Metaphor

TAP offers a metaphor for instruction that promotes conceptual change (Fives & Alexander, 2001). In this metaphor persuasion refers to "evoking a change in one's

understanding or judgment relative to a particular idea or premise" (Murphy, 2001, p. 224). Here persuasion is not considered to be a form of manipulation, rather, it is a method for engaging in discourse about a topic of interest, such that multiple views are presented and considered. In this metaphor persuasion is the act of encouraging learners to look more closely or deeply at a given topic through the use of a persuasive structure (Murphy, 2001). Essentially, instruction is guided by the principles of a persuasive text and utilizes components salient in such texts (e.g., interestingness, emotionality, multiple perspectives) as part of the instructional process (Murphy, 2001; Alexander, Fives, Buehl & Mulhern, 2001).

Teaching as persuasion has been advocated as a more adaptive metaphor to guide instruction than others such as "teaching as scaffolding" (Alexander et al., 2000; Sinatra & Kardash, 2004). The key advantage of the TAP metaphor is that it conceptualizes learning as more than mere assimilation, that learning also involves the processes of knowledge change and revision (Sinatra & Kardash, 2004; Sinatra & Pintrich, 2003). Thus, TAP encourages teachers to think about actively helping learners to develop the skills, strategies, and patterns of thought necessary to revise, change, and renounce their existing conceptual understandings when new evidence calls for such alteration. To do this, teachers must do more than scaffold learners' knowledge they must assist learners in building the structure of that knowledge, re-examining its contents, and re-engineering it when necessary.

Teaching as persuasion also recognizes that learning is a multidimensional process through which knowledge construction relies on changes in and development of learners' knowledge, beliefs, and interests (Murphy, 2001). Beliefs in this metaphor are considered to be a strong factor that influences how learners' approach learning tasks, engage with new bodies of knowledge, and are open to alternative understandings. The beliefs an individual holds about any

given topic may need to be changed as part of the learning process. TAP recognizes this and directly addresses the existence and influence of those beliefs as part of the learning process (Alexander, et al., 2000; Fives & Alexander, 2001).

Research in motivation, particularly the role of interest, has underscored the importance of this construct on learning. Interest can be understood as both a deep seated *individual interest* as well as a more contextual *situational interest* (Pintrich & Schunk, 2002) Individual interest is noted by a strong personal preference for the topic as well as a high store of knowledge related to it (Renninger, 1990, 1992). Situational interest, in contrast, refers to the psychological state of being interested in the task at hand (Alexander et al., 1994). Both forms of interest have been related to adaptive educational outcomes such as retention, attention, comprehension, and achievement (Hidi, 2000; Hidi & Harachiewicz, 2000; Schiefele, 1991, 1992; Tobias, 1994). The TAP metaphor seeks to build on learners' existing individual interest when possible and to engage their situational interest through the use of high quality learning materials (Chambliss, 1995) and lessons structured to connect to learners' motivation and emotion (Sinatra & Pintrich, 2002).

Research on Teaching as Persuasion

To date the research on TAP has followed two distinct lines: studies investigating the application of the metaphor in classroom settings (i.e., Alexander et al., 2002; Fives, Alexander, & Buehl, 2001) and those examining preservice teachers' responses to the TAP metaphor (i.e., Dole & Sinatra, 1999; Sinatra & Kardash, 2004). The former of these research lines has direct implications for the present study. Investigations have examined the influence of teaching as persuasion with middle school (6^{th} and 7^{th} grades – Alexander et al., 2001) and university (undergraduate – Fives, Alexander, and Buehl, 2001) level students.

Middle level research. Working with middle school students Alexander and colleagues (2002) conducted a design experiment in which the TAP metaphor was employed using both teacher-led and student-centered instructional conditions. Results indicated that students in these conditions out performed learners in the comparison group with respect to knowledge, interest, and beliefs. Moreover, there were significant differences between the two persuasive conditions. Namely, learners in the teacher-led group demonstrated significantly higher demonstrated knowledge at post test then those in the student-centered group. In contrast, students in the student-centered group demonstrated significantly greater levels of belief change than those in the teacher-led group.

These results provide evidence for the viability of the TAP metaphor for use with middle level students. Additionally, differences in the two persuasive conditions and their relative outcomes underscore the flexibility of this metaphor to achieve multiple instructional goals based on how it is employed.

University level research. Fives and colleagues (2001) extended the investigations of TAP to an undergraduate level sample. Moreover, this investigation maintained stricter research parameters with the use of a control group to compare with the TAP conditions. In this investigation the lesson content focused on Moral Development, a common topic in the Human Development courses targeted for this study. Thus, the content was naturally occurring for the students and was also reflected in their course texts. Three conditions were examined in this study. Two groups received the same persuasive lesson from the same instructor. However, for one group of students the instructor was a guest to the class (i.e., guest-instructor condition) and for the other, the instructor was the teacher of record (i.e., regular-instructor condition). The third group was used as a control (i.e., control-regular-instructor condition); in this group students

received instruction from their regular instructor, who was uninformed as to the TAP pedagogy. Thus, in this class students received typical instruction.

All three conditions demonstrated significant differences from pre-lesson to post-lesson with respect to the variables of perceived knowledge, demonstrated knowledge, beliefs, and interest. Post-lesson scores were examined for differences across the three groups. Significant differences were found with regard to demonstrated knowledge and beliefs. Specifically, learners in the guest-instructor condition out performed students in the regular-instructor and control conditions. And those in the regular instructor condition out performed those in the control group. Thus, learners in the teaching as persuasion conditions demonstrated significantly higher knowledge than those in the control group. Further, students in the persuasive guest instructor lesson demonstrated significantly stronger beliefs at post test then students in the persuasive regular instructor lesson.

These results, like those from the middle school study, underscore the potential for the TAP metaphor as a practical and effective teaching approach. Further, the results of the Fives et al. (2001) study highlight the importance of message *source* (in this case the instructor) as a fundamental component of the persuasive lesson. In this study the same instructor went into one class as a "guest" lecturer and was recognized as an "expert" on Moral Development. In the second class, the instructor went into her own class – who had been meeting for several weeks – and taught the lesson as part of her typical routine. Thus, although the lessons were identical in structure, content, and planning, salient differences existed with regard to the learners' perceptions of the instructor as well as communication patterns and other social aspects of classroom situations due to the differing histories students had with the instructor (guest vs. regular instructor).

Limitations in the Research

Although the existing research has lent support to the TAP metaphor limitations exist. First, is the overwhelming scarcity of research assessing this metaphor, only two empirical investigations have been conducted. Additionally, the previous investigations of TAP have relied on design experiment methodologies (Alexander, et al., 2002) and convenience samples (Fives et al., 2001) to assess the influence of this practice on change in learners' knowledge, interests, and beliefs. In addition to sampling issues (regular vs. guest instructor conditions) in the Fives et al. (2001) study, results may also have been clouded by the quality of the message offered in the control lesson. Certainly the control lesson was typical of college level teaching and that particular instructors' teaching practice. However, learners' responses from the control lesson were compared to responses to a lesson that was highly developed and had received much attention in the planning phases. This study may not have compared only persuasion to typical instruction; it may have compared a *high quality* persuasive lesson to a *mediocre* typical lesson.

Thus, future investigations of the TAP metaphor must move beyond these limitations. The previous research offers support for continued investigations of this pedagogy and as well as direction for future research. That is, the following issues should be addressed in future studies:

- the use of experimental or quasi-experimental design comparing similar groups and similar lessons;
- the relation of learners' to the instructor needs to be controlled for;
- instruction in all conditions (persuasion and control) needs to be of high quality.

Therefore, the present study seeks to further the research on TAP by addressing these concerns as well as further assessing the viability of this teaching approach as one that will influence learners' knowledge, interests, and beliefs.

Online Instruction

Scope of the Research

The research literature on online learning and teaching has proliferated in the past 10 years. With the advent of advanced technologies, the increasing accessibility of internet resources, and the economic advantages of online instruction and ever-increasing number of colleges and universities are incorporating more online courses into their curricula (Tallent-Runnels et al., 2005). Thus, researchers investigating online teaching have approached their task from multiple points of interest. Tallent-Runnels and colleagues (2005) organized their review of online teaching based on research themes they identified in the literature that also reflect the varied points of interest of importance to online teaching stakeholders (e.g., researchers, teachers, administrators). They categorized the literature into four aspects: course environment, learners' outcomes, learners' characteristics, and institutional and administrative factors (Tallent-Runnels et al., 2005).

Research assessing course environment typically dealt with issues of classroom culture (e.g., community of learners – Winograd), structural assistance (e.g., scaffolding – Greene & Land, 2000), success factors (e.g., access to material – Edwards & Fritz, 1997), interaction systems (e.g., online discussions – Davidson-Shivers, Tanner, & Muilenburg, 2000), and evaluation (e.g., multiple assessment techniques – Levin, Levin, & Waddoups, 1999). Investigations of learning outcomes were categorized as relating to the cognitive (e.g., exam performance – Bata-Jones & Avery, 2004) and affective (e.g., satisfaction – Bee & Usip, 1998) domains (Tallent-Runnels et al., 2005).

Investigations of learners' characteristics focused on examination of student motivation, reasons for choosing online classes, and relations between learner characteristics (e.g., learning

styles) and methods of delivery (Tallent-Runnels et al., 2005). These researchers concluded that the majority of the early research on online instruction focused on the interaction of different delivery formats (e.g., amount of text per page – Graff, 2003; computer mediated instruction verses face-to-face – Sonnenwald & Li, 2003) with student characteristics such as cognitive learning styles (Graff, 2003) and social interaction preferences (Sonnenwald & Li, 2003). In contrast more recent research seems to analyze the multidimensional relations among the learner, instructional design, the delivery system.

The final aspect of online teaching research identified by Tallent-Runnels et al. (2005) reviewed studies addressing institutional and administrative facets of online learning. While little research has been done in this area studies reviewed focused on institutional policies (Phipps & Merisotis, 2000), institutional support (e.g., Feist, 2003), and enrollment effects (Ridley, Bailey, Davies, Hash, & Varner, 1997). Based on these studies the reviewers concluded that more work needs to be done in this area, greater training and support for faculty should be offered, and online courses can increase university enrollment (Tallent-Runnels et al., 2005).

This framework provides for us a picture of the scope and type of research that has been conducted to better understand online teaching. Moreover, this framework underscores the *lack* of empirical research conducted on pedagogical interventions and approaches used in online instruction. Few studies seem to assess the actual teaching practices employed within online environments. Moreover, the emphasis on delivery systems echoed by Glahn and Gen (2002) suggests that product interests have out weighed those of pedagogy in the development of online instruction.

Glahn and Gen (2002) offered a brief chronology of the evolution of internet teaching. In this history, these authors maintained that the features and abilities of various online products

(e.g. Blackboard, WebCT) have become fairly standardized, that is the *product* innovations (developments in technology) have decreased. They also suggested that now is the time for advance in *process* innovations. By process they are referring to how the technology (or product) is applied and used. Thus, now that fairly stable technology exists in the platforms for online leaning, innovations can and should be made in how these technologies are used for instruction. Moreover, Glahn and Gen (2002) pronounced that "The current ad hoc nature of process innovation must give way to an emphasis in structure, best practices, and the codification of those practices" (p. 781). We infer this to mean that greater attention and systematic research needs to focus on the pedagogical applications and instructional processes available and viable for online environments.

Research on Specific Pedagogical Applications

There seems to be an abundance of published reports which describe the development of online courses or modules in accordance with a variety of pedagogical theory. For example, authors have described their construction and implementation of online instruction using pedagogical frameworks (e.g., constructivism – Moallem, 2001), metaphors (i.e., teaching as communities of practice – Schwen & Hara, 2003), strategies (e.g., case-based learning – Sudzina & Sudzina, 2003), and specific techniques or tools (e.g., scaffolding – Dabbah, 2003). The majority of this literature has explained how the pedagogical theory and online course design were married and the subsequent implementation of the course. That is, a "how we" perspective seems to dominate the current literature base.

Alternatively, very little empirical research using either quantitative or qualitative design has been reported assess or comparing the effects of these pedagogies once implemented. Among the existing research, studies have examined the influence of a problem-based learning approach

to course design (i.e., Chanlin & Chan, 2004; Trinidad & Pearson, 2004) and use of scaffolding as a teaching strategy (i.e., Greene & Land, 2000; Nussbaum, Hartley, Sinatra, Reynolds, & Bendixen, 2004; Sharma & Hannafin, 2004).

Problem-based learning. Problem-based learning (PBL) as used in traditional face-to-face environments involves a problem centered learning activity in which students work in collaborative teams to solve the problem with the teacher serving and a facilitator through the process (Chanlin & Chan, 2004). Trinidad and Person (2004) examined the implementation of PBL through mixed-method investigation of 14 part-time masters-level students. These researchers found that problem based learning was a practical strategy for online instruction. Taking the research a step further, Chanlin & Chan (2004) analyzed the discussion contents of students' engaged in a web-based PBL course. Though this analysis they attributed these students' tendencies to engage in deeper analytical processes the influence of the PBL experience. Further, they found that learners in the PBL group demonstrated more description of differing aspects of the topics studied in their final projects then did learners in other groups.

These studies indicate that PBL may be an appropriate strategy for web-based courses. However, the focus was again on the ability to use the pedagogy in an online environment – its implementation, rather than a detailed examination of the achievement related outcomes.

Scaffolding. Some of the research regarding online instruction has focused on the instructional strategy of scaffolding. Further, the concept of scaffolding is operationalized and implemented in a variety of ways across these investigations. Two studies offer an explicit investigation of the use of cognitive scaffolds as part of an online learning experience (i.e., Green & Land, 2000; Nussbaum et al., 2004). Green and Land (2000) conducted a multicase study of 18 college students' use of online scaffolding. In this study four types of supports were provided:

web resources, procedural guidelines, student-student interaction, and instructor-student interaction. Results of this investigation suggest that guiding questions developed by the course instructor, identified as cognitive scaffolds, helped students focus and develop their projects.

Nussbaum and colleagues (2004) examined the interaction of personality characteristics with scaffolding (i.e., note starters & elaborated cases) in on-line discussion among 48 undergraduate students in an introductory education course. Note-starters are a list of phrases made available for students to use as the beginning of a discussion note (e.g., My theory is … I need to understand…) introduced by Wood, Bruner, & Ross (1976) as a form of scaffolding to encourage deeper thinking by students. While this strategy has been used in other online learning environments (e.g., Scardamalia & Bereiter, 1991) little controlled evidence has been collected as to their effectiveness. Results indicated that "note-starters encouraged students to disagree and explore alternative viewpoints" (Nussbaum et al., 2004, 127). This was seen as a positive outcome since previous research has illustrated the tendency of college level students to agree with each other in online discussions and thereby maintain a surface level of analysis in their discussion of the content. Through engendering disagreement it was believed that deeper critical thinking would also be ascertained. Indeed, Nussbaum and colleges (2004) asserted that the note starters stimulated greater reflection among students.

Together, these studies represent the direction toward which online research on teaching must follow in the future. The examination of specific pedagogies and teaching strategies in controlled settings will provide online instructors with much information as to where their time and efforts should be invested rather than simply *how* they might do so.

Limitations in the Research

Given the relative age of online versus face-to-face learning environments it is not surprising that research on online instruction is lagging behind both its face-to-face counter part and its own developing technologies. Still, the scarcity of empirical research on online pedagogies remains a concern. Now that we have these tools we need to better understand how to use them as instructional aides (Glahn & Gen, 2002). Further, rather than the continued comparisons between face-to-face and online instruction we need to ask the more sophisticated question of, once online, which teaching technique is better. In the present study we sought to address these concerns by comparing two theoretically grounded and research based pedagogies (i.e., teaching as persuasion and expository teaching) in both online and face-to-face conditions.

TAP Online

We feel that the teaching as persuasion metaphor is particularly suited for use in online learning environments. The TAP metaphor draws on research from conceptual change and persuasive text research to suggest several pedagogical principles for teachers to use when implementing this model. We believe these strategies are not only easily transferred to an online learning environment but that doing so is in accordance with the principles Johnson and Aragon (2002) identified as necessary to bring about powerful online learning. Table 1 provides a comparison of these sets of principles.

The present investigation seeks to address the limitations found in the research literature of both TAP and online pedagogy, though the implementation, comparison, and evaluation of an online learning module on Intelligence. Specifically, we address the gaps in the TAP research by implementing a quasi-experimental research design that controlled for learners' knowledge of the instructor (all students known to the lesson instructor were allocated to the online conditions)

and the quality of the lesson (equally valid pedagogical modes were used to design comparison lessons in both online and face-to-face conditions). Additionally, this investigation adds to the research on online instruction by providing a systematic investigation of the influences of two pedagogical approaches (TAP and expository teaching) on learners' knowledge, interests, and beliefs in online settings and compares those differences to face-to-face classes. Thus, we forwarded the following research questions:

- Are there significant differences in the mean scores of participants' beliefs, interest, perceived knowledge, and demonstrated knowledge (see Table 2) as a function of the type of instructional method provided and environment in which the instruction was received, controlling for the presence of preexisting individual differences?
- Are there significant differences in the mean scores of participants' lesson reaction (i.e., positive emotion, negative emotion, autonomy, and feelings of competence presented in Table 3) as a function of the type of instructional method provided and environment in which the instruction was received?

Methodology

Lesson Conditions

Four lesson conditions were compared in this investigation: online TAP, face-to-face TAP, online expository; face-to-face expository. We chose to compare the persuasive lessons to lessons developed within the constructive framework of Ausubel's (1963) expository teaching model. Expository teaching has enjoyed a long life in the field of education, had received ample research support for its use, and is reflective of typical university instruction. Expository teaching recognizes learners existing knowledge and strives to provide them with a sound

structure for new information construction. Thus, it relies heavily on the use of advance organizers and reflective questions.

Differences in online and face-to-face versions of lessons using the same pedagogy were kept to a minimum. Overhead slides identical to those used in the online settings were used in the face-to-face classes and the same opportunities and prompts were given for reflection. Differences occurred with regard to text materials, in the face-to-face conditions rather than reading the onscreen text students heard the same information in a lecture format. Additionally, the reflection activities were completed using the Think-Pair-Share (Bromley & Modlo, 1997) technique whereas in the online conditions these activities were done individually via discussion boards. Finally, the online conditions also included a number of links to additional information and sources for greater detail available at vetted internet sites. In this condition students were able to examine any of these links at their own preference. In contrast, in the face-to-face condition students were repeatedly invited to ask questions of the instructor related to any of the information presented.

The two lesson types (i.e., TAP and expository) had several aspects in common (see Table 4). Specifically, within each lesson the *content* presented concerning each of the theories was identical. Content for each theory included a biography of the theorist, description of the source of the theory (i.e., how the theory was first conceptualized and influences on the theorist), how the theory defines intelligence, and an explanation of the theory and its constructs. Finally, a review of each theory was provided by reminding learners of each theory's perspective on the four organizing questions related to the source, stability, and universality of intelligence. Table 4 offers a brief comparison of the two lessons types.

Persuasive Lesson. The persuasive lesson was structured around two debatable guiding questions, which reflect some of the controversy among intelligence theories: Can you become more intelligent? And what is intelligence? Students were then asked to respond with their beliefs regarding these questions. The next component of the lesson introduces Howard Gardner's Multiple Intelligence (MI) Theory. Gardner's theory was introduced first for a number of reasons. First, this theory has a distinct position relative to our organizing questions in comparison to the other theories presented. Second, many of our participants were education majors and it was expected that they might be familiar with this theory given their previous course work. Third, we felt that MI theory is accessible and intuitive to most learners; therefore it provided a point from which to compare the other theories.

After reflection on MI theory learners were then provided with the major criticisms of the theory. Thus, following the persuasive metaphor, the theory was refuted. Subsequently, theories embracing a single intelligence factor were presented (i.e., Binet and Spearman). Students were then asked to identify the pros and cons of the theories presented thus far and consider whether their thoughts about MI theory had changed given the evidence provided.

At this point the lesson had moved from an 8-factor model of intelligence to a single factor (i.e., *g*). The next part of the lesson critiqued the use of a single intelligence factor by introducing the theory of R. Cattell, as an expansion of Spearman's work. This was followed by a presentation Sternberg's Triarchic theory and a critique of that as well.

All of the theories were then briefly reviewed and participants were asked to compare and contrast the theories relative to their perspectives on the source, stability, structure, and universality of intelligence (i.e., the organizing questions). As a final reflection activity students were asked to consider the guiding questions again.

The lesson was crafted to follow a persuasive discourse related to the stability and meaning of intelligence. As participants were guided through five well known intelligence theories, each theory was actively critiqued and examined in light of the findings of the other theories. Moreover, participants were encouraged to actively reflect on their understanding of the material, their personal beliefs, and consider the source both of the theories themselves as well as of the information and research presented.

Reflection, analysis, and sourcing strategies were modeled throughout the lesson. In the face-to-face condition the instructor modeled these by sharing with the participants how she thought about the constructs, questions she asked herself, and aspects of the research that concerned her. In the online condition a graphic professor would appear throughout the lesson and would make similar 'statements' through the use of callout bubbles.

Expository Lesson. The expository lesson followed the principles established by Ausubel (1963) to bring about *meaningful* learning. This approach emphasizes the importance of learners' prior knowledge, lesson structure, purpose, and the use of advance organizers. Thus, the lesson began by activating learners' prior knowledge with the question "What is intelligence?" After reflecting on this question the students were then apprised of the goal/purpose of the lesson, how the information would be presented, and the key aspects of intelligence (source, stability, structure, and universality) that would be examined for each theory.

Two Advance Organizers were used to provide further structure for students learning. First, each theory and theorist was introduced using a timeline. Thus, students were able to utilize a common organizational structure – chronology, to begin to develop an understanding of the field of intelligence. Next, students were provided a graphic organizer (onscreen in the online condition and on paper in the face-to-face condition) that tabled the key aspects of intelligence

for each of the theories to be examined. Following the introduction of each theory the graphic organizer was brought forward and filled in based on the information provided.

Theories of intelligence were then presented in chronological order of their emergence. The first three theories (i.e., IQ, *g*, Fluid & Crystallized) were presented in a single lesson component. These theories also reflected more traditional views of intelligence and a reliance of statistics and measurement to understand the construct. Students were then asked to reflect on the theories presented in connection to their existing understanding of intelligence. In this way, learners were guided to make meaningful connections between their exiting knowledge and the new information presented.

The next lesson component introduced the theories of Sternberg and Gardner respectively. Following this participants were asked to reflect on the theories and consider which they found most compelling and why. The lesson concluded with a final review of all the theories on the timeline, a comparison of the theories related to each of the aspects of interest, and a final review of the completed graphic organizer. Students were then asked to engage in a final reflection on the initial question: “What is intelligence?” This was done to further make connections between their prior knowledge at the onset of the lesson and the information presented to them.

Procedure

Ten classes selected from College of Education courses with syllabi including content related to intelligence were randomly assigned to one of four conditions; online TAP, online expository, face-to-face TAP, and face-to-face expository; that varied by environment and instructional method. Instructors of those assigned to the face-to-face conditions scheduled a time for the second author to enter their classrooms and instructors of students assigned to online

conditions scheduled a time for their class to be directed to a computer lab and Web CT course site online. The schedule of lesson presentations was spread across a period of approximately three weeks. Upon entering the assigned environments, participants received a copy of a consent form that was explained and then signed by those continuing with the study. All students voluntarily agreed to participate. Participants then completed the pretest questionnaires and subsequently participated in a lesson developed to promote an understanding of the construct of intelligence and its limitations that varied only in its method of delivery. Upon completion of the equivalent lessons, participants again completed the measures as well as the lesson evaluation instrument.

Participants

The sample was comprised of 202 undergraduate (n = 157) and graduate (n = 45) students attending a large Southwestern university. The participants were predominately women (67.3%) and overwhelmingly White (84.2%). One percent described themselves as Asian, 2% as Black, 10.4% as Hispanic, and 1% as other. Three participants failed to endorse a category. The average age of participants was 23.5 (SD = 5.58) with ages ranging from 18 to 51. One hundred forty participants (69.3%) reported no history of enrollment in an online course. Twenty-nine participants (14.4%) reported taking one online course, 12 participants (5.9%) reported taking two, and 11 participants (5.4%) reported taking three. The remaining 9 participants (4.5%) reported taking four or more online courses. One individual failed to respond.

Instruments

We developed the following research measures based on similar measures involved in prior studies of persuasion (e.g., Alexander, Fives, Buehl, & Mulhern, 2002; Alexander, Murphy, Sperl, & Buehl, 1997; Murphy & Alexander, 2004). In addition to this information, participants

reported demographic information as well as the number of online courses they had taken in the past.

Perceived Topic Beliefs. To evaluate participants' beliefs about intelligence, participants were presented with eight position statements concerning intelligence and asked to select their position using a 10-point linear scale ranging from *strongly disagree* (1) to *strongly agree* (10). Statements reflected popular positions about intelligence, such as intelligence can be changed, IQ scores explain much of a person's success in academic settings, and intelligence is a person's ability to deal with different problems and situations. These concepts were addressed in the lesson modules. An internal reliability estimate of Cronbach's alpha reached .71 for the pretest and .72 for the posttest. The maximum score for this measure was 80.

Perceived Topic Interest. Participants were presented with five concepts related to intelligence and asked to rate their level of interest for each using a 10-point linear scale ranging from *not interested* (1) to *very interested* (10). Concepts included in the intelligence lessons, such as Spearman's *g* and intelligence quotient were employed. Internal reliability estimates of Cronbach's alpha were .83 for the pretest and .85 for the posttest with a maximum score of 50

Perceived Topic Knowledge. To assess perceived topic knowledge, participants were asked to rate what they perceived that they knew about five selected concepts related to intelligence using a 10-point linear scale ranging from *relatively nothing* (1) to *a great deal* (10), with a maximum score of 50. Theoretical concepts of intelligence (e.g., intelligence quotient) and important theorists (e.g., Cattell, Gardner) were selected to represent lesson content in the measure. Internal reliability estimates using Cronbach's alpha were .63 for the pretest and .84 for the posttest. A lower reliability for the pretest was not viewed as problematic as participants were expected to enter the study with some knowledge of certain intelligence concepts due to their

general familiarity (e.g., IQ) but not others (e.g., Cattell's Crystalized and Fluid Intelligence), resulting in poor internal consistency.

Demonstrated Topic Knowledge. Participants were asked to demonstrate their knowledge of intelligence by completing a multiple choice test as well as four open-ended items. For the multiple choice test, twenty questions were developed with four response options for each that referred to content from the lesson modules. The response options for each item included a correct response scored as four points, a close distracter in the same topic area as the correct response scored as three points, a domain distracter from the same field of study scored as two points, and a non-domain distracter not related to the construct at all scored as one point. For example, the participants were presented with the question, *Whose theory of intelligence accounts for the declining reaction time of aging adults?* followed by responses including *Cattell* (correct), *Spearman* (close distracter), *Sternberg* (domain distracter), and *Adler* (nondomain distracter). This design resulted in greater variability in the scores, allowing for participants to receive credit for partial understanding. Internal reliability estimates of Cronbach's alpha were .94 for the pretest and .88 for the posttest. The maximum score for the multiple choice test was 80.

The open ended portion of the test of demonstrated knowledge consisted of four items (e.g., Gardner's Multiple Intelligence Theory). Participants were asked to "jot down words, phrases, and sentences" to show what they knew about the concepts presented. Responses were scored using a four-point rubric applied in prior studies investigating persuasion (e.g., Alexander, Fives, Buehl, & Mulhern, 2002; Murphy & Alexander, 2004). Responses with no correct information were scored 0, those with limited (i.e., 1 – 2 ideas) but partially correct information were awarded a score of 1, those with limited and correct information were awarded a score of 2,

those with extended (i.e., 3 or more ideas) information that was mostly correct were awarded a score of 3, and those with extended and correct information were awarded a score of 4. For example, in response to intelligence quotient, scores could range from a 4-point response of "Developed by Binet to identify children with mental retardation and defined as mental age divided by chronological age multiplied by 100 to a 1-point response of "a way to measure intelligence." The maximum score for this measure was 16.

Scoring was completed by the authors who, after training, jointly scored 20% of the responses. Interrater agreement (i.e., the proportion of agreed upon responses over the total responses) was above 91%. All points of discrepancy were resolved through discussion by the authors. Remaining data were scored by each of the authors independently. An internal reliability estimate of Cronbach's alpha was .29 for the pretest and .74 for the posttest. The very low estimate of internal reliability for the pretest was likely related to the participants possessing some knowledge of intelligence concepts through everyday experience but overall limited understanding. Thus, they could respond to one or two items with some accuracy but knew little about the remaining content, which resulted in a poor internal consistency.

Lesson Evaluation. Similar to Alexander et al. (2002), the lesson was evaluated to assess the emotional reaction of participants, which is important when teaching with a persuasive model (Covino & Jolliffe, 1995; Murphy & Alexander, 2004). Using a seven-point linear scale ranging from *not at all true* (1) to *very true* (7), participants were asked to rate what they thought and experienced during the lesson. Participants were presented with 24-items with 10 items assessing participants' positive reaction (e.g., While I was working on the lesson, I was thinking about how much I enjoyed it), five items assessing negative reaction (e.g., I felt pressured while doing the lesson), four items assessing their feelings of autonomy during the lesson (e.g., I felt like I was

doing what I wanted to do while working on the lesson), and five items assessing their feelings of competence (e.g., I think I did pretty well at this activity compared to other students). So that high scores reflected a positive experience, items assessing negative reaction were reverse coded, thus high scores under negative emotion indicate feelings of a more positive experience. Internal reliability coefficients for the four subscales, positive reaction, negative reaction, autonomy, and competence, were .94, .83, .89, and .83, respectively. The internal reliability estimate for the total measure was .92.

Data Analysis

Two multivariate analyses were conducted to evaluate the posited research questions. First, a 2 x 2 between-subjects multivariate analysis of covariance (MANCOVA) was performed on the five dependent variables associated with individual differences, including beliefs, interest, perceived knowledge, and demonstrated knowledge: multiple choice test and open-ended response. Adjustments were made for four covariates accounting for preexisting levels of differences in beliefs, interest, perceived knowledge and demonstrated knowledge on the multiple choice test. Second, a 2 x 2 between-subjects multivariate analysis of variance (MANOVA) was performed on four dependent variables associated with the lesson evaluation, including positive emotion, negative emotion, autonomy, and competence.

Results and Discussion

Descriptive and Univariate Analyses

To assess whether assumptions were met for multivariate analyses, which were utilized to answer the research questions for the present study, descriptive statistics were employed as well as univariate tests. Frequency distributions for each variable were evaluated to determine the presence of univariate outliers, and tests of Mahalanobis distance were employed to evaluate the

presence of multivariate outliers. As a result of these analyses, two cases were removed. The significantly skewed distribution of online courses taken by the participants did not allow the use of this variable as a covariate. Furthermore, the number of online courses taken was not strongly and significantly related to any of the dependent variables, indicating that the loss of a degree of freedom as a result of its inclusion would not be offset by reduced error variance. Because experience in online learning was expected to influence participants' comfort in the online conditions related to anxiety and self-efficacy with technology, which could influence their experience in the present study, accounting for this difference was deemed important. Therefore, participants who reported taking one or more online course were not included in the analyses.

Also problematic was the extremely low reliability estimate for the demonstrated knowledge open-ended pretest scores. Because covariates are assumed to be measured without error (Tabachnick, 2001), the use of preexisting open-ended knowledge as a covariate was inappropriate. Although accounting for specific preexisting differences was not possible, the open-ended score was included as a dependent variable. Preexisting demonstrated knowledge assessed by the multiple choice test was treated as a covariate and appeared to address differences in demonstrated knowledge that existed prior to participation in the study.

The removal of cases to ensure that prior experience in online learning environments would not influence the study's results, missing data related to participants skipping items, and the removal of outliers resulted in unequal sample sizes, which was adjusted in the SPSS analyses. All cells had a greater number of cases than dependent variables, and the assumption of homogeneity of variance-covariance matrices was met evidenced by nonsignificant Box's *M* tests ($p > .001$) for both multivariate analyses. A review of the correlation matrix (see Tables 3

and 4) of all variables revealed moderate relationships where expected, and no interaction between independent variables and covariates was expected.

Multivariate Analyses

Comparison of Individual Differences. A 2 x2 between subjects MANCOVA was performed on the four measures of individual differences. SPSS GLM was used for the analyses with instructional environment entered first and instructional method second. Examination of Wilks' criterion revealed that the combined dependent variables: beliefs, interest, perceived? knowledge, demonstrated knowledge on the multiple-choice test and open-ended responses; were significantly related to three covariates with F (5, 100) = 19.08, $p < .001$ for preexisting beliefs, F (5, 100) = 12.43, $p < .001$ for preexisting interest, and F (5, 100) = 3.00, $p < .01$ for preexisting demonstrated knowledge on the multiple-choice test. The combined dependent variables were not significantly related to preexisting perceived knowledge, F (5, 100) = 1.49, $p = .20$. Evaluation of partial η^2 indicated that preexisting beliefs (partial $\eta^2 = .49$) and preexisting interest (partial $\eta^2 = .38$) were large enough to consider their effect important. The effect size of preexisting demonstrated knowledge measured by the multiple-choice test was smaller (partial $\eta^2 = .13$). Therefore, important differences existed between the participants assigned to the four conditions in their beliefs about, interest in, and demonstrated recognition of intelligence prior to the presentation of the treatment and these differences were statistically controlled.

These preexisting differences were likely present due to the assignment of classes rather than participants to the treatment conditions. Because some of the classes were comprised of predominately special education majors, it is possible that these students had received some information concerning intelligence in other courses. In addition, they may have held stronger beliefs about this construct evidenced by their apparent interest in working with children who

think differently and receive labels, such as mentally retarded and learning disabled, that are related to these differences. In addition, participants who were further along in their coursework and enrolled in more advanced courses had likely already received instruction pertaining to the construct of intelligence. Thus, differences existed between the participants assigned to the four conditions on variables of interest prior to the presentation of the treatment and these differences were statistically controlled.

With preexisting differences in beliefs, interest, perceived knowledge, and demonstrated knowledge assessed by the multiple-choice test statistically controlled, no significant differences existed in the combined dependent variables between participants in face-to-face conditions and online conditions [F (5, 100) = 1.43, p =.22] or between participants receiving a TAP lesson and those receiving an expository lesson [F (5, 100) = 2.10, p = .07]. Although no significant main effects were present, a significant interaction between environment and instructional method [F (5, 100) = 4.13, p < .01, partial η^2 = .17] was found. Subsequent univariate tests of between-subjects effects suggested that the interaction was related to the dependent variable of interest [F (1, 104) = 7.12, p = .01]. However, plotted marginal means indicated that interactions were present in other variables (see Figures 1 – 3). This suggested that the dependent variables needed to be considered as a composite and not separately, which was the purpose of the conducting a multivariate analysis. Further, the use of univariate tests does not allow for optimally weighted linear combinations. Thus, interpretation was more challenging and tests of simple effects were conducted.

Using simple main effects, the same overall model was repartitioned into different effects. First, the main effect of environment as well as the environment by method interaction term were removed from the full factorial specification and replaced with a request for the

simple effects of environment separately for each level of the method. This was conducted for each dependent variable utilizing the covariates employed in the original analysis. Second, the same analyses were conducted requesting the simple effects of instructional method separately for each level of the environment. Results revealed significant contrasts for each independent variable on beliefs and interest as well as a significant contrast for lesson method on the demonstrated knowledge open-ended response scores.

Findings indicated that participants in online environments reported stronger beliefs concerning more sophisticated perceptions of intelligence (e.g., changeability) when they received a TAP lesson compared to those who received an expository lesson (see Figure 1). In contrast, participants in face-to-face environments did not report stronger sophisticated beliefs of intelligence when they received an expository lesson in comparison to those who received a TAP lesson. Furthermore, these beliefs were significantly stronger in participants who were taught in the face-to-face environment with an expository method in comparison to those who were taught in the online environment with an expository method. A contrast was not present for the TAP method, indicating that online and face-to-face participants did not significantly differ in their beliefs when both were presented with a TAP lesson.

When considering interest outcomes (see Figure 2), those receiving a TAP lesson in the face-to-face environment reported greater interest than those receiving an expository lesson in the face-to-face environment. However, those receiving a TAP lesson in the online environment did not report greater interest than those receiving an expository lesson in the online environment. In addition, participants in the face-to-face environment did report greater interest than those in the online environment when presented with a TAP lesson. This contrast was not found for those presented with an expository lesson.

Finally, participants receiving a persuasive lesson in the online environment performed poorer on the open-ended test of demonstrated knowledge than those receiving an expository lesson in the online environment (see Figure 3). However, no significant contrast was found for those in the face-to-face conditions indicating that the performance of those receiving the expository lesson and those receiving the TAP lesson did not significantly differ. Also, students' open-ended demonstrated knowledge in the online expository group did not differ from that of students in the face-to-face expository group. Similarly, students' open-ended demonstrated knowledge in the online TAP group didn't differ from that of students in the face-to-face TAP group.

Differences in the Lesson Evaluation. A 2 x2 between subjects MANOVA was performed on the four measures associated with the lesson reaction. SPSS GLM was used for the analyses with instructional environment entered first and instructional method second. Evaluation of Wilks' criterion revealed the presence of significant main effects for both method [F (4, 128) = 2.50, p = .05] and environment [F (4, 128) = 2.62, p = .04]. The effect sizes were small, partial η^2 =.07 and partial η^2 = .08, respectively. Follow up univariate ANOVAs were conducted and indicated that participants receiving the expository lesson reported significantly less negative emotion than those receiving the TAP lesson [F (1, 131) = 5.25, p = .02]. High scores on the negative emotion factor indicate more positive emotions. Participants receiving instruction in the face-to-face environment reported significantly more positive emotion [F (1, 131) = 5.60, p = .02] and significantly less negative emotion [F (1, 131) = 6.97, p = .01] than those receiving instruction in the online environment (see Table 3).

Conclusions

The present findings suggest that the type of instruction provided interacts with students' learning environments. The TAP method is advantageous in developing students' topic beliefs

and interests; however the students' environment is also important in determining these outcomes. Persuasive instruction was more effective than expository instruction at influencing students' beliefs when learning online. The TAP method was more effective than expository instruction at influencing students' interests when learning face-to-face. These differences existed despite the greater negative emotion reported by students in the TAP conditions. Interestingly, differences did not exist between lesson type in the report of positive emotion. This suggests that the TAP lessons, regardless of the environment, may create some strife in students as they are confronted with varying theoretical positions. This is important as some discomfort is necessary to instigate belief change.

Despite these positive outcomes related to the TAP method, expository instruction seems to benefit actual demonstrated knowledge in open-ended responses in the online learning environment. Although this result may be of interest to many educators and students who are concerned about academic performance in online courses in comparison to face-to-face sections, a statistically significant difference in demonstrated knowledge assessed with the multiple-choice test was not found between any of the four conditions suggesting that academic performance was quite similar regardless of environment. Furthermore, expository instruction itself may have assisted students' performance on the open-ended items because clear statements concerning concepts were presented rather than contrasting theoretical perspectives. Students in the TAP condition online may have found it difficult to merely state their ideas subsequent to a lesson that requested comparing and contrasting. Because this same effect was not observed in the face-to-face conditions, students in these conditions may have benefited from simple interaction with the instructor and may possibly have taken cues from inadvertent nonverbal communication that signaled which ideas were "correct."

Not surprisingly, the presence of an instructor is important. The lack of personal interaction may be reflected in the online students' report of less positive emotion and greater negative emotion in comparison to those in face-to-face conditions. However, we must acknowledge that while the students participating in online conditions did not benefit from a present instructor, students enrolled in many online environments experience interaction through the incorporation of discussion boards, chat rooms, and even new software that allows "real time" video lectures to students while allowing the instructor to receive student feedback through polling, instant messaging, and even drawings. Thus, the online conditions may not represent what occurs in some online courses.

When considering the aforementioned limitation, one must also consider the time commitment requested of participants. This was most problematic in the online conditions as participants in these groups worked independently in a computer lab for over an hour, which included their completion of a large number of measures. Although the participants in face-to-face conditions spent the same time engaged in their lessons and completing the study's measures, their involvement did not actively require reading content, and exploring links using computer software with which they were not always familiar. Despite these limitations, as well as the concern that preexisting differences between groups were present at the start of the study likely due to the assignment of classes rather than individual students to conditions, the current study provides a baseline for future research as well as supports that a number of learning outcomes are comparable between online and face-to-face settings and instructional design is especially important in both.

Prevalent in the online instruction research is the term "delivery." Researchers and instructors alike refer to course delivery instead of instruction. This coin of phrase underscores

the pedagogical belief that learners then “receive” the course and thereby increase their knowledge. Thus, the trend back toward transmission models of teaching. Our concern regarding the conceptualization of online instruction as a form of delivery echoes Burbules and Callister (2000) who suggested that technology in teaching not be seen as a delivery platform, but rather a learning environment – a place where learning and teaching can happen.

Teaching as persuasion is rooted in the conceptual understanding of teaching as a process by which learners must construct, deconstruct, and reconstruct their own knowledge structures rather then received them readily made as ‘delivered’ from the instructor. From this perspective instruction is not delivered, it is orchestrated. Each student like a member of an orchestra brings their own instrument (i.e., cognitive strategies and abilities), play list (i.e., prior knowledge), and passion for the music (i.e., interest in the content). Then as the conductor must work with the orchestra before him to bring about the desired musical piece, so to, must the teacher work with the class before her to enable them to develop more sophisticated understandings of the content. Rather than offering online educators with yet another “delivery” method for instruction, TAP offers online educators with a baton for orchestration.

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Table 1

Comparison of TAP and Online Teaching Principles

Merging TAP with Online Principles	
Aspects of TAP	Principles for Online Instruction
Structure instruction as a persuasive text, wherein multiple sides of a topic are presented, argued, supported, and critiqued (Murphy 1998)	Avoid information over load (Johnson & Aragon, 2002) Engender disagreement of ideas in online discussions (Nussbaum, 2004)
Recognize and address learners' prior knowledge (Dienes & Barry, 1997) Model and encourage reflection on arguments and underlying evidence (Dole & Sinatra, 1998) Model reflective and analytic techniques (Chambliss, 1995) Connect instruction to learners' sense of motivation and emotions (Sinatra & Pintrich, 2002; Vosniadou, 1994). Emphasis the role of teacher as *one* source of information (Hynd, 2001)	Address individual difference in instruction (Johnson & Aragon, 2002) Encourage student reflection (Johnson & Aragon, 2002) Uses note starters in online discussions (Nussbaum et al., 2004) Motivate students (Johnson & Aragon, 2002) Encourage social interaction

Table 1 continued

Aspects of TAP	Principles for Online Instruction
Ensure that a high quality message is provided (Chambliss, 1995) Explicitly teach sourcing strategies and techniques (Bereiter, 2002)	Create a real-life context

Table 2

Individual Differences Mean Scores by Condition

Variables	Conditions			
	Online Persuasive	Online Expository	Face to Face Persuasive	Face to Face Expository
Topic Beliefs				
Mean	55.70	52.19	56.48	56.21
SD	8.26	9.67	9.07	9.32
Topic Interests				
Mean	32.03	32.76	35.32	31.19
SD	10.51	8.91	7.44	9.05
Topic Knowledge				
Mean	32.81	31.12	30.93	32.66
SD	6.54	7.26	8.01	7.74
Demonstrated Knowledge (Recognition)				
Mean	63.15	61.59	62.03	63.26
SD	12.33	13.00	5.12	5.73
Demonstrated Knowledge (Declarative)				
Mean	6.52	8.88	6.10	7.48
SD	3.36	3.55	4.51	4.26

Table 3

Lesson Reaction Mean Scores by Condition

Variables	Conditions			
	Online Persuasive	Online Expository	Face to Face Persuasive	Face to Face Expository
Positive Emotion				
Mean	40.19	39.15	45.65	43.27
SD	10.70	12.28	10.34	15.48
Negative Emotion				
Mean	25.30	27.21	27.32	30.34
SD	6.98	6.67	5.36	4.33
Autonomy				
Mean	14.70	16.27	17.00	18.00
SD	6.84	7.46	6.37	5.98
Competence				
Mean	20.88	19.59	20.68	22.24
SD	5.80	4.21	3.36	5.03

Table 4

Lesson Descriptions

Common Aspects

Reflections: Online reflection activities were completed discussion boards online. Face-to-face reflection activities were completed using the Think-Pair-Share cooperative learning technique.

Presentation of Theories: The same content information was presented in all lesson types. Information included:

- Brief biography of the researcher.
- Source (conceptualization) of the theory.
- Definition of Intelligence
- Theory explanation (constructs defined)
- Review theory by answering the following *organizing questions* from the theory's perspective
    1. What is the source of intelligence?
    2. How modifiable or "plastic" is intelligence?
    3. What is the structure of intelligence?
    4. What is the role of culture in understanding the meaning of intelligence?

Color Cues and Icons: Each theory was represented by a single color and icon. This was done to provide learners with visual cues to assist in memory and organization of the information.

Length: Online between 45 – 75 minutes; Face-to-face 50 minutes.

Comparison of Lessons

	Persuasive	Expository
Component 1	*Guiding Questions* • Can you become more intelligent? • What is intelligence? *Reflection* • Respond to the two questions with *your* beliefs.	*Activate Prior Knowledge* • What is intelligence? *Reflection* • On question above.
Component 2	*Introduction to Theories* • Emphasized multiple ideas and approaches to studying intelligence. • Supported analytical thinking by directing learners to consider: o The *source* of theories presented. o Source, plasticity, structure and culture related to intelligence *Gardner's MI Theory* *Reflection* • Do you buy it? Do you agree with Gardner's theory why or why not?	*Purpose of Lesson* • Explained goals of the lesson to: o Answer the question "What is intelligence" from the perspective of 5 theories. o Explore the development and treatment of source, stability, and universality by theory *Advance Organizers* • Timeline of Intelligence Theories • Graphic Organizer of theories and aspects of interest (e.g., source). Used to summarize theories *Binet and IQ* *Spearman's g* *R. Cattell's Fluid & Crystallized Theory* *Reflection* • What do YOU Think? How do the theories presented so far compare to your own understanding of Intelligence?

Table 4 Continued

	Persuasive	Expository
Component 3	*Criticisms of MI Theory Presented* *Binet and IQ* • Critiqued *Spearman's g Theory of Intelligence* *Reflection* • What do YOU Think? What are the pros and cons of the Intelligence Theories discussed so far? • Have your thoughts about MI Theory Changed? Do you agree with Gardner's theory why or why not?	*Sternberg's Triarchic Theory* • Critique of Sternberg *Gardner's MI Theory* • Critique of Gardner *Reflection* • Which theory do you find most compelling? Why?
Component 4	*R. Cattell's Fluid & Crystallized Theory* • Critique of Spearman Sternberg's Triarchic Theory • Critique of Sternberg *Review* • Theory review • Comparison of theories relative to the organizing questions. *Reflection: Guiding Questions Repeated* • Can you become more intelligent? • What is intelligence?	*Review* • Theory review • Comparison of theories relative to the aspects of interest • Review of Graphic Organizer *Reflection* • When we started this lesson we asked "What is intelligence?" • Have your Thoughts Changed?

Table 5

Correlations between Individual Difference Variables

Variables	1	2	3	4	5	6	7	8	9
Pretests									
1. Topic Beliefs	1.00								
2. Topic Interests	.28**	1.00							
3. Topic Knowledge	.10	.28**	1.00						
4. Demonstrated Knowledge (Recognition)	-.09	.20*	.19*	1.00					
Posttests									
5. Topic Beliefs	.68	.09	.08	-.14	1.00				
6. Topic Interests	.14	.56**	.23**	.16	.20*	1.00			
7. Topic Knowledge	.00	.30**	.31**	.11	.07	.45**	1.00		
8. Demonstrated Knowledge (Recognition)	.04	.19*	.11	.30**	-.10	.09	.23**	1.00	
9. Demonstrated Knowledge (Declarative)	-.12	.19*	.14	.22*	-.19*	.13	.31**	.44	1.00

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

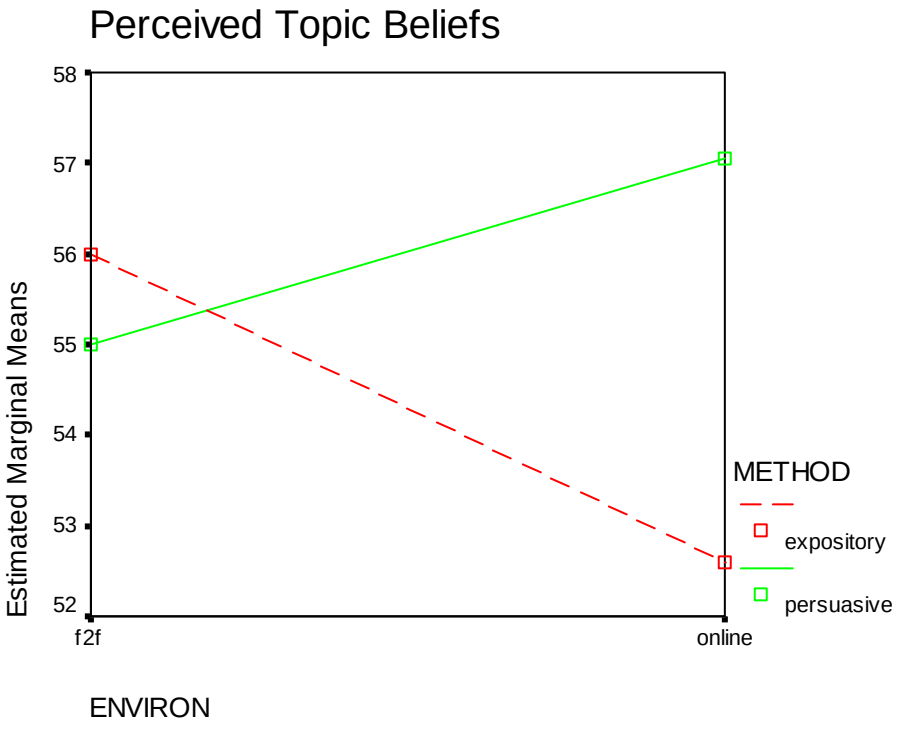
Table 6

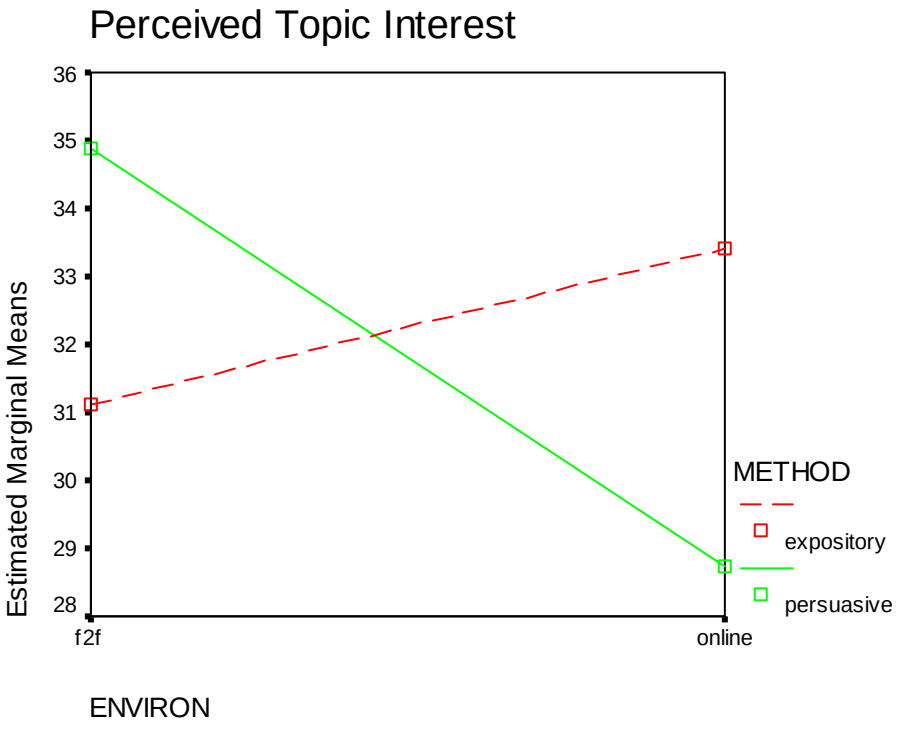
Correlations between Lesson Reaction Scores

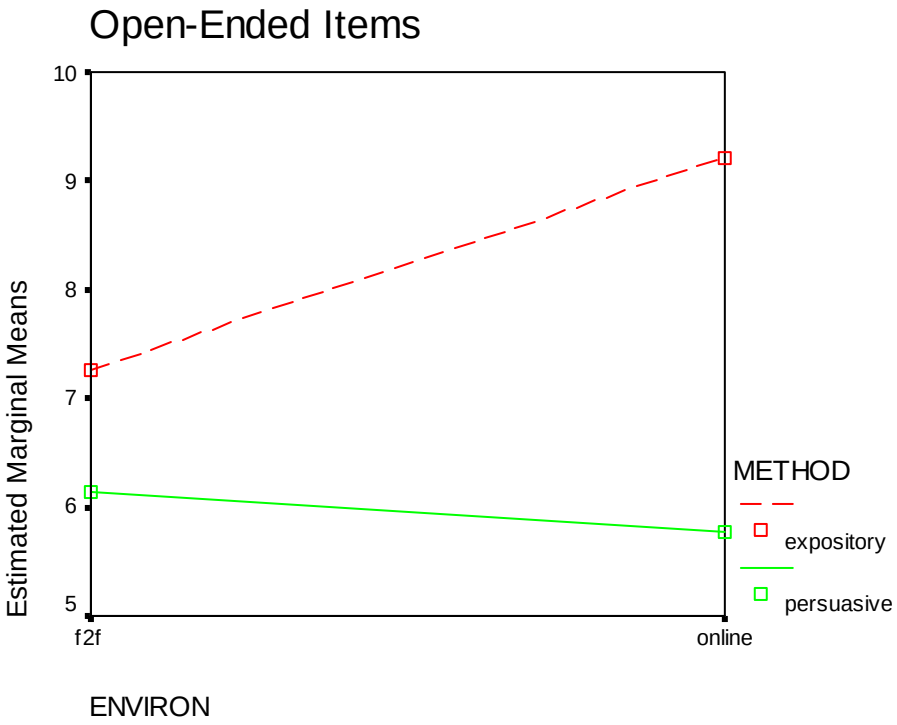
Variables	Positive Emotion	Negative Emotion	Autonomy	Competence
Positive Emotion	1.00			
Negative Emotion	.23**	1.00		
Autonomy	.43**	.31**	1.00	
Competence	.48**	.42**	.18*	1.00

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

Figures


Perceived Topic Beliefs
Estimated Marginal Means
58
57
56
55
54
53
52
f2f
online
ENVIRON
METHOD
expository
persuasive


Perceived Topic Interest
Estimated Marginal Means
36
35
34
33
32
31
30
29
28
f2f
online
ENVIRON
METHOD
expository
persuasive


Open-Ended Items
Estimated Marginal Means
10
9
8
7
6
5
f2f
online
ENVIRON
METHOD
expository
persuasive