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Federico, Pat-Anthony

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ACADEMIC DEPARTMENTS AND STUDENT ATTITUDES TOWARD DIFFERENT DIMENSIONS OF WEB-BASED EDUCATION*

PAT-ANTHONY FEDERICO
Naval Postgraduate School

ABSTRACT

In order to determine student attitudes toward various aspects of network-based instruction, 234 individuals voluntarily participated in research to ascertain their tendencies that will likely facilitate, or interfere with, interacting and learning from this innovative technology. Participants were requested to respond anonymously to 60 items of a survey designed to assess their attitudes toward distinct facets of network-based instruction. Student responses to survey items were analyzed using a number of multivariate and univariate statistical techniques. Students sampled from distinct academic departments disclosed significantly different attitudes toward different dimensions of Web-based education: Computer Science and Executive Management Education exhibited the most agreeable attitudes, and Oceanography, Physics, and Operations Research the least agreeable attitudes, concerning expectations of, learning from, beliefs about, and design of network-based instruction and hypermedia. Systems Management and Electrical and Computer Engineering manifested attitudes toward these distinct facets of on-line learning between these polar positions. The findings partially supported the general hypothesis theoretically based upon psychological distances and social representations and schemata.

*Opinions or assertions contained herein are those of the author and are not to be construed as official or reflecting the views of the Department of the Navy.

THEORETICAL FRAMEWORK

Many academic institutions and private corporations recognize the need for learning at a distance and continuing education and training on the job or in the schoolhouse (Keegan, 1996). Traditional residential classroom instruction is expensive and time consuming, requiring people to travel to courses' locations. Fortunately, we are in the midst of a paradigm shift in education and training from "classroom centric" to "network centric." Internet-based information and communication technologies are changing how instruction and assessment are being conducted in innovative schools, colleges, universities, and corporations throughout the world (Federico, 1997, 1998, 1999, 2000). Education and training are experiencing a noticeable transition "from the traditional centralized, local, classroom-teacher focused approach, to a de-centralized, global, network based, student focused one" (http://www.altgrp.com/Vision.html).

The recent digital fusion, the merger of computer, communication, and information technologies, enables a multimedia capability on the Internet or intranets. This consolidated technology can be used to complement customary instruction or to provide entire courses over networks which are becoming more capable of efficiently delivering the complete multimedia spectrum (Burbules & Callister, 1996; Cyrs & Conway, 1997; Jacobson, 1994; Jonassen, 1989, 1993; Kommers, Grabinger, & Dunlap, 1996; Nix & Spiro, 1990; Tergan, 1997; Vosniadou, De Corte, Glaser, & Mandl, 1996). In pursuit of such efficiencies, many academic and corporate institutions intend to transition, or already transitioned, prerequisite refresher preparation and a significant segment of scholastic core courses to network-based interactive multimedia collaborative instruction, or Web-based education.

"[A]ttitudes are defined at least implicitly as responses that locate 'objects of thought' on 'dimensions of judgment'" (McGuire, 1985, p. 239). Zanna and Rempel (1988, p. 319) regarded "an attitude as the categorization of a stimulus object along an evaluative dimension based upon, or generated from, three general classes of information: (1) cognitive information, (2) affective/emotional information, and/or (3) information concerning past behaviors or behavioral intentions."

Augoustinos and Walker (1995, pp. 13-14) concurred with McGuire and Zanna and Rempel, and asserted: "[A]ttitudes are evaluations. They denote a person's orientation to some object, or attitude referent. All attitudes have a referent, an 'object of thought,' a 'stimulus object.'. . . By denoting the attitude-holder's 'orientation' to the referent, an attitude conveys that person's evaluation of the referent. . . . The definition of attitude as evaluation is becoming increasingly common in social psychology, though still not universal."

According to Augoustinos and Walker, this explanation of attitude replaces a previously widespread "tripartite" description of attitude. Within this theoretical framework, "attitudes are predispositions to respond to some classes of stimuli with certain classes of responses" (Rosenberg & Hovland, 1960, p. 3). Three principal classifications of probable responses have been proposed: cognitive, affective, and behavioral. "Cognitive responses to a particular stimulus are the knowledge and beliefs the person has about the object; affective responses are simply how the person feels about the object; and behavioral responses are simply overt behaviors" (Augoustinos & Walker, 1995, p. 14).

The purpose of this reported research was to determine student attitudes toward different dimensions of network-based instruction. That is, the intent was to ascertain cognitive, affective, and behavioral predispositions that will likely facilitate, or interfere with, interacting and learning from this innovative technology. This study focused on the analyses of student attitudes among different academic departments in order to test the general hypothesis and to provide information to help design, develop, and deploy more effective Web-based education for these distinct curricula.

One general hypothesis was postulated: It was thought that academic departments, whose essential subject matter or tools were more inextricably intertwined with computer and associated technologies, would manifest significantly more favorable attitudes toward network-based instruction than academic departments, whose essential subject matter or tools were less inextricably intertwined with computer and associated technologies. Therefore, the general ranking of sampled academic departments, according to the agreeableness of their attitudes toward different dimensions of Web-based education, was the expected order: Computer Science (COMSCI), Electrical and Computer Engineering (ELECOM), Systems Management (SYSMGT), Executive Management Education (EXEMGT), Physics (PHYSIC), Operations Research (OPSRES), and Oceanography (OCENOG).

In part, this hypothesis was theoretically based upon the perceived psychological closeness, proximity, or distance between departmental course contents and network-based technology: The more close, more proximal, or less distant, the more favorable student attitudes toward on-line learning; the less close, less proximal, or more distant, the less favorable student attitudes toward on-line learning. This would likely be mediated by implicit positive or negative response sets induced by different departmental cultures and climates shaping intrinsic agreeable or disagreeable beliefs, feelings, and dispositions toward computer and associated technologies.

In addition to psychological distances and implicit response sets, two other hypothetical constructs, based upon theory and research in social cognition, can be employed to explain why different academic departments would likely demonstrate different attitudes toward different dimensions of Web-based education. These two speculative concepts are social representations and social schemata.

Moscovici's (1972) theory of social representations attempts to understand individual cognitive functioning within the framework of the relevant social or cultural milieu. According to this speculation, psychological experience is greatly influenced by commonly held collective views, knowledge, and language. Social processes impact upon the mental functioning of individuals and groups. Cognitive structures are acquired and developed within a social context; consequently, they are considered dynamic and changeable, concerning themselves with complicated belief systems and cultural value patterns. Social representations theory attempts to comprehend individual cognitive processes by taking into account social cognitive processes, and to provide social schemata with a needed common context (Augoustinos & Walker, 1995).

> For Moscovici, social representations are the ideas, thoughts, images and knowledge which members of a collectivity share: consensual universes of thought which are socially created and socially communicated to form part of a "common consciousness." Social representations refer to the stock of common knowledge and information which people share in the form of common-sense theories about the social world. . . . Human thought is regarded as an *environment*—always present and enveloping. Representations are hypothesized to mediate and determine cognitive activity, giving this activity form and meaning. . . . The role of representations is to conventionalize objects, persons, and events, to locate them within a categorical context [implying cognitive, affective, and evaluative processes]. Representations are also prescriptive in nature: determined by tradition and convention, representations impose themselves on our cognitive activity. . . . [W]hat makes representations social is their creation and generation, through social interaction and communication by individuals and groups (Augoustinos & Walker, 1995, pp. 135-137).

Different kinds of individuals possess different representations of their social surroundings. These shared cognitive, affective, and behavioral inclinations are essential in establishing group identities. That is, social representations function to define group memberships (Augoustinos & Walker, 1995).

Schemata are considered cognitive structures, containing universal expectations of the environment acquired through experience or acculturation. These general anticipations about physical and social settings are thought to give individuals a feeling of prediction and control over these situations (Federico, 1995). Schemata are employed to pick and process incoming information from these environments and underscore active construction of physical and social realities (Taylor & Crocker, 1981). Speculatively, schemata impose structure to events. Previous experiences, expectations, and preconceptions contribute to interpretations of newly encountered social situations (Augoustinos & Walker, 1995).

Classification and categorization of perceived persons, situations, or events trigger recognition-primed or schema-driven decisions and associated actions (Federico, 1995). Consequently, numerous judgments, evaluations, and opinions are formed automatically with little conscious thought and considered deliberation (Taylor & Fiske, 1978). Augoustinos and Walker (p. 173) contemplated "schemas as evaluative and affective structures which, when activated, can access schema-associated feelings and judgments." It is theorized schemata are shared among individuals and they develop from social conmiunication and interaction. Once social schemata are produced and reinforced through application, they are considered stable structures (Weber & Crocker, 1983).

Schema theory and social representations stress the use of "cognitive short-cuts, or heuristics" in the processing of socially relevant information (Moscovici, 1981, 1984; Nisbett & Ross, 1980). Also, schemata and representations are considered affective structures with intrinsic normative and evaluative dimensions (Fiske, 1982; Moscovici, 1981, 1984). Consequently, as cognitive functions, social schemata and representations have similar processing functions that direct the choice, connotation, and assessment of common knowledge and information. Schema theory is conceptualized primarily from an individual perspective; whereas, social representations are conceptualized primarily from a collective perspective (Augoustinos & Walker, 1995). Theories of schemata and social representations underscore how activations and utilizations of prefabricated knowledge structures and frameworks can easily bias social perceptions and judgments.

Therefore, within the framework of social representations theory, different attitudes toward network-based instruction, hypothetically possessed by students taking different curricula, can be learned and produced inside the social context of their respective academic departments. Individual members of these distinct scholastic programs can share common attitudes toward Web-based education, categorized within a familiar evaluative framework, formed from communication and interaction, determined by tradition and convention, and identified as particular to a curriculum. Students can accommodate and assimilate dissimilar evaluative and affective social schemata through experience and acculturation within their different academic departments, imposing specific structures and interpretations on their attitudes toward on-line learning, which are automatically formed and triggered as well as easily biased and predisposed.

METHOD

Participants

Students, enrolled in different academic departments of the Naval Postgraduate School, were asked to voluntarily participate in this research. They were requested to respond anonymously to each item of a survey designed to assess their attitudes toward distinct facets of network-based instruction. Students were asked to participate in order to obtain a sufficiently large sample size for analyzing the data statistically and extrapolating to the potential population of on-line learners.

The academic departments from which students were asked to participate, and corresponding sample sizes of those who completed the survey and accompanying two other forms, were as follows: COMSCI (38), ELECOM (37), EXEMGT (25), OCENOG (25), OPSRES (35), PHYSIC (33), and SYSMGT (41). Consequently, the total size of the student sample for this study was 234.

Instrument

A paper-based attitude survey was created, consisting of 60 Likert-formatted items to measure student attitudes toward varied aspects of network-based instruction. Participants were required to indicate agreement or disagreement with each statement by placing a check mark at the response alternative that most closely reflects their opinion. They were asked to use the entire extent of the 7-point scale, ranging from very strongly agree, strongly agree, agree, undecided, disagree, strongly disagree, to very strongly disagree, to show their response for each item. These response alternatives for each item were scored 7, 6, 5, 4, 3, 2, and 1, respectively. It took participants approximately 15 minutes to respond to all items of this educational research form.

For the first part of the survey, composed of 12 items, network-based instruction was theoretically classified along two dimensions: content (facts, concepts, procedures, and principles) and performance (find, use, and remember). Participants were required to indicate their opinion concerning the appropriateness of network-based instruction for learning how to find, use, and remember facts, concepts, procedures, and principles. For the second part of the survey composed of 48 items, participants were required to indicate their opinion concerning various aspects of the learning environment for network-based instruction, e.g., hypertext, hypermedia, nodes, links, navigation, chunking, animation, learner control and interaction, screen and instructional design. At the beginning of this part of the survey, hypertext, hypermedia, nodes, links, and learner control were defined and explained for the few participants who may, however unlikely, be uninitiated in the use of this technology, with the exponentially expanding popularly of the Internet, intranets, and World Wide Web. The most important items, identified by statistical analyses, will be presented in the results and discussion section. The alpha reliability coefficient for the 60 items of this attitude survey, using the total sample of 234 participants, was computed to be .91. This index implies the created attitude survey has high reliability.

Procedure

The attitude survey and its corresponding instructions were bound in a booklet. This was administered to some students in their scheduled classes or meetings where they completed the form. For a few curricula, it was less obtrusive to distribute the booklets to individuals through their departments and ask participants to respond and return them within a few days. In order to increase the size of the student sample from the Executive Management Education curriculum, some booklets were mailed to distributed individuals who were asked to complete and return them within approximately 30 days. Once booklets were recovered, scores for every one of the 60 items of the attitude survey were entered into a database for all participants who were only identified by coded curriculum and booklet number.

RESULTS AND DISCUSSION

These data were used to compute a number of multivariate procedures: factor and discriminant analyses, and their associated statistics, as well as several univariate techniques: variance analyses and range tests. Just the salient results from these statistical analyses will be presented, reflecting differences in measured attitudes among students from distinct academic departments.

Findings from the stepwise discriminant analysis among the seven academic departments, using participants' responses to the 60 attitude items and considering their multivariate interrelationships, disclosed that four independent dimensions distinguished these curricular groups. These four significant discriminant functions, or linear combinations of attitude items which maximally differentiate the seven groups, accounted for 83.37 percent of the variance among the academic departments.

Learning from Hypermedia

For the first orthogonal dimension (eigenvalue = .56; percent variance = 27.44; canonical correlation = .60; Wilks' lambda = .18; chi-squared (210) = 363.35, p = .000), dealing predominantly with learning from hypermedia, the rotated standardized discriminant coefficients revealed that student responses to ten of the attitude items contributed to the significant separation among curricula. Presented in order of their importance, according to the sizes of their discriminant coefficients for this linear function, these items and their corresponding contents are as follows:

(55) Hypermedia instruction should build on previous experiences of students.
(42) Exploring hypermedia on the Internet, employing browsers (e.g., Netscape Navigator, Microsoft Internet Explorer), is readily learned, easily used, efficiently accomplished, and greatly satisfying.
(22) Network-based education will be as good as traditional classroom instruction for learning managerial competencies.
(26) Inherently non-linear, readily modularized, and highly voluminous information is well suited to hypertext presentation.
(35) Visual cues (e.g., color, underlining, bold, italics, headings, arrows) will be effective in gaining and maintaining attention while interacting with hypertext.
(50) Meaningful interactivity will effectively lead to greater learning and retention in hypermedia instructional environments.

(4) Network-based instruction will be appropriate for learning how to find procedures.
(59) Professors are no longer "sages on stages," but "guides on the sides" of student learning in hypermedia instructional settings.
(1) Network-based instruction will be appropriate for learning how to find facts.
(19) Playing around with hypermedia will result in more effective initial learning and subsequent performance.

Curricular centroids for the first discriminant function, evaluated at the academic departments' mean scores for these ten items, revealed how the seven groups of participants were positioned along this linear dimension: the discriminant function transformed a participant's item scores into a single discriminant score. This indicated an individual's position along the linear dimension, understood as ranging from high to low agreeableness, which maximally separated the seven curriculum groups. Therefore, the ranking of academic departments, according to their computed centroids for the derived discriminating dimension, reflected their relative degrees of favorableness toward learning from hypermedia, specifically: EXEMGT (1.56), SYSMGT (.68), ELECOM (–.17), COMSCI (–.22), OPSRES (–.31), PHYSIC (–.56), and OCENOG (–.91).

Using individuals' discriminant scores derived for this first dimension, a one-way univariate analysis of variance and Duncan's multiple range test ($p < .05$) were computed among academic departments. These statistics established: 1) EXEMGT manifested significantly ($F(6,227) = 19.59$, $p = .000$) more favorable attitudes toward learning from hypermedia than OCENOG, PHYSIC, OPSRES, COMSCI, ELECOM, and SYSMGT; 2) SYSMGT manifested significantly more favorable attitudes toward learning from hypermedia than OCENOG, PHYSIC, OPSRES, COMSCI, and ELECOM; and 3) OCENOG manifested significantly less favorable attitudes toward learning from hypermedia than OPSRES, COMSCI, and ELECOM.

Subsequently, without taking into account the multiple interrelationships among attitude items, one-way univariate analyses of variance, Duncan's multiple range tests ($p < .05$), and group means disclosed individuals from distinct academic departments responded to items (50) and (59) significantly differently. For item (50), participants from COMSCI (5.31) indicated significantly ($F(6,227) = 2.97$, $p = .008$) more agreeable attitudes than participants from PHYSIC (4.55), OCENOG (4.60), ELECOM (4.65), SYSMGT (4.76), and OPSRES (4.80). Also, participants from EXEMGT (5.32) indicated significantly more agreeable attitudes than participants from PHYSIC, OCENOG, and ELECOM. For item (59), participants from COMSCI (4.34) revealed significantly ($F(6,227) = 3.58$, $p = .002$) more positive attitudes than participants from OCENOG (3.36) and OPSRES (3.51); participants from ELECOM (4.49) revealed significantly more positive attitudes than participants from OCENOG and OPSRES; and participants from EXEMGT (4.64) revealed significantly more positive attitudes than participants from OCENOG, OPSRES, and PHYSIC (3.79). Students sampled from COMSCI and EXEMGT were more favorable toward meaningful interactivity effectively leading to greater learning and retention in hypermedia instructional environments than students sampled from PHYSIC, OCENOG, and ELECOM. Furthermore, students sampled from COMSCI, ELECOM, and EXEMGT were more favorable toward professors no longer being “sages on stages” but “guides on the side” of student learning in hypermedia instructional settings than students sampled from OCENOG, OPSRES, and PHYSIC.

Expectations of Network-Based Instruction

For the second orthogonal dimension (eigenvalue = .47; percent variance 22.91; canonical correlation = .56; Wilks’ lambda = .28; chi-squared (170) = 269.31, p = .000), concerning chiefly expectations of network-based instruction, the rotated standardized discriminant coefficients indicated that student responses to six of the attitude items contributed to the significant separation among academic departments. Appearing in order of their importance, according to the relative sizes of their discriminant coefficients for this linear function, these items and their corresponding contents are as follows:

- (20) Interacting with network-based instruction will induce playful and exploratory behavior in students.
- (21) Network-based instruction will be excellent for learning, retaining, and supporting managerial skills.
- (1) Network-based instruction will be appropriate for learning how to find procedures.
- (6) Network-based instruction will be appropriate for learning how to use concepts.
- (27) Dividing themes or thoughts into discrete nodes for hypertext will impede the comprehension of the subject matter.
- (13) Regularly using the Internet by interacting with hypermedia is worthwhile and beneficial.

Curricular centroids for the second discriminant function, assessed at the academic departments’ mean scores for these six items, disclosed how the seven groups of participants were positioned along this linear dimension. The ordering of the curricular groups, according to their computed centroids for this discriminating dimension, indicated their relative degrees of favorableness concerning expectations from network-based instruction, specifically: COMSCI (1.01), SYSMGT (.60), ELECOM (.21), PHYSIC (–.37), OPSRES (–.67), EXEMGT (–.68), and OCENOG (–.71).

Employing participants’ discriminant scores derived for this second dimension, a one-way univariate analysis of variance and Duncan’s multiple range test

($p < .05$) were computed among academic departments. These statistics established: 1) COMSCI exhibited significantly ($F(6,227) = 16.67$, $p = .000$) more positive attitudes regarding expectations from network-based instruction than OCENOG, EXEMGT, OPSRES, PHYSIC, and ELECOM; 2) SYSMGT exhibited significantly more positive attitudes regarding expectations from network-based instruction than OCENOG, EXEMGT, OPSRES, and PHYSIC; and 3) ELECOM exhibited significantly more positive attitudes regarding expectations from network-based instruction than OCENOG, EXEMGT, OPSRES, and PHYSIC.

Afterwards, one-way univariate analyses of variance, Duncan's multiple range tests ($p <$ 05), and group means revealed individuals from distinct academic departments responded to items (6) and (20) significantly differently. For item (6), participants from COMSCI (4.84) disclosed significantly ($F(6,227) = 3.33$, $p = .004$) more positive attitudes than participants from OPSRES (3.83), OCENOG (3.92), SYSMGT (3.95), and PHYSIC (4.00). For item (20), participants from COMSCI (5.37) disclosed significantly ($F(6,227) = 3.06$, $p = .007$) more agreeable attitudes than participants from OPSRES (4.46), EXEMGT (4.48), PHYSIC (4.55), ELECOM (4.70), and OCENOG (4.72). Students sampled from COMSCI were more favorable toward the expectation that network-based instruction will be appropriate for learning how to use concepts than students sampled from OPSRES, OCENOG, SYSMGT, and PHYSIC. Also, students sampled from COMSCI were more favorable toward the expectation that interacting with this technology will induce playful and exploratory behavior in students than students sampled from OPSRES, EXEMGT, PHYSIC, ELECOM, and OCENOG.

Beliefs about Network-Based Instruction

For the third orthogonal dimension (eigenvalue = .40; percent variance = 19.89; canonical correlation = .54; Wilks' lambda = .41; chi-squared (132) = 188.20, $p = .001$), indicating predominantly beliefs about network-based instruction and hypermedia, the rotated standardized discriminant coefficients disclosed that student responses to four of the attitude items contributed to the significant separation among academic departments. Appearing in order of their importance, according to the sizes of their discriminant coefficients for this linear function, these items and their corresponding contents are as follows:

(9) Network-based instruction will be appropriate for learning how to remember facts.

(23) Network-based instruction will be an instructionally rich medium, because it will provide many verbal and nonverbal cues, permit direct feedback, employ natural language, and encourage personal communication.

(54) Hypermedia-based instruction should build on previous learning experiences of students.

(37) In hypertext learning environments, propagation of links should reflect the relevance of nodes to one another and the meaningful relationships among these concepts.

Curricular centroids for the third discriminant function, evaluated at the academic departments' mean scores for these four items, exposed how the seven groups of participants were positioned along this linear dimension. The arrangement of academic departments, according to their computed centroids for the derived discriminating dimension, reflected their relative degrees of favorable beliefs about network-based instruction and hypermedia, specifically: COMSCI (.84), EXEMGT (.60), ELECOM (.26), OPSRES (.03), PHYSIC (–.18), OCENOG (–.40), and SYSMGT (–1.01).

Utilizing individuals' discriminant scores derived for this third dimension, a one-way univariate analysis of variance and Duncan's multiple range test ($p < .05$) were computed among academic departments. These statistics established: 1) COMSCI manifested significantly ($F(6,227) = 14.23$, $p = .000$) more favorable attitudes regarding beliefs about network-based instruction than SYSMGT, OCENOG, PHYSIC, OPSRES, and ELECOM; 2) EXEMGT manifested significantly more favorable attitudes regarding beliefs about network-based instruction than SYSMGT, OCENOG, PHYSIC, and OPSRES; 3) ELECOM manifested significantly more favorable attitudes regarding beliefs about network-based instruction than SYSMGT and OCENOG; and 4) SYSMGT manifested significantly less favorable attitudes regarding beliefs about network-based instruction than OCENOG, PHYSIC, and OPSRES.

Subsequently, a one-way univariate analysis of variance, Duncan's multiple range test ($p < .05$), and group means indicated individuals from distinct academic departments responded to item (23) significantly differently. For item (23), participants from EXEMGT (5.20) disclosed significantly ($F(6,227) = 2.33$, $p = .034$) more positive attitudes than participants from SYSMGT (3.59) and OCENOG (3.60); and participants from COMSCI (4.63) disclosed significantly more positive attitudes than participants from SYSMGT, OCENOG, and PHYSIC (3.85). Students sampled from EXEMGT and COMSCI were more favorable toward the notion that network-based instruction will be an instructional rich medium than students sampled from SYSMGT, OCENOG, and PHYSIC.

Design of Network-Based Instruction

For the fourth orthogonal dimension (eigenvalue = .27; percent variance 13.13; canonical correlation = .46; Wilks' lambda = .58; chi-squared (96) = 116.17, $p = .079$), involving primarily design of network-based instruction and hypermedia environments, the rotated standardized discriminant coefficients disclosed that student responses to five of the attitude items contributed to the significant separation among academic departments. In order of their importance, according to the sizes of their discriminant coefficients for this linear function, these items and their corresponding contents are as follows:

(25) Network-based instruction should have highly structured content, demanding mastery of prerequisite sequential steps or units, before learning can continue.
(52) Low density computer screen designs, presenting content in smaller conceptual units, will require an increased number of instructional frames, thereby interfering with learning from hypermedia.
(53) Computer screen displays should be divided into specifically functional and exclusive areas for interacting with courseware, communicating with instructors and other students, and controlling the learning environment, and consistently maintained through the on-line course.
(43) Hypermedia-based learning environments should allow student browsing (narrowing down) and wandering (broadening up) through course content.
(34) Drawings, graphics, illustrations, or animations will enhance the learning of hypertext course content.

Curricular centroids for the fourth discriminant function, assessed at the academic departments' mean scores for these five items, revealed how the seven groups of participants were arranged along this linear dimension. The placement of academic departments, according to their computed centroids for the derived discriminating dimension, indicated their relative degree of favorableness with regard to the design of network-based instruction and hypermedia environments, specifically: ELECOM (1.06), OPSRES (.21), PHYSIC (.01), EXEMGT (–.02), SYSMGT (–.29), COMSCI (–.49), and OCENOG (–.63).

Employing participants' discriminant scores derived for this fourth dimension, a one-way univariate analysis of variance and Duncan's multiple range test ($p < .05$) were computed among academic departments. These statistics established: 1) ELECOM manifested significantly ($F(6,227) = 11.01$, $p = .000$) more positive attitudes concerning the design of network-based instruction than OCENOG, COMSCI, SYSMGT, EXEMGT, PHYSIC, and OPSRES; 2) OPSRES manifested significantly more positive attitudes concerning the design of network-based instruction than OCENOG, COMSCI, and SYSMGT; and 3) OCENOG manifested significantly less positive attitudes concerning the design of network-based instruction than EXEMGT and PHYSIC.

Furthermore, without taking into account the multiple interrelationships among attitude items, one-way univariate analyses of variance, Duncan's multiple range tests ($p < .05$), and group means disclosed individuals from distinct academic departments responded to items (7), (8), (44), and (55) significantly differently. For item (7), participants from COMSCI (5.13) indicated significantly ($F(6,227) = 2.78$, $p = .013$) more agreeable attitudes than participants from SYSMGT (4.07), OPSRES (4.20), and OCENOG (4.28). Students sampled from

COMSCI were more favorable that network-based instruction will be appropriate for learning how to use procedures than students sampled from SYSMGT, OPSRES, and OCENOG.

For item (8), participants from EXEMGT (4.68) manifested significantly ($F(6,227) = 3.69$, $p = .002$) more positive attitudes than participants from OPSRES (3.83), OCENOG (3.88), PHYSIC (3.97), and SYSMGT (3.98); and participants from COMSCI (4.87) manifested significantly more positive attitudes than participants from OPSRES (3.83), OCENOG (3.88), PHYSIC (3.97), SYSMGT (3.98), and ELECOM (4.08). Students sampled from EXEMGT and COMSCI were more favorable that network-based instruction will be appropriate for learning how to use principles than students sampled from OPSRES, OCENOG, PHYSIC, SYSMGT, and ELECOM.

For item (44), participants from EXEMGT (5.20) and OPSRES (5.14) disclosed significantly ($F(6,227) = 2.33$, $p = .034$) more agreeable attitudes than participants from ELECOM (4.57) and PHYSIC (4.61); and participants from SYSMGT (5.07) disclosed significantly more agreeable attitudes than participants from ELECOM (4.57). Students sampled from EXEMGT and OPSRES were more favorable toward the benefit derived from interacting with hypermedia will involve accessing information that supports learner's associative thinking process than students sampled from ELECOM and PHYSIC. Also, students sampled from SYSMGT were more favorable toward this benefit of interacting with hypermedia than students sampled from ELECOM.

For item (55), participants from EXEMGT (5.80) revealed significantly ($F(6,227) = 2.68$, $p = .016$) more agreeable attitudes than participants from OCENOG (4.88), PHYSIC (4.97), COMSCI (5.03), ELECOM (5.22), and OPSRES (5.23). Students sampled from EXEMGT were more inclined that hypermedia instruction should be situated in functional contexts of real-world activities and events than students sampled from OCENOG, PHYSIC, COMSCI, ELECOM, and OPSRES.

Within the contexts of this study and social psychological theory, students' attitudes were considered beliefs about, feelings toward, and dispositions to respond to various aspects of network-based instruction. These cognitions, feelings, and action tendencies were viewed as being organized into a multidimensional system. Once this structure was uncovered, theoretical and practical insights were possible into the nature of individuals' attitudes. The discriminant analysis and associated statistics conducted in this investigation revealed multiple independent attitudinal dimensions which significantly separated different academic departments. Interrelated individual survey items, contributing to separate discriminating functions, were considered attitude clusters. These interconnected items were viewed as being homogeneous in the sense of contributing to a single discriminating function, and heterogeneous in the sense of generally different items contributing to distinct discriminating functions. Entire sets of clusters, or independent dimensions, for academic departments were thought of as constituting attitude constellations. This information can be used to not only predict and control student behaviors, but also design and develop individualized on-line instruction which is more compatible with their distinct attitudes, thereby probably notably improving their acquisition performances in Web-based educational environments.

Generalizing from multivariate and univariate results, it was established that students sampled from distinct academic departments disclosed significantly different attitudes toward different dimensions of Web-based education. For academic departments, COMSCI and EXEMGT exhibited the most agreeable attitudes, and OCENOG, PHYSIC, and OPSRES the least agreeable attitudes, concerning expectations of, learning from, beliefs about, and design of network-based instruction and hypermedia. SYSMGT and ELECOM manifested attitudes toward these distinct facets of this on-line learning environment between these polar positions.

These findings partially supported the general hypothesis: academic departments, whose essential subject matter or tools were more inextricably intertwined with computer and associated technologies, would manifest significantly more favorable attitudes toward network-based instruction than academic departments, whose essential subject matter or tools were less inextricably involved with computer and associated technologies. In order to completely corroborate this hypothesis, the uncovered general ranking of academic departments, according to the agreeableness of their attitudes toward varied aspects of network-based instruction, should have been the expected order: COMSCI, ELECOM, SYSMGT, EXEMGT, PHYSIC, OPSRES, and OCENOG.

According to some of the established results, within the framework of social representations theory, it seemed different attitudes toward network-based instruction, possessed by students taking different curricula, were learned and produced inside the social context of their respective academic departments. Individual members of these distinct scholastic programs appeared to share common attitudes toward Web-based education, categorized within a familiar evaluative framework, formed from communication and interaction, determined by tradition and convention, and identified as particular to a curriculum. Students seemed to accommodate and assimilate dissimilar evaluative and affective social schemata through experience and acculturation within their different academic departments, imposing specific structures and interpretations on their attitudes toward on-line learning, which were automatically formed and triggered as well as easily biased and predisposed.

It was assumed throughout this research that student attitudes affect how individuals interact with and learn from network-based instruction. For academic departments, the findings of this study suggested the most agreeable attitudes disclosed by students from COMSCI and EXEMGT will likely facilitate interacting and learning from network-based instruction. Whereas, the least agreeable attitudes disclosed by students from OCENOG, PHYSIC, and OPSRES will likely interfere with interacting and learning from network-instruction. Also, the intermediate attitudes disclosed by students from SYSMGT and ELECOM will likely facilitate, or not interfere with, interacting and learning from network-based instruction.

The established results supplement Federico's (2000) findings that students possessing dissimilar learning styles disclosed significantly different attitudes toward various aspects of network-based instruction. This previous study ascertained that students with assimilating and accommodating learning styles demonstrated significantly more agreeable attitudes toward varied aspects of network-based instruction than students with converging and diverging learning styles. These findings partially supported the proposed general hypothesis: individuals who highly preferred combined reflective observation and abstract conceptualization learning modes (assimilators) would manifest significantly more favorable attitudes toward network-based instruction, than individuals who highly preferred combined: 1) concrete experience and reflective observation learning modes (divergers); 2) abstract conceptualization and active experimentation learning modes (convergers); or 3) concrete experience and active experimentation learning modes (accommodators). This prior research on learning styles and attitudinal differences was performed within the theoretical framework of adaptive instruction that advocates no single instructional strategy is best for all students. Consequently, students will be able to achieve learning goals more efficiently when pedagogical procedures are adapted or accommodated to their individual differences (Cronbach & Snow, 1977; Federico, 1980, 1987, 1991, 1999; Glaser, 1977).

Extrapolating from the found outcomes, the following recommendations were made to appropriate sponsors, academic administrators, faculty members, and instructional developers interested in realizing on-line learning:

1. Attempt to change individual attitudes, regarding expectations of, learning from, beliefs about, and design of network-based instruction, disclosed in this study for students sampled from OCENOG, PHYSIC, and OPSRES. Demonstrating for students from these departments, well designed, developed, and deployed on-line learning for their specific curricula may make their attitudes more agreeable toward the various aspects of network-based instruction which were the focus of this research. More agreeable attitudes among the students in these academic departments will likely facilitate interacting with, and learning from, Web-based educational environments.

2. Consider attitudes of students from the academic departments sampled in this research, regarding expectations of, learning from, beliefs about, and design of network-based instruction, when planning, producing, and implementing network-based instruction. Heeding these student attitudes, during the instructional systems design process, will likely result in enhanced Web-based educational environments which will probably improve individual interaction with the interface and acquisition of knowledge.

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Direct reprint requests to:

Dr. Pat-Anthony Federico
4493 Pescadero Avenue
San Diego, CA 92107-3628