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ABSTRACT

This between-subjects experiment was designed to examine the impact of physical distance on affect and cognition in a distance education situation. Participants were 48 undergraduate students enrolled in communications classes. All subjects were exposed to identical instructional material, but half of the students were told that the material was prepared by a distance learning institution located nearby (20 or 200 miles away), while the other half were told that the institution was located far away (2000 or 5000 miles away). Results showed that subjects in the near condition felt that the material was significantly clearer, more appropriate, and less in need of cosmetic improvement than their counterparts in the far condition. However, there were no differences in memory for content as a function of physical distance. (Author/AEF)

The Psychological Importance of "Distance" in Distance Education

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In a distance education scenario, does the degree of physical distance between the instructor and the student affect the latter's affect and cognition? A between-subjects experiment was designed to answer this question. All subjects (N=48) were exposed to identical instructional material, but one-half was told that the material was prepared by a distance learning institution located nearby (20 or 200 miles away) while the other half was told that it was located far away (2000 or 5000 miles away). Results showed that subjects in the near condition felt that the material was significantly clearer, more appropriate, and less in need of cosmetic improvement than their counterparts in the far condition. However, there were no differences in memory for content as a function of physical distance.

The phenomenal growth of distance education in recent years (Rampal, 1991; Rose, 1997; McHenry, 1995; Bernier, 1996) is premised on educators' belief that it promotes "open learning" by removing barriers imposed by geographical as well as socioeconomic factors and making access to education not only egalitarian but also more efficient, convenient and cost-effective (Sopova, 1996; Coffey, 1977; Bruce, Katz & Tomsic, 1991). However, some scholars contend that the very "openness" of open learning engenders a "closure" in the educational process (Harris, 1987; Rose, 1997). They argue that for each avenue it opens, open learning negatively affects another aspect of learning (Harris, 1987; McHenry, 1995) and creates new hurdles.

One such hurdle is the often enormous physical distance between the instructor and the learner, which many believe creates a psychological chasm between the teacher and the taught (e.g., Rose, 1997). Despite the availability of technology for two-way communication, students at remote sites constantly complain about a feeling of isolation from the teacher (McHenry, 1995; Kelly, 1987). Although distance education is lauded for transcending physical boundaries, it is faulted for potentially negative psychological consequences arising from the absence of face-to-face contact (e.g., DeVries, 1996; Penn State, 1992). Some scholars argue that physical isolation negatively affects students' perceptions of course material, serving as a demotivating influence on learning (Rodriguez, 1990; Christophel, 1990; Sanders & Wiseman, 1990; McHenry, 1995).

The present investigation is a test of this claim. The study reported in this paper attempts to empirically address the impact of physical distance on affect and cognition in a distance education situation. Using a controlled experimental design, the current investigation measures content perception and memory as a function of distance from the instructor.

A review of the literature will be used to hypothesize a negative effect of distance on affect as well as an inverse relationship between distance and learning. This paper will then present the methods and results of an experiment designed to test both hypotheses. Finally, it will discuss

the findings with a view to advancing knowledge on actual as well as perceptual effects of physical distance in the learning process.

Literature Review

Learning under any circumstance is associated with several social-psychological factors such as teacher immediacy, learner-instructor interaction, course design, student motivation and involvement with the content (Christophel, 1990; Hackman & Walker, 1990).

Teacher immediacy is defined as the extent to which particular communication behaviors enhance physical and psychological closeness (Andersen, 1979; Christophel, 1990; Hackman & Walker, 1990). This psychological closeness, presumably bridging the perceived distance between a teacher and a student, has been shown to affect learning outcomes by affecting motivation and involvement, which in turn affect the attitude towards the learning content (Sanders and Whitman, 1990). Moore (1996), for example, found that student ratings of instructors was positively related to the frequency of immediacy behavior on the part of instructors. Even though teacher immediacy is recognized as a "success factor" in distance education, there is little empirical data that directly links the degree of immediacy and students' performance or their perception of the content delivered from a distance.

Learner-instructor interaction, which is a social aspect of learning, has been identified by students as one of the most desirable characteristics of effective communication (Moore,1991; DeVries, 1996; Newhagen, 1996). In distance education, this interaction is primarily written, mechanical or electronic, thereby restricting or completely eliminating any personal social contact. Transactional theory of distance suggests that leaner-instructor communication can be enhanced by building in interaction into the design of materials such that there is less structure and more dialogue in learning materials (Moore, 1996). However, the efficacy of increased interaction in a distance education setting has not been empirically determined.

Since instructional material is the primary means of communication between the instructor and the student, learning in a distance education situation is essentially dependent on the nature of learner-content interaction. In the absence of structured class meetings, distance learners require more motivation than conventional classroom learners. Motivation has been defined as a combination of "enduring predisposition toward learning" and "an attitude toward a specific class, subject or topic" (Christophel, 1990). Motivation toward learning is often stimulated through various forms of modeling, communication of expectations, face-to-face interaction or equivalent, and socialization by teachers. Additionally, positive attitudes are influenced by association with the messenger (teacher), and by preparing content to appeal and involve the particular audience (e.g., Petty, 1997). Prescribed materials in distance education are considered successful to the extent they evoke student interest in subject matter and motivate him/her to learn.

While in conventional education, most of the factors affecting motivation have a possibility of being addressed by face-to-face interaction they remain questionable in distance education (Sewart, 1989). It has been suggested that students' state motivation is a central causal mediator between immediacy and learning (Christophel, 1990, Rodriguez, 1996). State motivation refers to the motivation a student experiences toward a particular class, task, or content area at a particular time. Based upon an experimental study, Rodriguez (1996) has further emphasized the significance of teacher immediacy by proposing an affective model. According to the affective model, the relationship between teacher immediacy and student's cognitive learning is mediated by student's affective learning, which is an intrinsic motivator. Rodriguez (1996) contends that attitude towards a particular content and thus its perception is based heavily on teacher-student relationship. In distance education, this relationship is somewhat weakened because the interaction between the teacher and the student is mediated by instructional materials and/or technology (satellite, web, telephone etc.).

However, the effectiveness of mediated communication can be enhanced by increasing "social presence," defined as the degree to which a given interaction can approximate the characteristics of face-to-face interaction (Hawkes, 1996; Short, Williams & Christie, 1976). Absence of social presence has been identified as a source of frustration (Ruchinskas, 1982).

Scholars in distance education have long noted that mediated communications are most effective when students perceive a personal sense of involvement (e.g., Holmberg, Schuemer & Obermeier, 1982). Teacher immediacy and teacher-student interaction have been shown to positively influence all aspects of learning (Christophel, 1990; Rodriguez, 1996; DeVries, 1996). For the same reason, it has been suggested that in a situation where the norms of a face-to-face interaction are being followed (as in a distance education scenario), a medium with high social presence, such as television, must be adopted. If this is beyond the technological or financial means of a distance education institution (as is often the case with small universities or developing nations), it is suggested that print-based courses be presented in a way that specifically enhances social presence (Hackman & Walker, 1990). Rumble (1990), for example, has suggested an increase in two-way communication for the purpose of enhancing social presence. The rationale behind such suggestions is as follows: Engaging students in activities and providing them with timely feedback could induce a sense of immediacy and reduce social and psychological distance, which in turn may improve learning. The underlying assumption here is that sheer physical distance has psychological correlates; hence the need for social and psychological remedies for solving the "problem" caused by the distance between the instructor and the learner.

Latané's theory of social impact, which considers immediacy as one of the three major determinants of any form of social influence, states that the impact exerted by a source decreases with the increase in distance between source and receiver (Latané, 1981). More specifically, it suggests that social impact is generally an inverse square function of distance (Latané & Nowak, 1994). This relationship between distance and social impact has been demonstrated even in the presence of new technologies that seek to overcome the distance

barrier. A recent international study examining social impact in three very different social settings with different levels of technology provided strong support for Latané's theory (Latané, Liu, Nowak, Bonevento & Zheng, 1995). The study gathered self-report data on memorable interactions between people. Memorable interaction was operationalized as memory of people with whom important discussions took place. Consistent with Latané's social impact theory, the results indicated that with the increase in physical distance, the number of memorable interactions decreased and hence "social space" increased. "Social space" could be understood as a construct between psychological and physical space, implying that psychologically, with the increase in physical distance, people also extend the social distance, thereby reducing social impact on each other.

In sum, the literature overwhelmingly points to negative effects of increased distance between the instructor and the learner. Two species of arguments are forwarded to support this notion. According to the first, distance creates a psychological barrier whereby students are affectively discouraged from making full use of the educational material. The physical divide between the teacher and the student has perceptual consequences: Students perceive a loss of immediacy and a lack of interaction, leading them to be less motivated and less involved with course content. This, in turn, affects their learning potential. Based on this argument, we propose the following hypothesis:

> *H1: The greater the distance between instructor and student, the more negative the perception of content.*

The second type of argument, articulated most strongly by Latané, suggests that physical distance directly affects behavior and/or memory. Self-report data from correlational studies are used to point out that even in this day and age of telephones and other communication technologies, people remember verbally interacting with those nearby significantly more than they do interacting with those far away. This implies that the effect of physical distance is more than merely affective or perceptual. It is actively cognitive and behavioral. Therefore, we extend this argument to apply to distance education with our next hypothesis.

> *H2: The greater the distance between instructor and student, the lesser the memory for content.*

Method

All subjects (N= 48) in a between-subjects experiment were exposed to identical course material on American Public Policy prepared by a distance education institution in the United States. The independent variable, distance, was operationalized as a four-category ordinal variable, whereby subjects were told that the "lesson was prepared by a distance learning institution" either 20, 200, 2000, or 5000 miles away. The dependent measures relating to content perception were operationalized with a set of 17 questions administered to subjects after they read the course material. Memory for the material was ascertained via a seven-item battery of multiple-choice questions.

Subjects

Forty-eight undergraduate students enrolled in communications classes were randomly assigned to one of the four distance conditions. The number of subjects in each condition was 12. All subjects signed an informed consent form prior to their participation in the experiment.

Stimulus Material

An introductory lesson on American Public Policy designed for undergraduate students taking a correspondence course was chosen as the instructional stimulus material. The lesson, entitled "Federalism and the Separation of Powers," comprised a little over 1500 words and was typical of most distance education material in length, style and layout. The rationale behind choosing this topic was its relevance to all participants (American citizens) regardless of their area of interest.

Manipulation

A page informing the subject about the distance from the instructor was attached in front of the reading material. At the top of the page, in 24-point bold font, it said, "What you are about to read is a lesson designed for distance education." This was followed at the center of the page by the following text in 36-point bold font: "The following lesson was prepared by a distance learning institution 20 miles away from State College, PA." This cover page was identical for all four conditions with one difference: the number miles was 20 for a fourth of the subjects, 200 for another one-fourth, 2000 for another one-fourth, and 5000 for the rest. At the end of the lesson, another instantiation of the manipulation was included. It read, in 12-point bold typeface, "You just read material designed by a distance learning institution __ miles away from State College, PA" Similar manipulation information about the distance was included at the beginning of the questionnaire containing the dependent measures. In order to perform a check of the manipulation, the last question on the questionnaire asked subjects to indicate, in multiple-choice format, the distance of the distance learning institution from the subject. All subjects in all conditions correctly identified the number of miles from the institution.

Dependent Measures

The questionnaire administered to subjects after they read the lesson contained 17 measures of content perception (see Notes for the exact wording of the items) and seven quiz items designed to measure memory for the lesson material. The former were administered via 10-point likert-type scales anchored between "not at all" and "very much." The latter seven were all multiple-choice questions quizzing subjects about various factual details covered in the lesson.

Procedure

The experiment was administered to subjects in groups. The experiment administrator began each session by announcing that we were conducting a study on distance learning materials. Subjects were then handed the lesson and encour-

aged to read the material as they would read a lesson delivered by an instrcutor in a distance learning context. Following the reading of the lesson, subjects returned the lesson to the experimenter before filling out the questionnaire. After all subjects handed in the completed questionnaires, they were debriefed, thanked and dismissed.

Data Analysis

A principal components factor analysis of the 17 likert-type measures of content perception was first conducted in order to identify meaningful groupings of dependent measures. The emergent factors were labeled and the measures grouping together were additively indexed for analysis. The measures comprising each index were checked for their multiple-item reliability (internal consistency) before proceeding with analysis.

All seven memory items were coded such that correct answers were awarded one point each while incorrect and unanswered items were coded as zero. This yielded a single measure of memory, ranging in value from zero to seven.

Since it was determined early in the analysis that there were no significant differences on most measures between the 20 and 200 mile conditions, these two conditions were combined and labeled "near." The 2000 and 5000 mile conditions were similarly collapsed into one category named "far." Thus, the independent variable was reduced from a four-category variable into a variable with just two values — near and far — with 24 subjects in each condition.

The indices obtained from the factor analysis were entered as dependent measures, separately, in a series of one-way analyses of variance, with distance as the independent variable, in order to test H1. The composite measure of memory was entered as a dependent measure in a similar analysis for testing H2.

Results

When the principal components analysis was performed on the 17 measures of content perception, six factors with eigenvalues above one emerged, accounting for 79.04 percent of the variance. Upon varimax rotation, the six dimensions of content perception were ideally differentiated, with each of the 17 measures enjoying a clearly high loading on one of the factors and negligible loadings on the other five. Six additive indices corresponding to the six factors were created by summing the measures loading under each factor. These indices were labeled as follows: Appropriateness, Need for Graphics, Need for Proximity, Need for Better Presentation, Clarity, and Relevance.[1]

When the Appropriateness index was entered as the dependent variable in a one-way analysis of variance, a significant effect for distance was found, F (1, 46) = 4.67, $p < .05$. Subjects in the near condition perceived the stimulus material to be significantly more appropriate than their counterparts in the far condition.

On the Need for Graphics index, the analysis showed that subjects in the far condition expressed a greater need for graphics than their counterparts in the near condition, but the mean differentiation between the two conditions was not statistically significant, F (1, 46) = 2.43, p =.12.

Similarly, on the Need for Proximity index, there was no significant effect of distance, F (1, 46) = 0.13, p = .71.

However, on the Need for Better Presentation index, distance had a statistically significant effect, F (1, 46) = 7.85, $p < .01$. Subjects in the far condition expressed a significantly greater need for better presentation of distance education material than subjects in the near condition.

Distance also had a significant effect on the Clarity index, F (1, 46) = 7.85, $p < .01$, such that subjects in the near condition rated the stimulus material significantly higher on clarity than their counterparts in the far condition.

On the Relevance index, there was no significant mean differentiation as a function of distance, F (1, 46) = .03, p = .86.

The results relating to the first hypothesis may be summarized as follows: Subjects in the near condition (i.e., those recipients of distance education material who were led to believe that the material came from 20 or 200 miles away) rated the distance education material significantly higher on appropriateness and clarity than subjects in the far condition (i.e., those recipients of distance education material who were led to believe that the material came from 2000 or 5000 miles away). Furthermore, subjects in the far condition expressed a significantly greater need for better presentation in order to facilitate their understanding of the material. However, subjects in the two distance conditions did not differ significantly in their perception of the relevance of the material. Nor did they differ in their expression of the need for graphical enhancement of the material and the need for greater proximity to instructor.

For testing the second hypothesis, a one-way analysis of variance was conducted with distance as the independent variable and the summed index of the seven memory measures as the dependent variable. The 24 subjects in the near condition had a slightly higher average score (M = 3.58) than the 24 subjects in the far condition (M = 3.37), but the difference was statistically insignificant, F (1, 46) = 0.26, p = 0.6.

In sum, Hypothesis 1 was partially supported while Hypothesis 2 failed to receive support from our data. In a nutshell, the results indicate that although physical distance between instructor and student does not affect memory for content, it impacts students' perception of content.

Discussion

The remarkable aspect of the perceptual differences discovered in this experiment is that a relatively simple manipulation (of distance in miles between instructor and student) produced such statistically sound differences. The content read by subjects in the near and far conditions was identical. Yet, the subjects made significantly different claims about its clarity, appropriateness for the intended audience, and need for better presentation. In particular, those who thought that the instructor was nearby felt that the instructional material was significantly clearer, more appropriate, and less in need of cosmetic improvement than those who thought that the material came from far away. This difference in

evaluation of identical content, purely as a function of the distance between the teacher and the learner, is strong evidence of the social-psychological barrier created by distance. It lends support to the Affective Model (Rodriguez, 1996) by suggesting that students' attitudes toward distance education material are heavily influenced by such mundane physical factors in student-teacher interaction as distance in miles. It also indirectly supports claims made by social space theorists about the negative psychological consequences of distance on social interactions and impact.

In explaining the differences between the two conditions, three reasons may be cited. One, the subjects in the far condition may have lost interest in course content since the source of the material is so remote. This might have played a demotivating role and resulted in them losing enthusiasm for the task. The second explanation is that distance might have prompted subjects in the far condition to scrutinize the content more carefully and this may have led to the more critical nature of their ratings. A third explanation is that subjects in the near condition may have felt a "psychological closeness" to the instructor and hence evinced a positive attitude about the subject matter.

Regardless of the theoretical mechanism of the affect induced by physical distance, this study has clear implications for practitioners. It calls for a greater need to convey teacher immediacy, even if only geographically. A number of technological solutions could be employed to achieve this need. Web-based interactions with teachers could be used to convey a sense of synchronous immediacy. In less developed settings, a simple solution like setting up a local office or a post office box may go a long way in creating the most appropriate affective climate amongst distance education learners.

In broader terms, the study's findings relate to the ever-increasing need for interactivity in educational transactions. Specifically, it is important that recipients of education perceive a high degree of interactivity that seemingly transcends geographical boundaries. With audio-visual delivery of education, new telecommunications technologies like videoconferencing allow for that, but in more traditional correspondence-course settings, an attempt should be made to provide toll-free numbers, study centers, and regular meetings with instructors and peers. Numerous studies have shown that isolation of the student in distance education impedes the learning process by creating a "social-psychological distance." Simple procedures like providing student and faculty directories, and including group projects can help overcome the "distance barrier."

In hindsight, the absence of support for the second hypothesis, about the effect of physical distance on actual learning, is not so surprising. Our null finding not only supports results in earlier studies indicating a similarity in the scores of conventional and "distant" students (Johnstone, 1991, Christophel, 1995), but also questions the appropriateness of memory as a measure of the effectiveness of distance education. Besides, the subjects used in our experiment were hardly typical of distance education recipients. They were all undergraduates in conventional classroom settings, trained to take tests and do well on them. Therefore, it is necessary for us to test this hypothesis in a more ecologically valid setting before making conclusions about the effect of physical distance on acquisition of knowledge.

Notes

[1] The first factor was labeled "Appropriateness" and comprised the following measures: "To what extent do you think this lesson matches up to a conventional lesson in one class period?"; "How appropriate do you think is the presentation of the lesson for an undergraduate student?"; "How well do you think the material matches a conventional lesson in a reputed university?"; and "How much improvement do you think this material needs before it can be used for undergrads?" All four of these measures were weighted equally in an additive index. The index was checked for internal consistency and was found well above acceptable levels (Cronbach's $\alpha = .87$).

The second factor, labeled "Need for Graphics," was characterized by high loadings from the following two measures: "How much better do you think the material would be if graphics were added to it?" and "How much would adding graphics improve your understanding of the material?" The additive index of these two measures also enjoyed high internal consistency (Cronbach's $\alpha = 0.94$).

The third factor, labeled "Need for Proximity," consisted of the following three items: "How much more sense would this material make to you if you knew the instructor personally?"; "How much more do you think you would be able to learn if the instructor writing the material was located here on campus?"; and "How much would it improve your understanding of the material if the instructor was closer to here?" The additive index of these three measures was internally consistent (Cronbach's $\alpha = .72$).

The fourth factor, labeled "Need for Better Presentation," comprised the following two questions: "How much would changing the font improve your understanding of the material?" and "How much would changing the layout improve your understanding of the material?" The index combining these two items was also reliable (Cronbach's $\alpha = .85$).

The fifth factor, labeled "Clarity," comprised the following three items: "How complicated do you think this is for an undergraduate student?"; "How clear do you think the material would be to someone who knows little about the topic?"; and "How much would a face-to-face talk with the instructor improve your understanding of the material?" The additive index of these measures was internally consistent (Cronbach's $\alpha = .59$).

The sixth factor, labeled "Relevance," also had three items: "How much does this material relate to you?"; "To what extent do you feel the instructor had someone like you in mind when he wrote the course?"; and "To what extent does the vocabulary used in the material matches that of an undergraduate student?" The additive index comprising these items was also internally consistent (Cronbach's $\alpha = .75$).

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