Dialogue in a distance education physics course

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This study investigated the kinds of dialogues utilized by Open University students while studying an intermediate level physics course. Research objectives were twofold: to document what dialogue types, mediated through which resources, were (1) generally utilized by students as they learned; and (2) were specifically utilized by students to overcome conceptual difficulties. It was found that all students initially chose individual study characterized by intrapersonal dialogue. Only when individual study failed did students opt for interpersonal dialogue. This finding conflicts with the assumed importance often ascribed to interpersonal dialogue by some distance education theorists.

Keywords: *Distance education; Instructional dialogues; Instructional resources; Study strategies*

Introduction

This article recounts a research study aimed at exploring individual accounts of the process of learning university physics by focusing on the instructional resources and dialogues utilized by students. The study, in part, is a response to observations that few research endeavors have attempted to explore adult learners own description of their processes of formal learning (Brookfield, 1994). Brockbank and McGill (1998) wrote that processes involved in teaching and learning remain a 'black box' which is still largely unexplored (p. 65). Haggis (2002) pointed out that there have been 'few investigations into the relationship between theoretical ideas about 'adult' learning and the process of learning as described by adult learners themselves, particularly in the context of higher education' (p. 208). This study explored the complexity of real, situated learning experiences and possibly created new ways of thinking about factors and influences, especially communication modes and technologies, which may be crucial in determining the success or failure of distance education courses.

Modern distance education systems include a diverse array of resources for intrapersonal dialogue such as self-instruction texts, web-based instructional systems, audio and video cassettes, television and radio programs, computer-based

simulations and tutorials, etc. In addition, there are many and diverse resources for interpersonal dialogue such as web sites for synchronous and asynchronous interaction, video and audio-conferencing, telephone, email, face-to-face meetings with instructors and peers, etc. Given this diversity, we suggest that students' study strategies and practices might be investigated usefully in terms of the kinds of dialogues engaged in and the resources which enabled these dialogues.

To carry out such an analysis, however, a need exists for a broad conceptual framework of distance education systems which recognizes the centrality of instructional dialogue and views the resources of an instructional system in terms of the kinds of dialogue each resource supports. Such a framework was proposed by Gorsky and Caspi (in press). A brief review follows.

Dialogue: a theoretical framework for distance education instructional systems

The framework provides a theory of instruction centered on dialogue for describing learning activities in distance education systems. The key element of the framework is *learning*—not the learner, not the instructor and not the physical or temporal distance separating them. Gorsky and Caspi (in press) cite five basic assumptions which underlie the framework:

1. Learning is an individual activity characterized by internal mental processes.
2. Learning is *mediated* by intrapersonal dialogue.
3. Learning is *facilitated* by interpersonal dialogue.
4. Dialogue is enabled by structural and human resources.
5. Dialogue and learning outcomes are correlated.

A schematic overview of the framework appears in Figure 1.

Structural resources for intrapersonal dialogue include all materials of any kind that students may learn from. Structural resources for interpersonal dialogue include all available communications media and the availability of instructors and fellow students. Human resources for interpersonal dialogue are the instructors and students who may engage in instructional dialogue. Students may utilize resources as they see fit, in accord with their goals, abilities and needs.

Given these assumptions, *all* study strategies and practices used by students in distance education courses may be viewed and analyzed in terms of the *instructional dialogues* they engage in and the *instructional resources* which make the dialogues possible. Two illustrations follow:

1. A student reads a self-instruction text. The text is a structural resource which enables intrapersonal dialogue.
2. A student posts a message in an asynchronous discussion group. The asynchronous discussion group is a structural resource which enables interpersonal dialogue. The student who responded is a human resource.
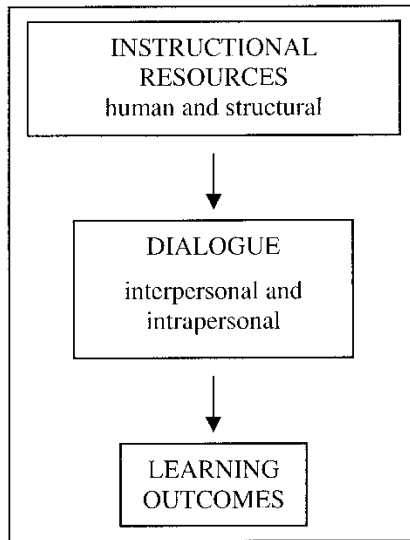
Figure 1. The framework of instructional dialogues and resources

The model of intrapersonal instructional dialogue

The construct 'intrapersonal instructional dialogue' subsumes those internal mental processes engaged in by students as they are purposefully trying to learn. According to Gorsky and Caspi (in press):

> ... when students read self-instruction texts, listen to lectures or audio tapes, view educational films, solve problems, manipulate computer simulations with the intent to learn, they are said to be engaged in intrapersonal instructional dialogue. Furthermore, dialogue may occur without the physical presence of instructional materials; for example, a student walking alone or jogging *and* thinking about subject matter is engaged in intrapersonal instructional dialogue.

Mental processes may be described by psychologists as 'assimilation' or 'accommodation' (Piaget, 1970), 'accretion', 'structuring' and 'tuning' (Rumelhart & Norman, 1978), 'intra-psychological processes' (Vygotsky, 1978) or as 'an internal didactic conversation' (Holmberg, 1989). The actual internal processes are relevant in so far as they contribute to the *design* of instructional resources.

Students utilize structural resources as they see fit. The quality and availability of the resources make a significant impact on learning outcomes. However, Gorsky and Caspi (in press) contend that the most significant resource in intrapersonal dialogue is the human being, the learner, not the structural resources:

> Each individual learner is characterized by a constellation of variables which include his or her goals for the course, prior knowledge, motivation, intelligence, and anxiety, among others. These variables differ for each learner and they determine the extent of intrapersonal dialogue that occurs and its quality.

The model of interpersonal instructional dialogue

The underlying assumption is that interpersonal instructional dialogue is a discursive process through which learner understanding may be increased. Ultimately, all learning is perceived as occurring through intrapersonal processes, even learning facilitated by interpersonal dialogue. However, given the direct impact of interpersonal learning on concept acquisition, two distinct dialogue types are distinguished.

Dialogue. Interpersonal instructional dialogue is defined as a discursive relationship between two or more participants characterized by thought provoking activities such as questioning, hypothesizing, interpreting, explaining, evaluating, and rethinking issues or problems at hand. A dialogue is said to have occurred if one or more of the activities listed above is manifested in an interaction, either instructor–student or student–student. This is a judgment based on a qualitative analysis of data from sources such as observations, videos, transcripts, interviews and questionnaires.

There are different kinds of dialogue with different specific aims which, in turn, derive from different philosophical stances. Dialogue may be used as a means to increase learner understanding or to sharpen learners' analytic skills or as an evaluation tool. Burbules (1993) listed four types of dialogical engagement: inquiry, conversation, instruction and debate. Each may be either instructor–student or student–student. The instructor, characterized by personality traits and facilitation skills, plays a critical role in creating and maintaining dialogue, both in traditional and in distance education programs (see Dewey, 1916; Bruner, 1966; Rogers, 1969). The student, characterized by prior knowledge, motivation, anxiety, autonomy and other traits, will participate in interpersonal dialogue to greater or lesser degrees.

Learning outcomes. Two learning outcomes, achievement and learner satisfaction, are included in the framework. A direct, causal relationship between instructional dialogues and learning outcomes, which may be investigated empirically, is hypothesized.

Summary

This conceptual framework of distance education systems associates every resource in an instructional system with a specific dialogue type. In so doing, it provides a description of the mechanisms at play in distance education systems and proposes relationships between different constructs which may be tested by empirical research. It is the theoretical basis upon which this research is grounded.

The study

Background

The Open University of Israel is a distance education university designed to offer academic studies to students throughout Israel. Established in 1974, the university

Table 1. Human and structural resources available to the Open University students

	Human resources	Structural resources
Intrapersonal dialogue	Learner	• Self-instruction texts • Tutorial sessions • Website materials • Recommended texts
Interpersonal dialogue	Instructor; learner(s)	• Website discussion groups, synchronous and asynchronous • Telephone • E-mail • Personal face-to-face meetings • Tutorial sessions

offers a home study system based on textbooks, tutors and study centers throughout the land. Enrolment for the academic year 2003–2004 was more than 38,000 students. Each university course offers 'regular' tutorials held every two or three weeks. Some courses offer 'extended' tutorials held weekly. The classic text–tutor system was enriched in 1999 with the introduction of a 'web-based instructional environment' (WBIE) wherein each course has its own web site. These sites are intended to enrich students' learning opportunities and to increase interpersonal interaction, both instructor–student and student–student. Web site use is optional, non-mandatory, so that equality among students is preserved (at the time the study was conducted, only about 42% of the students had home access to Internet). The WBIE does not replace textbooks or face-to-face instructor-led tutorials that are the pedagogical foundations of the Open University. The WBIE enables asynchronous instructor–student and student–student interactions as well as a synchronous forum for chat between and among all logged-on participants, including the instructor.

The physics course from which participants were surveyed is an intermediate level course required of all physics and chemistry majors. It accounts for six credits out of a total 108 needed for graduation. Table 1 lists the human and structural instructional resources for each of the dialogue types that were available to students.

About six weeks prior to the start of the semester, students received the written course materials, mailed to their home addresses. Written materials included self-instruction texts and a booklet of problems to be solved and submitted by certain deadlines. About two weeks after having received the materials, they were required to enroll in a tutorial group, either regular or extended. In addition, they received a password which granted access to the course's web site. In this study, 'instructor' is the term used for the person who communicated with students in tutoring sessions, by email, by telephone or in person.

Research objectives

Research objectives were to document (1) what dialogue types, enabled through which structural resources, were generally utilized by students; and (2) what dia-

logue types, enabled through which communication resources, were specifically utilized by students to overcome conceptual difficulties.

Methodology

The use of dialogue and resources was investigated through a qualitative, naturalistic approach which enabled the participants to be studied in a natural, open and non-threatening context. The method enabled participants to review their personal learning processes and to communicate their perceptions. Data were gathered from two sources: from semi-structured interviews with the students and from a conversation with the course coordinator.

Participants. Eight students, out of 41 who had completed the course 'Foundations of Physics II' during the spring semester of 2003, participated in the study. The course coordinator, a senior member of the faculty of natural sciences, also participated. The students, all of whom were studying part-time, were selected according to the following criteria: all expressed willingness to explore their own learning activities and all had completed successfully at least two science courses in a previous semester. The latter criterion ensures that students had amassed enough experience in distance learning so that dialogue preference and resource utilization would be the result of conscious decision-making and not the result of random trial and error. That is, they have acquired a sense of knowing how to learn based on direct personal experience.

Data collection and analysis. Data were gathered from semi-structured interviews with the students and from an interview with the course instructor. Initial phases of data analysis involved classifying data in accordance with the research questions. Data generated by each student were analyzed in terms of the two research questions for purposes of pattern formation and pattern matching. Pattern matching involves looking for similarities in the reactions, thoughts, and actions of the participants (Ericsson & Simon, 1984; Hill & Hannafin, 1997). Patterns may lead to a model or to a set of related models which can explicate students' use of dialogue and instructional resources in a specific distance education setting. In order to achieve this goal, a constant comparative method (Silverman, 2001) was used in which initial, provisional patterns (hypotheses) were proposed and then tested in subsequent interviews with different students. This process was carried out until no more new knowledge was gathered.

Interviews with students. Each participant was interviewed once, at the end of the course, in a semi-structured interview which took about 40–60 minutes. The interviewer made brief notes during the session and extensive notes immediately upon completion of the interview. Participants were asked questions aimed to be as neutral and open-ended as possible while probing for particular, idiosyncratic aspects of experience. Some examples follow:

- How did you learn? That is, what kinds of learning activities did you engage in?
- What factors influenced your choice of learning activities?
- Did you personally communicate with the instructor or with other students?
- Did you post messages on the web site?
- What did you do when you couldn't solve a problem?

Interview with the course coordinator. The interview took place after completion of the course, after students' final grades had been recorded and after the interviews with students. The coordinator explained and discussed his perspectives about the course. He was asked to express perceptions of and opinions about the quality of the self-instruction materials, the relative difficulty of assignments and tests, the tutorial sessions and the quality and amount of interactions and dialogues that occurred with students.

Findings

Interview data from the course coordinator

The senior academic faculty member responsible for the course participated in the interview. He felt that students could be classified into two groups: physics majors who were 'actually interested' in the subject matter and non-physics majors who were for the most part 'just interested in achieving a passing grade'. He believed this to be true since the course is a requirement for all science majors and many of the participants were chemistry and biology students with little real interest in physics. The coordinator defined the course as 'average to somewhat difficult'. Difficulty, he believed, emerged from the fact that the course included a large number of abstract basic concepts which were represented mathematically. The fact that the mathematic structures were algebraic reduced difficulty.

From his past experience with the course, he felt that he knew where and when students experienced special difficulties. Tutorial sessions focused on the specific conceptual difficulties being experienced by the learners as well as on problem solving. He felt that students used the weekly telephone session to its fullest extent and that students also utilized the course web site as a means of communicating with him.

Interview data from students pertinent to research objective 1: what dialogue types, enabled through which resources, were generally utilized by students as they learned?

It was found, without exception, that all students reviewed the self-instruction materials after having received them in the mail. They did so, in part, because of the need to enroll in a particular tutorial session, either 'regular' (once every two or three weeks) or 'extended' (weekly). It was found that two factors influenced the choice of tutorial, desired grade and perceived difficulty of the course. Data are shown in Table 2.

Perceived difficulty emerged from two sources, reviewing the texts and discussions

Table 2. Study strategies prior to start of course

Name	Major	Desired grade	Perceived difficulty of impending course	Tutorial type	Planned to attend tutorials
Tomer	Life Sciences	high	difficult	extended	yes
Avi	Physics	high	intermediate	extended	yes
Ovad	Engineering	high	intermediate	extended	yes
Guy	Physics	high	easy	extended	yes
Alex	Physics	high	easy	extended	yes
Hod	Life Sciences	high	easy	regular	yes
Noam	Physics	high	easy	regular	yes
Yossi	Life Sciences	passing	intermediate	regular	yes

with friends who had already taken the course. All the students, except for Yossi, expressed motivation to achieve the highest possible grades. Five were willing to invest the additional time, inconvenience and effort to achieve them by attending the extended tutorials which met weekly. Furthermore, two students, Guy and Alex, who perceived the upcoming course as 'easy' chose to attend the extended tutorials. This choice seemed to reinforce their sincerity about achieving the highest possible grade. Guy said:

> I'll go to the tutorials even though the material doesn't seem too difficult because it'll give me an edge—the instructor emphasizes what's important and I want a high grade.

Alex tersely explained his decision to attend the extended tutorials despite his perception that the course is easy: 'Just in case. For safety's sake'. Two other students, Hod and Noam, who also perceived the course as easy, chose regular tutorials in the belief that they could successfully cope with the material. Noam said: 'I go to extended tutorials when I want a high grade and things look difficult. This course is a piece of cake'.

It appeared that students initial learning strategies *vis-a-vis* tutorial choice, derived from their aims and from their perceptions of course difficulty which were established from reviewing the self-instruction texts, the problems to be solved prior to the start of the course and from discussions with friends who had already taken the course. Students chose tutorial types in a manner which would achieve this aim.

After the course began, students studied and learned from the self-instruction texts, by attending the tutorials and by downloading materials from the course web site which included sample problems and sample exams. These activities were performed alone, as individual study, intrapersonal dialogue.

Interview data from students pertinent to research objective 2: what dialogue types, enabled through which resources, were specifically utilized by students to overcome conceptual difficulties.

It was found, however, that at some point, *all* participants confronted some concep-

Table 3. Courses of action for overcoming conceptual difficulty and modes of communication

Name	First course of action	Second course of action	Third course of action
Tomer	Peers (tel, f2f⋆)	—	—
Avi	—	—	—
Guy	Peers (f2f⋆, tel, Web)	instructor/private (f2f⋆, tel)	—
Ovad	instructor/public (at tutorials)	Peers (tel)	instructor/private (tel, f2f⋆)
Alex	instructor/private (f2f⋆)	—	—
Hod	instructor/public (at tutorials)	Peers (tel)	instructor/private (f2f⋆, tel)
Noam	instructor/public (at tutorials)	—	—
Yossi	Peers (f2f⋆, tel)	—	—

⋆ f2f = face to face.

tual difficulty, either the inability to understand a concept or the inability to solve a problem with a high degree of certainty. For example, Tomer recalled trying to solve the first set of assigned problems: 'Oops! This isn't so easy'. Alex (who also thought the course would be easy), when he actually sat down to solve the first set of problems, said:

> Wow, this isn't so easy. Then again, it's not all that hard. Then again, I'm not absolutely sure I got the right answer. I have to know if I got the right answer!!!

The different courses of action taken to overcome conceptual difficulty and the communication modes by which they were mediated are shown in Table 3. The modes of communication, which appear in parentheses, are listed in order of preferred use. Four specific behavior patterns emerge from the data.

1. Upon confronting conceptual difficulty, each student, except for Avi, responded by engaging in some form of interpersonal interaction, instructor–student and/or student–student. Avi was indeed the ultimate 'autonomous learner' who redoubled efforts when confronted with difficulty. Students who had attended tutorials as passive listeners began to ask questions (Ovad, Hod and Noam). This form of interpersonal dialogue was cited as 'instructor/public' since the dialogue occurred within the group tutorial. Tomer, Guy and Yossi chose not to ask questions at the tutorials, but instead turned to peers for help in overcoming difficulty. Alex spoke with the instructor privately (instructor/private) both before and after the tutorials.
2. Five of the eight participants cited peer collaboration as the most important and effective means of overcoming conceptual difficulty. Both Tomer and Guy studied with a friend on a permanent basis. Ovad participated in a forum of three that communicated frequently by telephone. He described the forum as an 'important and effective means of getting help to solve problems'. Noam reported that although he managed to solve problems alone, he had a 'friend in waiting' if he needed any help.

3. Except for Alex, a personal instructor-student interaction (outside the realm of question asking at the group tutorials) was generally a last resort used only after other courses of action had been utilized, or not at all. Hod explained why he did not contact the instructor: 'I don't have anything against the instructor, I just prefer working things through alone or with my friends where I'm comfortable and can say dumb things'. Other students pointed out that the two hour per week availability of instructors was insufficient since the line was usually 'busy'.

4. Asynchronous communication via the web site was not a popular mode of communication. The primary reason cited was a lack of immediacy. Noam's comment, 'When I'm stuck, I want an answer right away', was echoed by most students.

General patterns

It was found that experienced distance education students utilized instructional dialogues and the instructional resources offered by the Open University of Israel (see Table 1) in similar ways. Four general patterns emerged from the findings.

Patterns of intrapersonal dialogue.. Prior to the start of the course: (1) *all* students reviewed the self-instruction texts; (2) *all* defined goals, especially the desired grade; (3) *all* defined an initial study strategy based on participating in either regular or extended tutorials; and (4) *all* began the course in an individual study mode using the structural resources of intrapersonal dialogue (self-instruction texts, tutorials, web site materials) listed in Table 1. Only one student purchased the recommended text. This pattern of intrapersonal dialogue prevailed until some non-resolvable difficulty was experienced, usually the inability to solve a problem. Indeed, this mode of behavior is the paradigm of distance education at the Open University of Israel.

Patterns of interpersonal dialogue. Interpersonal dialogue emerged when students were confronted with what appeared to be an unsolvable problem or an uncertainty regarding the correctness of an answer. As seen in Table 3, the choice between turning to peers or turning to the instructor is about evenly divided. What is clear, however, is that the preferred communication mode with the instructor is face-to-face at the tutorial sessions. A personal dialogue with the instructor, either face-to-face or by telephone, was generally a last resort.

Patterns of media selection. Table 1 shows the different structural resources available for interpersonal dialogue. For the seven students who engaged in interpersonal dialogue to resolve some conceptual difficulty (see Table 3), the overwhelming preference was for the 'old fashioned' synchronous modes of communication: face-to-face encounters or telephone conversations. Computer mediated technologies were utilized infrequently or not at all. The students participating in the study did not utilize the facilities for synchronous 'chats'; they did not send emails and

only one student (Guy) reported posting messages to the asynchronous discussion group.

A general algorithm for viewing students' utilization of dialogues and resources. All students participating in the study followed the same path. Differences among students expressed themselves on a time axis; that is, some experienced conceptual difficulty or the inability to solve a problem earlier in the course than did others. It appears that the utilization of interpersonal dialogue is motivated by the student's immediate need to understand a specific concept or, especially, to solve a specific problem rather than by a learning preference or cognitive style or some inherent degree of learner autonomy.

The simplicity of this general study strategy may be deceptive since, although several courses of action may have been pursued theoretically, in fact, the actual degrees of freedom available to students were limited. First, during the period prior to the start of the course, the only resources available to students were the self-instruction materials. Thus, individual study characterized by intrapersonal dialogue was the only realistic option available at the time. Second, after the course started, courses of action available to students who encountered conceptual difficulty (instructor–student or student–student dialogues) were not equivalent; that is, availability of peers was essentially unlimited while instructor availability was limited to either a once weekly two hour open telephone which was often busy or a hurried conversation before or after a tutorial session. Furthermore, at least in this particular physics course, students were generally interested in getting the correct answer to a problem that had to be solved while instructors were generally more prone to explain underlying concepts so that students could solve the problems on their own. It is not surprising, therefore, that many students preferred collaborating with peers rather than with the instructor.

In any event, students preferred to learn by themselves. Only when confronted by some insurmountable difficulty did they turn to others for help.

Discussion

Two issues will be discussed: (1) the compatibility of these findings with theoretical premises regarding the place of interpersonal dialogue in distance education; and (2) the relation between research findings and the conceptual framework cited above.

The place of interpersonal dialogue in distance education

Findings indicate that for all students participating in the study, intrapersonal dialogue characterized by individual study, was the primary and preferred dialogue mode engaged in while learning an intermediate level physics course at the Open University of Israel. Student initiated interpersonal dialogue was engaged in generally for the purpose of solving problems. This finding illustrates very clearly the tension between distance education theories on the one hand and practices engaged in by distance education students on the other. Students are often motivated by very

practical concerns such as passing courses with the highest possible grade (Eison *et al.*, 1986). Distance education theories, such as Moore's (1993) theory of transactional distance, often assign to interpersonal dialogue, especially between instructor and student, an importance that may not be realized in practice. These generalizations must be limited, however, by a key constraint imposed by the particular study; that is, these conclusions are drawn from a very small sample of eight students. Although findings converged into what appear to be clear patterns, they are at best tentative. Further research on a much larger scale will help clarify these issues.

The framework of instructional dialogue and resources

The research questions of this study were formulated in terms of the elements of the framework of instructional dialogue and resources. It was possible to categorize all the components of the instructional system of the Open University in terms of the framework's categories (see Table 1). In addition, all activities engaged in by students could be classified in terms of a dialogue type and the supporting resource or resources.

The significance of the framework, however, is not to be found merely in these acts of categorization. A framework is judged in terms of how adequately it represents the functioning of a system, what correlations exist between the elements and, ultimately, its usefulness. The theoretical base of the framework, the centrality of instructional dialogue, points toward a research agenda which encompasses many points of view: pedagogical, psychological and economic.

For example, some pedagogical studies may describe how different kinds of instructional dialogue influence learning outcomes. Psychological studies may explore how certain resources can enhance learner motivation. Economic studies may analyze the impact of particular resources on instructional dialogue and subsequent learning outcomes in terms of cost/benefit. These questions, of course, are not new. The conceptual framework of instructional dialogue and resources, however, integrates all these variables into one coherent, unified system.

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