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Web-Supported Emergent-Collaboration In Higher Education Courses

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ABSTRACT

This study focused on the integration of a Web shell for supporting emergent-collaboration activities in six graduate courses (115 students) in the Tel-Aviv University School of Education. Emergent-collaboration is the process by which group configurations and transactional patterns evolve among participants during the course of learning. The research questions addressed in the study were related to: (a) the didactic modes that have been devised for supporting emergent-collaboration learning processes, and (b) the extent of participation of students and teachers in Web- supported emergent-collaboration learning processes. Six Web-based instructional modes evolved during the study supporting: social interaction; critical group reading; students- or teachers-moderated issue discussion; peer evaluation and review; collaborative construction of knowledge bases; and projects on-line presentation. Quantitative as well as qualitative dat a and analysis regarding the different modes is presented. The results indicated that the use of the technology affected learning and teaching processes in significant ways, increasing the students participation and involvement in the courses, supporting a wide range of transactional modes, and contributing to the groups' social climate and collaborative work.

Keywords

Emergent–collaboration, Educational transactions, Web-based shells, Collaborative learning, Synchronic/asynchronic learning

Introduction

The integration of Web technology into higher education instruction is receiving growing attention within the University community (Bates, 2000; Flanagan & Egert, 2000; Harasim, 1990; Collis, 1998). As a result, a variety of models and configurations are being developed and implemented, ranging from local experiments aiming to explore the possibilities of the new technologies for higher education, up to complete virtual programs and academic degrees (Hiltz, 1997).

Among other salient features of the Web technology, its potential for supporting collaborative learning processes deserved particular attention among scholars and developers (e.g., Anderson & Kanuka, 1997). Collaborative learning refers to an instructional situation at which students interact while accomplishing an academic task. The theoretical roots of this approach includes the view of the learner as an active agent responsible for the construction of her or his own knowledge (Kafai & Resnick, 1996), the perception of knowledge as a social construct (Scardamalia & Bereiter, 1994), and the perception of the teaching environment (teacher, instructional means) as facilitator of individual and social learning processes (Brown, 1992). Within this framework,

interactions -among students, students and teachers, students and knowledge resources- play a quintessential role. According to the partners' (students, teachers) needs and goals while performing learning assignments, interactions may fulfil varied functions, e.g., co-operation, collaboration, competition, distribution (of knowledge), or sharing (of knowledge resources). Aiming to encourage these different forms of interaction, a variety of instructional models and methods have evolved (e.g., Brown, 1992; Sharan, 1994).

With the advent of computer technology, and more recently the wide accessibility of communication technology, the collaborative learning concept is undergoing reformulation as new ideas and models of technology-based collaboration are implemented. Departing from a well founded body of theory and research (e.g., Sharan, 1994), new technology-based models imply an expansion and even a transformation of the variables, components and processes characterizing collaborative learning events. Examples of issues affected by the use of the technology are: the *setting* of the activity (e.g., asynchronous, anytime/anywhere and non face-to-face interactions); the *dynamics* of the interactions (e.g., support of dynamic definition of ad-hoc roles and functions within the group; support of members' equal opportunity to participate and contribute); the *configuration* of the group (e.g., allowing the occasional participation of additional partners, such as experts or other groups' members, according to emerging needs); or the variety of *communication means* used for interacting (e.g., mail, chat, video-conferencing, online collaborative-work support tools). Correspondingly, the repertoire of technology-based models and tools is rapidly growing. Examples are tools for supporting the collaborative construction of knowledge bases (Linn & Hsi, 1998), collaborative investigation of scientific phenomena (Pea, 1994), group engagement in game-like learning tasks (Ben-Haym, 1999), peer review and evaluation of each other learning products (Scardamalia & Bereiter, 1994), online peer mentoring (Lamaster & Tannehill, 1999), or discussion groups (Hammond, 1999). However, research focusing on the extent to which the potential (and expectations) of these tools and models is actually fulfilled is still neither conclusive nor consistent in its results (Hiltz & Benbunan-Fich, in press).

Considering this redefinition of collaboration supported by novel technological means, we would like to distinguish here between two learning situations: structured and emergent collaborative events. Structured collaborative tasks are well planned didactic solutions that follows the conceptual guidelines proposed by collaborative learning researchers and practitioners. Usually these tasks are presented as comprehensive didactic sets, which offer clear definitions of the varied aspects of the activity, e.g., goals, contents, distribution of roles or required functions, stages in the process. A different approach is reflected in the design of emergent-collaboration tasks. Emergent-collaboration is the process by which group configurations and transactional patterns evolve among participants during the course of learning in a specific course. In these activities, the preliminary definitions relate mainly to the goals, as well as constraints (e.g., technology to be used, time-tables, actions allowed, potential partners), of the learning activity. Then the collaboration situations evolve and take different configurations in correspondence with the (extent and quality of the) students involvement in the learning process, and their commitment to different aspects of the task (Ogata, & Yano, 1999). As the task proceeds, varied transformations in the group functioning may occur, e.g., changes in configuration, exchange of roles, formation of ad-hoc subgroups. This shift in perception of collaborative processes has practical implications for the planning, implementation and even the research of collaborative learning situations. The planning process will focus now on the definition of goals and constraints, rather than on the detailed formulation of structural or organizational aspects. And as researchers, we will be more interested in the transactional fabric (among all participating agents), the emergent-collaboration patterns and their evolution in time, and self-organization mechanisms, rather than on the degree of actualization of a predetermined group-functioning structural contour. We believe that the essential features of ICT technologies, offer strong support for learning activities based on such unstructured and highly malleable emergent-collaboration processes.

In the project reported in this paper, we adopted the emergent-collaboration approach. Within this approach, we refer to the whole range of interactions taking place among students in terms of *educational transactions*. These transactions, which are the building blocks of emergent-collaboration, comprise the many-to-many teaching and learning interactions by which partners (students, teachers), holding defined goals, both contribute-to and are benefited-from the course's course of events. In this paper we intend to depict, both in quantitative and qualitative terms, our experience with Virtual-TAU, a Web-shell for supporting online learning at Tel-Aviv University. More specifically, we will focus on different instructional models involving educational transactions and emergent-collaboration processes as they evolved with the integration of Virtual-TAU in the teaching of graduate courses in the Tel-Aviv University School of Education. It should be noted here that the Web-shell was integrated as a complement to the regular courses' activities. Along with all regular duties of the face-to-face course (e.g., lectures, reading assignments, learning tasks, group meetings), the students participated in additional Web-based activities.

The Study of Web-supported Emergent-Collaboration Learning Modes

The overall rationale guiding the planning and implementation of the Web-shell in Tel-Aviv University academic teaching comprises a number of principles:

- Virtual-TAU is not intended to replace the "real" courses by complete virtual courses. It is conceived as powerful tool complementing existent instructional means in regular courses.
- The participating teachers adopted the goal to develop different models of integration of Virtual-TAU in their courses, rather than adopting one common model. By this approach, we seek (a) to explore and define instructional models that take advantage of unique features of communication technology, and (b) to assess the potential added value of these different models for learning.
- Focusing on educational transactions and emergent-collaboration processes, we aim to explore novel learning situations as an alternative to traditional academic teaching, encouraging a more active, diversified, and mindful participation of the partners (students, teachers) in the courses.

As part of the integration process of Virtual-TAU in the teaching of academic courses, a study was conducted focusing on the following questions:

1. What didactic modes have been devised for supporting emergent-collaboration learning processes?
2. What is the extent of participation of students and teachers in Virtual-TAU based emergent-collaboration learning processes?

Method

The study was conducted during the 1998/1999 and 1999/2000 academic years, focusing on six classes participating in four one-semester (12-14 weeks) courses. All courses dealt with theoretical and research aspects of using ICT in education: Cognitive technologies for learning (two classes: 'a' and 'b'); ICT- Based learning environments (two classes: 'c' and 'd'); Web-Based learning (class 'e'); and Virtual environments in education (class 'f'). The first two courses were compulsory for students in the graduate program for computers and telecommunication in education, the third was an advanced seminar and the fourth was an advanced course in the same program. The research population included 3 lecturers, 3 teaching assistants and 115 graduate students. The majority of the students were first and second year MA students, and few Ph.D. students in the Tel-Aviv University School of Education. Data were collected by means of: (a) log files of students' hits and page views within Virtual-TAU; (b) transcriptions of forums' and collaborative activities with the shell; (c) students' products; and (d) unstructured observations.

Virtual-TAU: The Web-based Learning Environment

Virtual-TAU is a Web-shell for supporting online learning at Tel-Aviv University. As in similar Web-supported instructional shells (e.g., WebCT; Learning Space; Teletop; see Collis, 1999) Virtual-TAU allows three main modes of work: course development mode, teaching/learning mode, and administration mode.

A set of basic tools is offered to the teachers for course development, e.g., Web-page editor (for content composition in the Hebrew language), forum engine, survey engine, chat application. Materials requiring other development tools (e.g., VRML, Java applets) were developed outside the shell and imported to its course development module.

The teaching/learning mode is password-protected, and access to it is allowed after registering to one or more Virtual-TAU supported courses. Registered users have access to all course materials, discussion forums, course's address book, public noteboard, surveys tool, and synchronous and asynchronous communication tools.

In administrator's mode all technical, maintenance and system operations are made, e.g., opening new courses, defining a course's participants file, creation of new discussion forums, accessing the courses' ongoing information, tracing faults or deficiencies in the prototype's work and feedback the results to the development team.

At the present the shell is a fully working prototype, which will be completed and enhanced in light of the results of the current pilot running stage.

Results

The results will be presented according to the two main focal points of our study, namely, the learning modes devised and implemented, and the students' participation in the Web-based emergent-collaboration activities.

Web-supported emergent-collaboration modes

Our first focal issue relates to the variety of collaboration modes that emerged through the development of the Web-supported courses, and the learning processes that took place as a result of their implementation. The analysis and classification of the Web-supported educational transactions resulted in the following six functional categories:

1. Web-supported social interaction

This category refers to activities designed to integrate and maintain the courses' social fabric. The core of these activities are social transactions aiming to encourage group consolidation and functioning processes. An example of these activities is the courses' introductory social forum, in which students presented themselves (e.g. background, occupation, previous studies, interests) initiating group interaction.

Teachers reported all along the semester on the "Who's Tamy" effect, referring to the situation in which, at the beginning of the class, there was always a student wanting to know who was her partner (i.e. Tamy) in the last night's forum discussion or chat exchange. In regular lecture-based courses, where little interaction among students takes place, it is a commonplace that participants get acquainted mainly with their limited-reference-group of friends or close classmates. There is little opportunity (and need) to interact, and therefore to want to know, "who's that Tamy". In contrast, within Web-based activities several content foci arise, generating "message-waves" which become rapidly interwoven. As a result, students meet each other (virtually) around different topics and discussion themes, prompting the motivation to meet each other (really) in the class. This emerging ingathering at the social level sets the ground for emergent-collaboration at the learning level.

2. Web-supported critical group-reading

This category includes online activities supporting students in their reading assignments for the courses. In traditional-format courses (e.g. lectures) reading is mostly an individual activity. Only part of the students participate in class discussions following reading assignments, and this proportion (and the opportunity to participate) decreases as the size of the course increases. Also the types of reading assignments are usually limited in format (e.g., paper review, papers comparison).

Two outcomes could be clearly observed from the very early stages of the study. The first was the rich repertoire of reading-support tasks evolving and growing as the courses proceeded, e.g., directed-reading discussion forums, e-papers contest, bibliographical-sources group synthesis and integration, or "apply-the-paper's-model" for group analysis of computer-based learning materials. The second was the dramatic increase in the students' reading performance, both in terms of scope and personal involvement. The requirement to participate in the weekly assignment as part of the learning group, and to make a concrete (written) contribution within the Web-environment, affected the students' disposition towards the reading tasks and reading materials. A more detailed example of the processes in this mode will be presented in a later section.

3. Synchronic and asynchronic issue-discussion

Exchange of ideas, opinions and beliefs about key issues can be considered at the core of group-based knowledge -building processes. The Web-environment offered the opportunity to expand (in frequency) and enrich (in quality) issue-discussion activities. For one aspect, these activities took place both in synchronous and asynchronous modes (in contrast to only-synchronic regular class discussions), increasing considerably the number of group-discussion events during the course. In another level, a variety of discussion configurations emerged on the basis of the debate-moderation function. Web discussion activities were conducted as student-moderated, teacher-moderated, or non-moderated events at which the leading role in the debate passed among participants. In this case a participant stepped to the center of the virtual stage when the topic (issue, question)

she raised generated a round of transactions among peers. A more detailed example of students-moderated discussions will be provided in a later section.

Of particular interest, were activities in course 'd' based on synchronic interactions. Besides the explicit instructional function fulfilled by these activities, an important outgrowth was the opportunity to unveil questions regarding the characteristics of synchronous educational transactions, e.g., the properties of the roles of the discussants acting as real-time-players in the intellectual game; or the nature of the discussed topic as a rapidly evolving "knowject" (virtual-knowledge-object) whose form changes in time and gets modeled according to the discussants' inputs.

4. Peer evaluation and review

A key characteristic of knowledge generating communities, (e.g., scientific or professional communities) is the dissemination and mutual review of ideas and intellectual produce. In regular courses based on traditional teaching/learning means, there is little opportunity for the exercise of these types of transactions. In the courses included in this study, several forms of Web-based peer evaluation and review activities were developed, e.g., reference and response to peers' contributions, formative evaluation of peers' work-in-progress, or judgement of peers' contributions in selection or contest tasks (e.g., proposals for important research questions or best-e-paper contest). One practical issue that obstructed the full implementation of some of these activities was the participants' incapability to adhere to the task's agreed schedule. As a result, not all assignments were evenly completed by all students.

5. Collaborative construction of knowledge bases

The idea of the public accumulation and preservation of knowledge generated by the group members stood behind the creation of activities at which the students were asked to contribute to a common knowledge base. An example was the joint creation of an annotated database of educational Websites. The students were required to search for Websites following agreed criteria, evaluate the sites using a common instrument, and enrich the database with the resulting information. In another activity, the students were required to suggest ideas for the integration of discussion forums into learning units. Gradually, a repository of unit proposals was built. The resulting knowledge bases not only served the learning of the originators, but also are now offered to new groups of students which in turn continue to contribute and enrich them.

6. Group projects online presentation

A well-known phenomenon regarding courses' final assignments or projects is that these become mainly a teacher-student event. The student (or small group) hand out the work to the teacher (possibly after a couple of iterations), which is evaluated then stored with little chance that other students will read or use it as reference for further work.

Within Virtual-TAU a project-presentation mode was developed, offering the students a platform for developing their work and at the same time holding it public at any desired stage. This allows the students to gather opinions, suggestions, or help during the making of the project as well as after its final presentation. Another variation of this mode was the planning of MUD's in small groups. At the end of the process, the final product of each group was electronically delivered to the course's lecturer.

The above presented six modes of Web-based transactions developed by the courses' teachers, are but a sample of the promising ways the communication tools may contribute to both expand our repertoire of didactic solutions, and trigger more meaningful emerging-collaboration processes.

Students' Participation in Virtual-TAU Activities

The usage of the Web-Based learning environment was high in all courses. Students' involvement and participation in Web-supported transactions was of no precedent compared to the situation in traditional courses. One student declared that "I never worked so hard and so comprehensively in an academic course; I felt that the course is running after me; If two days pass without going into virtual TAU, I felt that I miss something

important happening right now". Many of the students expressed their experience with the courses in similar terms.

Table 1 presents the extent of the students' participation in Virtual-TAU forums within the six courses participating in this study. The table shows the overall number of entries to the forums' main pages, of messages delivered, and the average number of entries and messages per student for all courses. In addition, the ratio between operational and observational participation was analyzed (by computing the ratio between number of messages and number of page views).

Course	No. of students	No. of forums	No. of entries to forums	No. of messages	Ave. messages per student	Entries Per student	Entries Per messages
a	20	4	400	90	4.5	20	4.4
b	22	6	431	196	8.9	20	2.2
c	18	8	815	231	12.8	45	3.5
d	15	5	745	346	23	50	2.2
e	30	7	1560	442	14.7	52	3.5
f	10	4	250	114	11.4	25	2.2
Total	115	34	4201	1419			
Course average	***19.2***	***5.7***	***700.1***	***236.5***	***12.3***	***36.5***	***3.0***

Table 1. extent of participation in the courses' forums

The overall figures reinforce in quantitative terms the students' subjective assertions. Averages of 700 site entries per one-semester course (37 entries per student), and of 237 messages per course's forums (12.3 messages per student), are indicators of intense Web-based activity complementing the regular courses' tasks. The individual student visited the courses' sites about 3-4 times a week in average, out of which once a week, in average, contributed to a forum's discussion. These figures can be read also as indicator of two modes of engagement in the forums activities, namely operational versus observational modes. About 3/4 of the times students entered a forum not to contribute a new message, but to observe what is currently going on in it (e.g., to trace how the discussion evolves, to check reactions to her previous messages). This is a clear evidence of the contribution of the Web-environment to the creation of a virtual-transactional-milieu within which the students' felt involvement and commitment to the course's concerns.

Activities	No. of courses	No. of forums	AverageDuration (weeks)	Moderation	Ave. No. messages per Forum	% of responses	Ave. No. messages per Student
Social Interaction	3	3	5	none	49.3	50.7%	2.3
Web-Supported Reading	4	12	3.25	lecturer	33.3	41.1%	1.7
Issue Discussion	3	9	1.6	students	65.1	68.8%	3.9
Knowledge Base Construction	1	1	5	none	146	49.3%	4.9

Table 2. Students participation in selected activities

The table summarizes data on students' participation in 25 forums, in which the mode of emergent-collaboration evolved. The table presents for each mode the number of courses and forums in which the activities took place; the average duration of the forums; moderation agent; average number of messages per forum; percentage of responses out of the total number of messages (which indicates group interactions); and average number of messages per students per forum.

Data in this table shows that the two most intensive modes of emergent-collaboration were the student-moderated issue discussion, and the collaborative construction of databases. The most frequently used mode was the Web-supported academic reading. Above half of students' contributions to the forum were responses to messages posted by others, implying an intense flow of transactions during the discussions.

Two examples of emergent-collaboration processes

The following are examples of emergent-collaboration processes in two different instructional modes: student-moderated discussion and critical group-reading.

Students-Moderated discussion groups

One of the most successful educational transactions that took place in the study was the students-moderated discussion group. In course 'd' three issues were assigned for students-moderated discussion. For each forum, 3-4 students were appointed as discussion-moderation group. Their responsibilities were to work collaboratively aiming to (a) prepare the background for the discussion; (b) present it to all students participating in the forum (about 15); (c) open the discussion, and moderate it during two weeks; (d) summarize it with the class; and (e) post a report on it to the course's Website.

Two parallel processes took place during the moderation-group's work. The first was the collaboration process within the moderation group (e.g. meeting for planning, assigning rolls, writing up the report) following structured collaborative learning schemes. The second process comprised the emergent-collaboration transactions between the moderators and the rest of the students in the course.

According to the self-report of all the students that served as moderators, their role was extremely effortful, and meaningful. As one of the students stated it, "This activity was extremely demanding both because of the intensity of our moderation group interaction and the responsibility we shared in keeping the discussion alive and on high level. However, I learned a lot from the processes, and enjoyed it very much. I think this kind of activity should be integrated in many more courses". One of the concerns of the moderators was how to engage the entire class in the discussion. Therefore, they invested a lot of time and creativity to create a contextual-framework to the discussion, and used e-mail to encourage their classmates to participate.

Table 3 presents the extent of participation of the students in the three discussion groups of the course. In all these discussions, the enrolment was very high. An average of 19 messages were contributed to the discussion by each participant, more than three messages a week. Moderators involvement was also very high, although varied among groups. The use of additional communication tools (e.g. polls, chat, e-mails) was also an initiative of the student-moderators.

The primary achievement of this educational activity was the successful transfer of the responsibility from the lecturer to the students. First, they collaboratively learned in order to lead their classmates learning, but at the same time, they cooperated with their peers when they, in turn, were responsible for the discussion. This activity resulted in increased effort, motivation, and satisfaction leading to meaningful learning. It was evident that the use of the Web-supported environment was a required condition for its successful implementation.

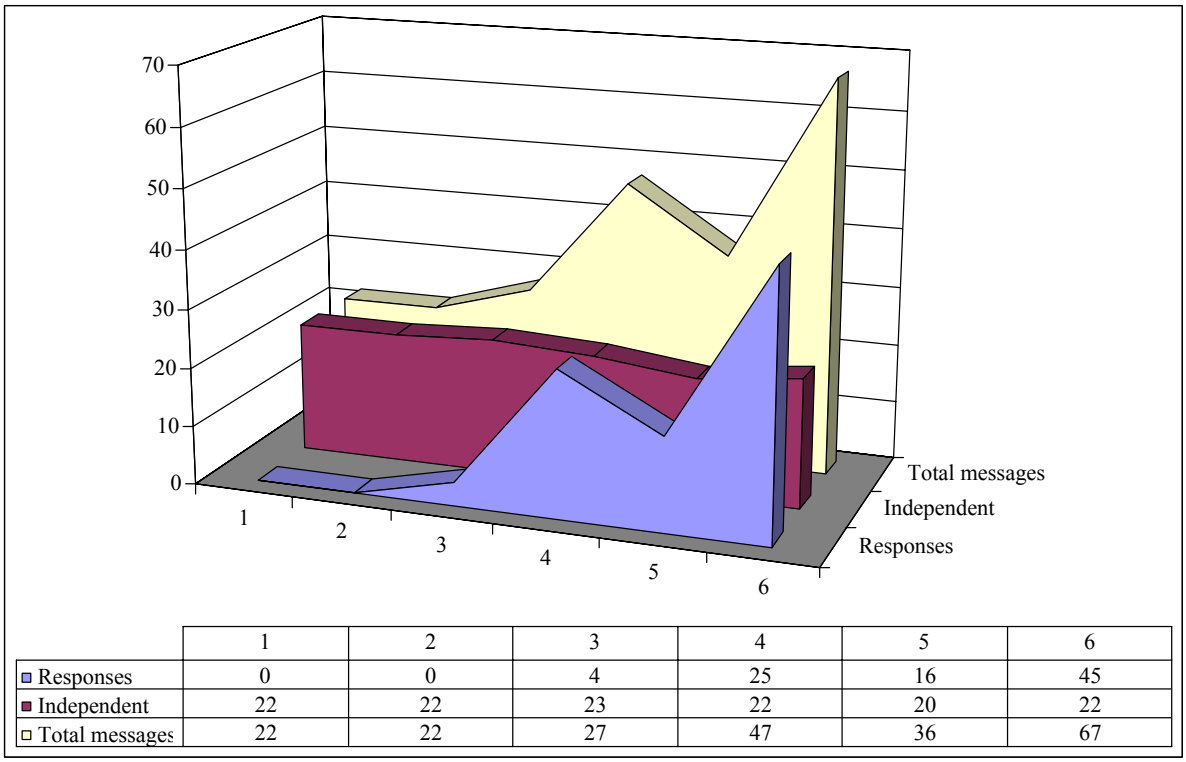
The teacher's main role in this activity was to guide and support the moderation-groups work.

	Forums (no. of messgs.)		Poll	Chat	e-mail (to whole group)
	Total	moderators			
Issue 1	87	27	√	√	1
Issue 2	108	50	-	-	4
Issue 3	90	14	√	-	2
Average	**91.1**	**30.3**			

Table 3. Usage of communication tools as facilitator of emergent-collaboration during three two-week student-moderated discussion groups (n=15).

Web-supported Critical Group-Reading

Bibliographical resources are essential components of any academic course, serving as raw materials for the implementation of diverse learning formats (e.g., class debates, public trials, topical surveys). In most courses the students do critical reading at a limited extent, due to diverse reasons, e.g., the size of the class (in large classes individualized reading support mechanisms are difficult to implement), students' degree of motivation and perception of the readings' learning value in correspondence with the perceived character of the learning task, or even language barriers for Hebrew speakers (being most professional and academic publications in the English language).

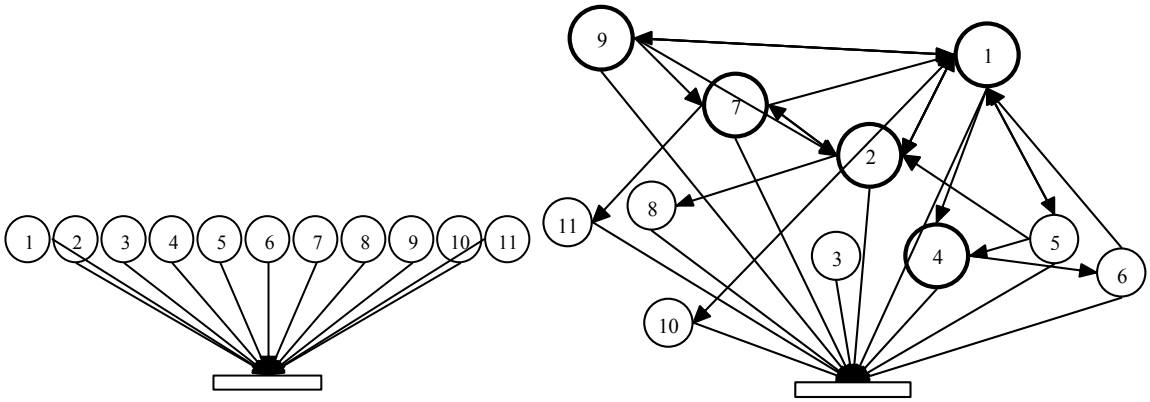


	1	2	3	4	5	6
Responses	0	0	4	25	16	45
Independent	22	22	23	22	20	22
Total messages	22	22	27	47	36	67

Figure 1. Number of transactions in six forums of a course

In the course on which we report here, critical reading activities were devised as Web-supported, contextualized, and collaborative tasks. Web-support took two main forms: most reading materials were located (full text, digital form), or could be reached, in Websites; and Web-shell tools (e.g., forums, mail) served the students' work. Contextualization was implied in the format of the different tasks, e.g., analysis of educational software in light of theoretical principles of programmed instruction, or multiple-sources definitions and discussion of the concept "virtual" and its translation in the building of virtual environments, virtual books, virtual schools, etc.). Finally, collaboration was incorporated not in the sense of pre-structured collaborative tasks, but as invoking working milieu within which learning transactions and dynamic partnerships were expected to evolve along the semester's course of events.

Figure 1 shows the evolvement of the transactional volume in quantitative terms. The course (22 students) included six forums focusing on critical-reading tasks. For the first two forums, each student entered one message, according with the minimal requirements. By the fourth task the participation increased notably, up to a triplication of the initial values in the last task. The interesting aspect of these figures are that the number of independent contributions remained the same for all tasks, while the difference was made by the increasing amount of responses to each other messages –none at the beginning up to 45 in the last task.



Form task 1 Forum task 6

Figure 2. transactional patterns for two task forums

However, a clearer evidence of the emerging collaboration patterns can be appreciated if the transactional map is depicted as in Figure 2. For clarity reasons, only half of the students are represented. In task forum 1 at the beginning of the course, all contributions were made independently (and only once per student). This configuration gradually changed, becoming in task 6 an intricate web-like pattern. Students 1-2-4 constituted a very active sub-group, complemented also by students 7-9. Not only the density of the lines around these students' nodes, but also the number of transactions within the subgroup and with other classmates reinforces this observation, e.g., students [1-2]=8 transactions; students [7-2]=8 transactions; students [2-9]=5 transactions. Analysis of the content of the messages show that this subgroup, besides participating in the debate, assumed a variety of group functions, e.g., discussion moderation, triggering new discussion paths, supply of relevant information (e.g., related URL's).

A more detailed presentation of the evolution of collaboration patterns during this course's work is beyond the scope of this paper. However, even this succinct report indicates that the students' continuous and systematic involvement in activities supported by the Web tools clearly affected (a) their performance in critical-reading tasks, and (b) the emergence of collaborative learning situations that enhanced the quality of the transactional web within the group.

Discussion and Conclusions

This study focused on the process by which collaboration learning situations emerged among students, with the support of Web-based tools. Participated in the study 115 graduate students from six courses at the Tel-Aviv University School of Education. The results indicated that the use of the technology supported the emergence of collaboration configurations which qualitatively contributed to enhance the learning processes. The discussion on the results will be first presented according to the research questions, followed by general considerations and conclusions emerging from this study.

The first question addressed in the study focused on the different modes of Web-based transactions that emerged during the planning and implementation of the experimental courses. At the level of this particular study, the reported results show that even within its limited setting (e.g., six courses, three teachers, and a Web shell in prototypical stage) a fairly interesting set of learning assignments and collaborative tasks emerged. The learning events ranged from transactions aimed at supporting group reading and bibliographical work, up to the development and (digital) presentation of collaborative projects. At a more general level, the results represent a valuable (if modest) contribution to the endeavor shared by many educators and researchers aiming to define new pedagogical schemas fitting the features and qualities of the Web technology (a Webagogy?). Almost every technological shift in education (as in other venues of life) went through a transition stage at which the new technology was implemented in terms of pedagogical models and solutions typical to the use of previous technologies. The educational implementation of the Web technology is undergoing such a transition (Dede, 1996; Mioduser, Nachmias, Oren & Lahav, in press; Nachmias, Mioduser, Oren & Lahav, 1999). But at the same time, interesting examples of novel pedagogical solutions are emerging (e.g., virtual learning communities, immersive environments, the hypercurriculum) indicating the raising of promising trends (Mioduser, Nachmias, Oren & Lahav, 1999).

The second research question aimed to examine the extent and quality of participation of the students in the different activity modes, with the support of the Web tools. The results were conclusive for all courses regarding the increased intensity and involvement of students and teachers in the courses' activities. The density of participation in the courses' Web-based forums and assignments -which, as already mentioned, were but a complement of the face-to-face activities- represents a convincing evidence of the Web shell role in support of learning transactions and the emergence of collaboration patterns. The average number of entries per forum was about 700 (for about 20 participants, the average number of students per course). Students entered the Web environment more than three times a week in average. At least one out of three entries aimed to contribute to a forum or a collaborative task, and the other to watch for updates and keep connected to the evolving events. This distinction between two modes for visiting the courses' sites, namely operational and observational modes, was also a revealing indicator of the students' continuous concern with the courses' affairs. The students' perceptions of their experience can be summarized by one participant's claim that the course, instead of a "14-meetings-course", became a "14-weeks-course". The sense behind this claim is that while in the traditional mode the course was perceived as a series of discrete events (namely class meetings, and limited time spent in out-of-class assignments), it is now perceived as continuous intellectual engagement comprising face-to-face as well as virtual meetings, and anytime/anywhere transactions among all partners.

However, it should be noted that the complementary aspect of "being in touch", of taking part in continuous learning transactions, of being mindfully attentive to the others (students, teachers) requirements, of generating novel Web-based learning tasks -is an increase in time and effort which has to be devoted to a course's affairs. It is evident that neither students (learning a full-time program) nor teachers would expect to respond to a similar level of demand for all courses. Therefore, criteria for reaching appropriate balance among courses based on demand levels should be developed.

In light of the rapid technological developments, one can adopt several approaches. A common practice is to push the technology into the class expecting that this by itself will make a difference in educational processes. Experience shows that without the creation of an appropriate technology/pedagogy composite, no educational impact should be expected. In the other hand, another common approach is to attach the new technological means to existent pedagogical models. The result in most cases is that the added value of the technology can be hardly recognized in comparison with the previous situation. In this study we adopted a different perspective, and found that the implementation of ICT technologies within innovative pedagogical approaches can contribute to the emergence of novel pedagogical modes and learning collaboration patterns among the students.

The experience reported in this paper also represents an alternative view about the role of advanced learning technology in distance learning processes. By the traditional view the main focus is on individualization of the instruction, allowing each student to engage in learning activities at her own pace and demand. In contrast, this study focused on harnessing Web-based tools in support of collaborative processes that are of great contribution to the individuals' learning. From this perspective, we expect a major role of the Internet in education to be to support and enhance collaboration and socialization processes among students. In addition to the traditional model based on one-individual access to distant knowledge resources, we expect the multiple-participants transactional model to be come a central component in the development and implementation of novel distance learning systems.

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