A tutoring model for promoting the pedagogical-disciplinary skills of prospective teachers

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Abstract

This article presents a tutor-centered tutoring model that aims to develop and establish the pedagogical-disciplinary knowledge and skills of prospective teachers. The tutoring model and the research that accompanied its implementation are presented. The tutor-tutee pairs worked for two five-session cycles for two semesters, enabling prospective teachers to experience teaching situations by guiding the tutee through problem-solving processes. The sessions were based on difficulties that arose during the tutees’ learning process. The research findings focus on the evaluation of the model by its participants—tutors, tutees, and program coordinator—and indicate that the main tutoring targets were achieved. This tutoring model was implemented with prospective computer science teachers; we suggest, however, that it is applicable in teacher preparation programs in other disciplines in which problem solving is inherent.

Keywords: tutoring model, pedagogical-disciplinary tutoring, prospective teachers, preservice teachers
Teacher training usually includes disciplinary studies, education and pedagogical studies (for example, educational psychology and pedagogical skills), and pedagogical-disciplinary studies. Pedagogical-disciplinary studies focus on principles and tools used to teach knowledge domain concepts, and focus mainly on learners’ difficulties and the development and adaptation of learning activities and teaching tools to different learner levels and skills. Pedagogical-disciplinary studies can be viewed as an inherent part of Shulman’s (1986, 1990) concept of pedagogical content knowledge (PCK), which refers to what a teacher is required to know in order to teach a certain subject matter.

Teacher training programs that include pedagogical-disciplinary training comprise two main components:

1. *Theoretical studies*: school curriculum contents and in-depth study of core curricular concepts, and approaches to teaching them;

2. *In-school experience (practicum)*: observing and teaching several lessons in schools, with the objective of introducing prospective teachers to the actual field work of teachers who teach the knowledge domain (Eick, Ware, & Jones, 2004).

During their practicum, prospective teachers are treated as guests, even in the case of more profound models of coteaching (Eick et al., 2004) or of professional development schools (Darling-Hammond, 2001; Furlong, 2000; Teitel, 2003). In such settings, the regular class teacher—not the prospective teacher—bears the main responsibility for teaching. When prospective teachers actually teach in these settings, the prospective teachers are often concerned about the degree of cooperation they will receive from learners and with problems involving class management and disciplinary issues.

Difficulties of new teachers entering the field work are also addressed in mentoring programs in which veteran teachers mentor new teachers in their first steps. Athanases and Achinstein (2006) found that the attention of novice teachers is not focused on learners’
learning, and they suggest that schools develop mentoring programs to help novice teachers “move past survival mode” (p. 23). Special attention is also given to the choice of the veteran teacher mentoring new science teachers, with respect to the development of their PCK (Shore & Stokes, 2006, and see also Achinstein & Athanases, 2006 for a discussion of mentoring settings for new inservice teachers).

With respect to teacher preparation programs, we suggest that prospective teachers lack the opportunity to experience three essential pedagogical issues: coping with learners’ difficulties in a meaningful framework; following up on learners’ development in the context of the fundamentals of a given knowledge domain, and tracking the impact of their own teaching methods on the learners.

To meet the new teachers needs, we propose an additional preparatory stratum—Disciplinary Focus Tutoring (DFT)—that will enable prospective teachers to practice disciplinary learning-teaching situations, with the goal of promoting their PCK-related abilities and skills. According to the DFT model, tutoring is carried out in pairs, whereby a prospective teacher (hereinafter referred to as the tutor) tutors a novice computer science (CS) student enrolled in an introductory CS course (hereinafter referred to as the tutee). The tutors, who are novice CS teachers but whose CS knowledge is more established, support the learning processes of the tutees. The tutoring takes place in two five-session cycles, with sessions two weeks apart. The focus in DFT is on the promotion of the tutors' teaching skills and the program aims to develop and establish the tutors' pedagogical-disciplinary knowledge. More specifically, the DFT aims to promote the skills of prospective teachers in guiding learners through problem-solving processes in the discipline. The DFT focuses on hands-on experience and is based on theoretical studies offered within the Methods of Teaching Computer Science course, which introduces prospective teachers to the initial pedagogical-disciplinary background required for the individual tutoring.
In addition, DFT encourages meta-cognition through reflective processes that are integrated into the tutoring activity. Tutors are encouraged to think about their tutees’ cognitive processes, as well as about their own performance as teachers. At the end of each session, tutors are required to complete a feedback form that enables them to revisit the session and focus on both the teaching objectives and the teaching methods applied. Furthermore, the feedback form also enables the tutoring coordinator to provide the tutors with feedback.

The DFT model was implemented at the Department of Education in Technology and Science of the Technion, Israel, in the context of CS. We believe, however, that DFT can be applied also in teacher preparation programs in other disciplines. This article highlights the model’s general tutoring aspects. Tutoring aspects related specifically to CS are presented in Ragonis & Hazzan (2008c) and are not covered here.

Settings for Tutoring in the Academia and Teaching Preparation Programs

The terms tutoring and mentoring are sometimes used interchangeably to describe frameworks in which one person supports and promotes another person or group of people. The literature reveals considerable variance with respect to tutoring and mentoring, among them the type of setting (academic, school, social), its nature (formal, informal), the number of tutees (single, group), and the objective of the tutoring program (social skills, acclimation of the tutee, promotion of disciplinary understanding, promotion of teaching skill). What most programs have in common is the objective to advance the tutees. Nonetheless, despite the focus on the tutees, many studies also indicate a benefit to the tutors, particularly in such dimensions as improving interpersonal communication skills (Budge, 2006; Vaidya, 1994).

The term tutoring usually refers to an interpersonal interaction whereby one person has the intention of assisting the other in the area in which the assistance is given (Topping, 2000). Peer tutoring relates to one learner instructing another learner of a similar status in an
area in which the first is considered to be an expert and the second is considered to be a
novice (Damon & Phelps, 1989). *Mentoring* in its traditional sense usually refers to a
situation in which a more experienced person facilitates the development of a less
experienced person (Harris, 2002). In both tutoring and mentoring, the two people willingly
form a relationship of mutual respect and trust that focuses on objectives that meet the needs
of the *instructed* person (Kochan, 2002).

The DFT model is not typical of peer tutoring, primarily because its structure reflects
more a of teacher-student relationship, although DFT takes place in a friendly environment.
In DFT, the tutor is responsible and is the leader. In addition, the goals of the participants in
the DFT model are different—the tutees promote their knowledge of the discipline, and the
tutors promote their knowledge and skills as teachers. The focus of the DFT objectives is,
however, on the tutor rather than on the tutee. Specifically, the objective of DFT is to
promote the tutors’ knowledge, and the DFT measures for success are the processes that
tutors undergo and the contribution of these processes to the building of the tutors' teaching
skills.

*Tutoring in academic settings*

Studies in the area of tutoring in academia refer mainly to the construction of the
tutoring setting (e.g., Kochan, 2002), the conditions for the success of these models (e.g.,
Jacobi, 1991; Topping, 2000), and student perceptions of the tutoring activity (e.g., Harris,
2002). In academic settings, the objectives of tutoring are usually the acquisition of academic
skills and the prevention of student drop-out from academic programs (Budge, 2006).
Additional objectives of academic tutoring settings are improving learners’ achievements and
reinforcing learners’ positive positions with respect to learners’ choice of the subject of
learning (Brown, David, & McClendon, 1999; Ferrari, 2004; Packard, 2003). DFT, with its
focus on tutors, differs in its objectives. DFT is not directed at improving the tutees’
academic performance or at establishing the tutees’ positive approach towards CS, although these goals are also accomplished. The DFT model can be viewed as improving the tutors’ teaching performance and reinforcing tutors’ positive attitude regarding their choice of profession as CS teachers.

Tutoring in academic settings can also be directed at the co-studying of a domain that is almost equally familiar to both partners, with the objective of encouraging the partners to cope with similar difficulties, acting out of similar interests (Greenwood, Hou, Delquadri, Terry, & Arreaga-Mayer, 2001; King-Sears, 2001). The essence of DFT tutoring is not co-studying, but rather the explicit instruction that the tutee receives.

Finally, in a comprehensive literature survey on mentoring and tutoring in higher education that presents taxonomy for tutoring models (Terrion & Leonard, 2007), none of the 54 tutoring programs reviewed presents tutor-focused models.

*Tutoring in teacher education programs*

Tutoring is implemented also as a way of training novice teachers (Fresko & Wertheim, 2006; Hay, 1995; Veenman, Latt, & Staring, 1998; Villani, 2002). Training novice teachers usually focuses on the acquisition of general pedagogical knowledge, with objectives that refer to the acquisition, reinforcement, development and improvement of teaching skills (Athanases & Achinstein, 2006; Kloyer, 2006; Morgan, Whorton, & Willets, 2000). In teacher preparation programs, tutoring is also mentioned in the context of the teaching practicum in which coacher-teachers tutor prospective teachers who observe them at work (Hudson, 2007). We did find an inservice mentoring activity that, like DFT, focuses on the *pedagogical-disciplinary* aspect (Shore & Stokes, 2006), but not within pre-service teachers education, as DFT does.

The Disciplinary Focus Tutoring Model
The DFT model was integrated into the Methods in Teaching Computer Science course at the Department of Education in Technology and Science of the Technion, Israel (Lapidot & Hazzan, 2003; Ragonis & Hazzan, 2008b). The Methods course is a two-semester course (28 hours each semester) and is usually taken in the student’s third year (out of four). The course focuses on problem-solving processes, learners’ difficulties and misconceptions, and varied teaching methods.

The tutors’ knowledge in the DFT model base is based on: 1. prior disciplinary knowledge from previous CS courses; 2. prior knowledge in education and teaching from courses tutors studied in this area, and 3. knowledge acquired in the Methods of Teaching CS course in which DFT is implemented.

Tutoring was done in tutor-tutee pairs, whereby each pair met for two five-session cycles, with sessions held once every two weeks. Tutors were teaching students enrolled in the Methods of Teaching CS course, and tutees were undergraduate students (or high school pupils) enrolled in an introductory CS course. During the sessions, the tutees raised problems and the tutors guided them through the problem-solving process. Tutoring was based on the identification of learner difficulties and subsequently applying different teaching strategies in order to overcome such difficulties. The serial nature of the sessions enabled the tutors to receive feedback on the knowledge the tutees acquired in previous sessions, and thus, in fact, to receive feedback on their own teaching.

Support for tutors

The tutoring process was accompanied by a coordinator (the first author), who coordinated the process and provided tutors with ongoing guidance and support, in the form of coaching, throughout the entire tutoring period. The coordinator adopted an open-door policy, and tutors could discuss difficulties related to disciplinary content, teaching of content, or any other session management problems, as well as share tutors’ experiences with
the coordinator. Such coordination and guidance activity can be considered to be meta-tutoring. The coordinator tutors the tutors with the objective of advancing them; the tutors are the coordinator's tutees. The following definition is compatible with the spirit of the objectives of the DFT coordinator:

You help your students achieve the potential within them that is hidden to others—and perhaps even to the students themselves. You share stories with students about your own educational career and the ways you overcame obstacles similar to theirs. (Omatsu, 2004, p. 4)

In addition, online support forums were established for the tutors. One forum was dedicated to discussions about tutoring sessions, with the objective of enabling tutors to ask questions related to the sessions and provide tutors with a place to present conflicts and experiences that occurred during the tutoring sessions. A second forum was dedicated to questions on disciplinary-related topics. In addition, a third forum was launched, per one tutor’s request, for both tutors and tutees.

**Tutor obligations**

During each of the two tutoring cycles, the tutors were required to:

1. Identify a tutee from among students enrolled in an introductory CS course;
2. Hold five tutoring sessions, each lasting about two hours;
3. Complete a feedback sheet for each tutoring session and submit it to the DFT coordinator (Figure 1);
4. Hold individual meetings with the DFT coordinator: one following the first tutoring session and one after completing the cycle of five tutoring sessions;
5. Present the Methods of Teaching CS course plenum with one episode from the tutoring process;
6. Complete a final summarizing feedback questionnaire.
Central considerations of the DFT model

It is important that all tutoring sessions in a series be held with the same tutor-tutee pair. Fixed tutor-tutee pair enables continuity of activities, allows the tutor to refer to previous sessions, and neutralizes the tutor's concerns regarding the need to develop new relations and communication styles with a new tutee each meeting. Tutoring a different tutee in each cycle, however, enables the tutor to compare and draw conclusions from the first cycle and apply the conclusions to the second cycle. Working with a different tutee in each cycle also allows flexibility when tutor-tutee relations are not satisfactory, a situation that could compromise the effectiveness of the tutoring sessions.

A 10-hour tutoring framework seems reasonable in terms of the tasks required from a student in the course. The two-week interval provides time for the tutee's learning process. We recommend face-to-face meetings, but online sessions are also an option, depending on the tutee’s needs.

To ensure an appropriate tutoring framework, the DFT coordinator must carefully monitor the tutor’s session feedback forms and intervene as needed (e.g., tutor’s disciplinary mistakes or a negative affective influence).

As the tutors will eventually teach in high school, tutoring a high-school student seems to be appropriate. Nevertheless, having to find a high-school student might be difficult for some tutors, whose living and learning environment is the college or university campus. Those tutors, who are performing their school practicum and are in closer contact with high-school students, can work with high-school tutees.

The tutee perspective

As tutors are the target of DFT, tutees can be regarded as the means toward this target. This perspective, however, is not completely correct, as the tutees gain a free, personal teacher in the process. In addition, in order to lead the tutees to reflect on the tutoring process,
the tutees were asked to complete a summarizing questionnaire and were invited to hold a personal conversation with the DFT coordinator in which the tutees could share their experience. Due to space limitations, the discussion of the tutees' perspective in this paper is limited. We should mention, however, that tutees' feedback was positive, and that most of the tutees were very grateful and appreciated the benefits of working within the DFT model.

Method

The research objectives were to investigate the pedagogical contribution of the DFT model and to examine its practicability. The following research questions were derived from the research objective:

1. How is the DFT model evaluated by model participants from the pedagogical, organizational, and affective perspectives?
2. How do the tutors acquire the following pedagogical skills: becoming reflective practitioners and applying a variety of teaching strategies?
3. How do the tutors acquire the following disciplinary-pedagogical skills: identifying difficulties encountered by CS learners and guiding CS learners through problem-solving processes?
4. Do the tutors promote their disciplinary (CS) knowledge?

In this article we focus on the first research question, which can be addressed in a broader context than solely CS education. The other research questions are discussed in Ragonis and Hazzan (2008a, 2008c).

Research population

During the first semester, the research population consisted of 10 tutors (preservice CS teachers) who participated in the Methods of Teaching CS course at the Technion, Israel. Each tutor tutored one student enrolled in an introductory CS course; one tutor tutored a high-school student. The research population in the second semester was almost identical to that of
the first one. One tutor who participated in the first semester did not participate in the second semester, and one new tutor joined the Method course. The tutees were different, and two tutors chose each to tutor a pair of tutees rather than one. Thus, the combined research population included 11 tutors (10 each semester) and 22 tutees.

Data gathering tools

To answer the research questions, we employed both qualitative and quantitative research tools. Qualitative tools are suitable for this kind of research as qualitative tools enable the examination of attitudes, processes and outcomes. Although quantitative data tend not to be significant with small populations, quantitative data analysis is used in this research to supplement the qualitative findings.

To validate the findings, different and wide research tools were used, as follows:

1. Interviews with the tutors following their first and last tutoring sessions.
2. Tutoring session feedback worksheets: Five forms completed by each tutor each semester, after each tutoring session (Figure 1).
3. An overall evaluation questionnaire completed by the tutors at the end of each semester, including 36 Likert-type questions (on a 1-7 scale; 7—highest score) and 16 open questions.¹
4. An overall evaluation questionnaire completed by the tutees at the end of each semester, including 13 Likert-type questions (on a 1-7 scale; 7 – highest score) and 5 open questions.
5. Summary interviews with some of the tutees.
6. Analysis of tutors' homework assignments (for samples, see Ragonis & Hazzan, 2008b).
7. Researcher’s diary.

Data analysis
Statements made by students during the interviews, feedback questionnaires, and answers to the summarizing questions, form the qualitative data (students are identified in this paper by a number in square brackets). Quantitative data are based on the attitude questions in the overall evaluation questionnaires completed by both tutors and tutees (research tools 3 and 4). Because the sample is small, the statistical analysis is restricted to averages and standard deviations.

Findings

In this section we present the DFT evaluation by model participants from the pedagogical, organizational, and affective perspectives.

Pedagogical perspective

The tutors’ feedback displays the great appreciation the tutors felt towards the process they underwent and the tools and experience they acquired. For example:

The tutoring is something that is very important for me, it contributes something personal. Learning how good you are with other people. In terms of teaching, how successful you are and how much patience you have to teach people. It was important to me, not only how I teach, but also how I relate [to my tutee]. From a professional point of view—since our profession is teaching—each time you find different, more correct words, you find a more correct way and also other methods; there is always something to improve… I still don’t feel confident enough in my teaching. [St. 3]

The results presented in Table 1 confirm this statement regarding the tutors’ appreciation of DFT. The table shows that from a pedagogical perspective, the tutors value the DFT and its general contribution, and believe that the DFT has advanced their knowledge on teaching CS and enhanced them as future CS teachers. The tutors also believe that this experience is similar to situations they will encounter in real-life teaching.
One of the questions that received the highest average rating refers to the importance of the DFT for teaching trainees, indicating that the tutors think that implementing the DFT model is important for the training processes of preservice teachers. An interesting point, worthy of further research, is the tutors’ position that a similar model can be developed for the teaching of other disciplines.

[Insert Table 1 here]

Tutors and tutees were asked to address the benefit that tutees gained from the tutoring. The tutors believed that they contributed significantly to their tutees: The average for the said statement in the first semester was 5.80 ($SD = 0.92$), and for the second – 5.60 ($SD = 0.84$). The tutees’ average score was even higher: 6.18 ($SD = 0.73$).

The tutors’ pedagogical success in performing their task was also evident in the very high evaluation given by the tutees with respect to the main focus of the tutoring process – imparting problem-solving tools. The tutees stated that they acquired tools that would help them with problem-solving processes in the future. The tutees average score of the said statement was 6.14 ($SD = 0.88$).

Tutees’ positions were also supported by the tutees’ answers to the open-ended questions and by the interviews held with some of them. Following is one answer to the question "How did you benefit from the tutoring sessions?"

The sessions provided me with a way to simplify the material that was studied and to understand it more deeply. In addition, I was exposed to different and varied ways of thinking, which contributed to my approach to other questions. [St. 4’s tutee, 1st Semester]

*Organizational perspective*

In what follows we address five topics related to the organizational aspect of the DFT: a continuous process within a fixed pair, one-on-one tutoring, second round of tutoring
sessions, reflective mechanisms, and implementation of the DFT model within the Methods of Teaching Computer Science course.

A continuous process within a fixed pair. The tutors acknowledged the importance of the continuous process that took place between each fixed pair throughout all five sessions, and attested to the advantages of observing a single learner over time and tracking that learner’s progress. Following are two illustrative excerpts taken from the tutors’ interviews:

It’s important that it [the tutoring] is with the same student because there is continuity…. This way, the next session, you know where he [the tutee] might go wrong. I’m familiar with his thinking. I already hear by his words where he went wrong, where he’ll not understand the problem correctly, and that’s where I intervene. [St. 1]

With each new session, I feel that he [the tutee] and I have found a common language. It’s easy for us to communicate and I think he feels comfortable enough to ask me questions that he could find embarrassing, but he doesn’t hesitate and he asks me. [St. 6]

The tutors’ feedback indicates that one-time sessions with different tutees would not have enabled the tutors to acquire the skills and gain the special perspective that is evident in their words.

One-on-one tutoring. The basic setting for the tutoring sessions was a tutor-tutee pair, developed primarily to enable the tutors to focus in depth on identifying learners’ difficulties, adapting their teaching methods to these difficulties, and closely following the development of the tutee’s disciplinary knowledge in accordance with the tutor’s teaching skills throughout the teaching processes.
Two tutors chose to experience a different setting and each tutored two tutees in the second semester. The feedback from these two tutors suggests that working with two tutees brought the tutors no benefit, and the experience left the tutors more frustrated:

I had some concerns during the session that I would not treat the two tutees equally; I mean that I would give more attention to the better one than to the weaker one because she answers the questions immediately. I solved the problem by addressing each question to only one of them, in turns. [St. 7]

Eventually, both tutors added separate meetings to assist the weaker tutees.

*Second round of tutoring sessions.* In the current structure of the DFT model, expansion regarding different ways of thinking and different behaviors is achieved by tutoring a different tutee in each cycle. At the end of the second semester, the tutors were asked about the role of the second round of tutoring sessions. The tutors' positions are presented in Table 2.

[Insert Table 2 here]

As can be seen, the tutors believed that there is value in holding another round of tutoring sessions and that they gained additional skills to those acquired during the first semester. The following statements support these positions:

[There is a change] in terms of my ability: I think about what she will think. I didn’t do that during the first semester. [St. 7]

I learned from mistakes I made last semester. I delegated more responsibility to my student. Last semester I hadn’t taught her to come prepared with questions that she had already read and tried to solve, and this made the lessons less effective and longer…. [In the second semester] I asked her to come prepared, to first read the problems and try to solve them – otherwise, it’s a waste of time for both of us. [St. 3]
Reflective mechanisms. The reflective practitioner perspective, introduced by Schön (1983), guides professionals (architects, managers, musicians, educators, and others) to rethink and examine their professional creations during and after the accomplishment of the creative process. The underlying assumption is that such reflection improves proficiency and performance. With respect to teaching, a significant way to acquire pedagogical-disciplinary knowledge involves activities performed in actual teaching situations that guide the teacher towards reflective processes that address learners’ thinking (Putnam & Borko, 2000; Wilson & Berne, 1999).

In the present research, the tutors engaged in reflection in several circles: before the tutoring session, after the tutoring session, and after receiving written feedback from the DFT coordinator. Additional reflection was done by the tutors following feedback from their fellow tutors and interviews with the tutoring coordinator. Table 3 shows the tutors’ positive approach to reflection, as revealed in their answers to the position questions in the overall evaluation questionnaire.

[Insert Table 3 here]

Tutors’ appreciation of the reflective process was also evident in the tutoring session feedback worksheets, completed by the tutors after each tutoring session. The tutors addressed three aspects of reflective processes: reflection on teaching processes, the role of reflective processes, and the encouragement of reflective processes among the tutees, as illustrated in what follows.

1. Tutors reflect on their teaching processes:

First of all, I would definitely not have started with the first question. It was a pretty difficult question for the tutee and it affected his mood. I saw that his motivation dropped compared to the beginning of the lesson. [St. 10]

2. The role of reflective processes:
When you read the report you are able to look at things that you don’t always pay attention to. The reading helps you organize things in your head into those that should be preserved and others that should be improved. [St. 10]

3. Encouragement of reflective processes among the tutees:

I guided the tutee to reflect on the reasons for his failure to solve the problem and to learn from his mistakes. [St. 8]

The interviews with the tutoring coordinator also encouraged the reflective process, although the tutors did not generally feel it necessary to hold a feedback meeting with the DFT coordinator after each session. The average score for the position question "It is important to hold a meeting with the course instructor after each tutoring session" was 3.90 ($SD = 1.80$) in the first semester, and 4.00 ($SD = 2.00$) in the second semester. All values in the 1-7 range were given as answers, a range which testified to a lack of consensus on the importance of these meetings. From the tutors' answers to the open questions and expressions in the interviews, the lack of need to meet the course coordinator after each tutoring meeting can also be attributed to the detailed written feedback that the tutors received from the DFT coordinator after submitting their own feedback on each tutoring session. The feedback given by the DFT coordinator was not defined in advance as one of the model’s components, but was implemented in practice and proved to be very significant to the tutors. Following are two illustrative feedback comments given by the DFT coordinator:

1. Reinforcement of the tutors’ actions:

It’s nice to see the progress you’ve made with respect to tutoring, to see how you’ve improved your preparation for the lessons on the one hand, and your attention to the difficulties and guidance towards problem solving on the other. [To St. 10]

2. Addressing the tutors’ self-criticism:
Don’t be too hard on yourself… you are absolutely fine! Obviously we benefit from experience, and that’s why we undergo experiences. A first time is always a first time, it is different from the second time and again different from the time after that… [To St. 3]

Implementation of the DFT model within the Methods of Teaching Computer Science course. The DFT model was integrated into the Methods of Teaching CS course for two reasons. First, the course contents together with the DFT constitute a suitable basis that enables tutors to acquire appropriate knowledge and background in order to achieve the tutoring objectives. Second, the support the tutors receive by the DFT coordinator must be provided by a facilitator who is an expert at teaching the discipline (namely, the instructor of the Methods course).

In the final interviews, the tutors were asked to express their position regarding the implementation of the DFT model within the Methods of Teaching Computer Science course. Following are illustrative quotes of the tutors’ opinions which reflect their agreement with respect to the importance of such integration:

The tutoring must take place together with the Methods of Teaching CS course. The tutoring must be disciplinary and it cannot be general for all subjects. It must focus on the discipline rather than on class behaviors. [St. 2]

It is imperative that the coordinator is someone from the discipline because the kind of feedback and emphasis given is important. A coordinator who is not a CS person would not be able to appreciate the learners’ difficulties and the tutors’ progress. [St. 1]

Affective perspective
Table 4 presents tutors’ positions regarding affective aspects. The questions are divided into two categories: tutor attitudes before and during the activity, and difficulties that emerged during DFT model implementation.

[Insert Table 4 here]

The tutors’ positions regarding their feelings before and during the activity indicate that the tutors did not have any significant concerns. The tutors testified to minor difficulties in finding tutees and coordinating the tutoring meetings. Additionally, during the second semester, the tutors declared that the tutoring project imposes too great a burden. This position was supported in interviews with the tutors and led to the conclusion that the tutors thought that the tutoring tasks, alongside the course’s many assignments, constitute too great a load relative to the academic credits the tutors received. Clearly, the tutors appreciated the pedagogical gains, but felt that they deserved additional credits for the tutoring work.

We end this part with two quotes that highlight the contribution of the DFT model from the affective perspective.

1. Personal empowerment—confidence in abilities:

   The tutoring experience benefited me a lot. It added to my self-confidence, now I feel that I can teach high-school students as well. I feel that I have the tools and the required knowledge. [St. 7]

2. Responsibility, satisfaction and contribution:

   Toward the end of the lesson there definitely was a breakthrough in terms of her [the tutee's] level of understanding. I felt that I had succeeded and that she [the tutee] had learned something, and that feeling was worth all the effort. [St. 3]

Conclusion

This paper presents the DFT—Disciplinary-Focused Tutoring—model in detail, and outlines the research findings addressing the evaluation of the DFT model from pedagogical,
organizational, and affective perspectives (see also Ragonis & Hazzan, 2008a, 2008c).
Terrion and Leonard (2007) presented a taxonomy of articles on peer mentoring, and referred
to various measures that affect the success of such programs. Of these, the following
measures are highly relevant to the DFT model and are manifested in it: ability and
willingness to commit time, motivation, communication skills, tutors’ ability to support
tutees, and trust.

Based on the research findings, we suggest that the DFT model can be implemented
in other teacher preparation programs, especially in the sciences, where guiding pupils’
problem-solving skills is at the heart of the discipline. A more extensive implementation of
the DFT model can lead in the future to an examination of the entrance of those prospective
teachers, participated in DFT as tutors, into the field of teaching.

Endnotes

1 Some of the questions appear in the presentation of the research findings. The full
questionnaires can be obtained from the authors upon request.
References


Figure 1. Tutor feedback worksheet on tutoring session

A. General aspects:
1. Describe the subject of the session:

__________________________________________________________

2. Describe the problem discussed:

__________________________________________________________

3. Write a general description of the course of the session:

__________________________________________________________

B. Tutor feedback
1. What concept/s you think constituted a difficulty for the tutee?
2. Describe the difficulty / misunderstanding / misconception / …
3. What teaching tools did you use to help the student overcome the difficulty / misunderstanding / misconception / …?
4. Did you use knowledge that you acquired in the Methods of Teaching Computer Science course or in another course?
5. What else would have helped you give the necessary assistance? (additional disciplinary knowledge, additional teaching knowledge, what kind of knowledge?, which tools? …)
6. If you could repeat this tutoring session, what would you do differently?
7. What is your personal feedback at this stage of the tutoring? (the kind of communication between you and your tutee, quality of support, do you feel that you are advancing the tutee student? are you benefiting from the tutoring? difficulties… etc.)
Table 1

*Tutor evaluations from the pedagogical perspective (scale 1-7) (N = 10)*

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<th>Question</th>
<th>Average per semester</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1st semester (SD)</td>
</tr>
<tr>
<td>During the tutoring activity, I engaged in the kind of activity that I will also encounter in my work as a teacher.</td>
<td>5.70 (1.42)</td>
</tr>
<tr>
<td>I think I benefited significantly from the tutoring activity.</td>
<td>5.90 (1.52)</td>
</tr>
<tr>
<td>I think the tutoring activity promoted my knowledge of CS education.</td>
<td>5.30 (1.34)</td>
</tr>
<tr>
<td>I think the tutoring activity is important for teaching trainees.</td>
<td>6.00 (0.94)</td>
</tr>
<tr>
<td>I think it is an opportunity to enhance myself as a future teacher.</td>
<td>5.40 (1.65)</td>
</tr>
<tr>
<td>I think a similar model can be developed also in other teaching areas.</td>
<td>6.30 (0.68)</td>
</tr>
</tbody>
</table>
Table 2

*Tutor evaluations of a second series of tutoring sessions (scale 1-7), Tutors (N = 10)*

<table>
<thead>
<tr>
<th>Question</th>
<th>Average 2nd semester (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>It is important to hold two rounds of the tutoring activity.</td>
<td>5.60 (1.17)</td>
</tr>
<tr>
<td>I acquired different/additional skills during the second tutoring</td>
<td>5.60 (1.51)</td>
</tr>
<tr>
<td>activity than those I acquired during Semester I.</td>
<td></td>
</tr>
<tr>
<td>I benefited more at the end of the tutoring activity in Semester II,</td>
<td>4.60 (1.78)</td>
</tr>
<tr>
<td>than I benefited at the end of the tutoring in Semester I.</td>
<td></td>
</tr>
</tbody>
</table>
Table 3

*Tutor evaluations of integrating reflection processes into the DFT (scale 1-7), Tutors (N = 10)*

<table>
<thead>
<tr>
<th>Question</th>
<th>Average per semester</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1st semester (SD)</td>
</tr>
<tr>
<td>Dealing with the different aspects of reflective thinking contributed to my learning.</td>
<td>6.00 (1.20)</td>
</tr>
<tr>
<td>I think that dealing with the different aspects of reflective thinking will contribute to my work in the future.</td>
<td>6.50 (0.53)</td>
</tr>
<tr>
<td>It is important to complete a reflective report after each tutoring session.</td>
<td>6.20 (1.14)</td>
</tr>
</tbody>
</table>
Table 4

*Tutor evaluations of affective aspects of the DFT implementation (scale 1-7), Tutors (N = 10)*

<table>
<thead>
<tr>
<th>Aspect</th>
<th>Question</th>
<th>1st semester (SD)</th>
<th>2nd semester (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feeling</td>
<td>I was fearful when I first heard about the tutoring activity.</td>
<td>2.10 (1.45)</td>
<td>Was not asked</td>
</tr>
<tr>
<td></td>
<td>I was fearful during the tutoring activity.</td>
<td>3.00 (1.70)</td>
<td>3.90 (1.85)</td>
</tr>
<tr>
<td>Difficulties</td>
<td>I think the tutoring project imposes too great a burden.</td>
<td>4.70 (2.00)</td>
<td>5.30 (1.64)</td>
</tr>
<tr>
<td></td>
<td>It was hard for me to find a student to tutor.</td>
<td>3.60 (1.65)</td>
<td>2.70 (1.34)</td>
</tr>
<tr>
<td></td>
<td>It was hard to coordinate meetings with the student-tutee.</td>
<td>3.80 (2.25)</td>
<td>3.30 (2.31)</td>
</tr>
</tbody>
</table>