Abstract: Even though integrating technological tools into teaching and learning scenarios is an agreed upon goal it is still far from being fully implemented. This study examines a process of integration of a technological tool, to which a group of teachers participated. The technological tool was developed to enhance dialogism and argumentation, in one Grade 9 class. The question we focused on concerns whether the technological tool used by each teacher for a specific subject matter became integrated in teaching and learning practice across disciplines. Data included 22 discussion maps in five activities by different teachers. The analysis focuses on two dimensions of use of the technological tool: its form and its function. The findings show a process of appropriation of the technological tool could be detected along the five activities. This appropriation could be seen through the increase of arguments and challenges, the growing reference to each other’s ideas, and capitalization of previous arguments in follow-up arguments. The results of this study stress the importance of the participation of teachers in the same teacher training and shows that appropriation of norms afforded by a tool are instigated by their participation in two activity systems stimulated by the same technological tool.

Introduction
Integrating technological tools into teaching and learning scenarios has been an important goal (Fishman, Marx, Blumenfeld, Krajcik, & Soloway, 2004), but still far from being fully implemented. Technological tools such as MS-Word, PowerPoint are used for simple goals and are not utilized for promoting learning in their daily work (e.g., Cuban, 2002). It appears that teachers consider the use of technologies as a waste of time that time should be devoted to the teaching of subject matter. In addition, teachers are concerned about being perceived as incompetent by their students.

Pedagogical solutions often focus in two main areas: One concerns the adoption of known technological tools (chat, forum, etc.) for teaching and learning purposes (Herring, 2004). The second concerns efforts to develop innovative pedagogical technological tools and assimilate their use in a design research program (e.g., Fishman, Penuel, & Yamaguchi, 2006). This research belongs to the second category. The integration of innovative technological tools into teaching scenarios can be effectively developed through teacher training programs. Those programs typically include the combination of a specific content in a subject matter with the articulation of a pedagogy which incorporates to the use of a tool especially tailored for reaching a goal expressed by the developers. However, the use of such tools in classrooms often differs from the initial intention of the programs' developers (Squire, et al., 2003). An innovative approach has evolved in the EC-funded KP-Lab (KP-Lab FP6-IST-2004, 27490) teachers' training program (Engeström, 2003, Schwarz, & de Groot, 2007). Teachers are required to assume responsibility for the integration process of technological tools. The program introduces the teachers to many open or mediating technological tools (instead of specific tool) and provides them with technological and pedagogical support from expert teachers, in order to address difficulties arising while working with such tools (e.g., copy-paste habits). Furthermore, the teachers are required to apply what they have learned during their professional training in their own classrooms by designing learning units which make use of one of the tools presented in the program and implementing them with their students.

The aim of this study is to accompany the integration process of a technology. Our question is whether the technological tool used by each teacher for a specific subject matter became integrated in teaching and learning practice across disciplines. The answer to this question will shed some light on the teaching and learning processes that take place in the same class. We will show that when the technological tool is used by all teachers of the same class, the intentions of the developers are progressively instilled in the learning/teaching culture in school. This instillation is communal and occurs across disciplines. At the end of the paper we will show the crucial part of the in-service teachers program played to turn teachers' participation in the same activity system a trigger for appropriation of the norms afforded by the tool by the students in the second activity system that constitutes the class.
Methodology

Research plan

The present research focuses on the implementation of the technological tool in the classrooms, as a result of an in-service teacher training program. Three of the teachers in this program taught a different subject matter (Bible, Civics and History of Music) in the same class. They were invited to design learning units capitalizing on the same technological tool – Digalo. Digalo is a technological tool developed to enhance dialogism and argumentation by providing an argumentative map – a graphical representation personalized argumentative moves. As discussants are invited to discuss an issue, each discussants chooses a shape from the argumentative ontology provided. The upper bar in Figure 1 shows an ontology which includes claims (rectangles), arguments (hexagons), questions (trapezes), and three kinds of arrows (neutral, support and opposition. The discussant chooses a shape, inscribes its title and enters its content within the shape. He/she generally connects his/her intervention by an arrow to others’ interventions. The argumentation map progressively produced is a group product, which can be capitalized on in further learning activities (Schwarz, & de Groot, 2007). Figure 1 presents examples of argumentation maps (a detailed discussion on this figure is in the finding section).

Example from the first session

Example from the fifth session

In the present study, the three teachers of the same Grade 89 class preferred to use technological tool in small group of students, the class was divided in 4-5 groups, so that each student worked with the technological tool several times during the experiment. Table 1 presents the research plan.

Table 1. Research plan

<table>
<thead>
<tr>
<th>Subject matter</th>
<th>1st session</th>
<th>2nd session</th>
<th>3rd session</th>
<th>4th session</th>
<th>5th session</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technological tool</td>
<td>History of Music</td>
<td>Civics</td>
<td>Bible</td>
<td>Civics</td>
<td>Bible</td>
</tr>
<tr>
<td>Participants</td>
<td>1/3 of the class students</td>
<td>½ of the class students</td>
<td>½ of the class students</td>
<td>½ of the class students</td>
<td>½ of the class students</td>
</tr>
</tbody>
</table>
Data collection and analysis
Data were collected by 22 discussion maps. They included 295 shapes and 666 links. In addition we undertook observations during the five lessons during which Digalo was used and in four other lessons. Also participatory observations during the teachers training program were undertaken. In order to trace the use of Digalo in the class we focused on two dimensions, the form and the function of use.

Integration of the technological tool into classroom practices
Form of use
This dimension expresses the different options used by discussants. We found change in the use of options the tool offers: 1) Concerning shapes, at the beginning 85% of the created shapes were deleted, in the last enactment approximate 90% of the shapes created remained (with their contents) until the end of the discussion; 2) Concerning connections, at the beginning of the discussion, the use of connections was rare and inconsistent. Later on, as the students became more familiar with Digalo most of the shapes were linked to more than one shape. Figure 2 displays the progression in the use of shapes chosen in discussions.

Function of use
The function of use focuses on the quality and characteristics of the shapes and the connections. In order to examine the function of use of the shapes, a scale was elaborated:

1. Closed intervention: declaration, expressing position without mentioning other opinions. Does not include reference to the other.
2. Open/linked intervention: calls for a response/clarification (is not declared as a ruling or final point), linked to other responses (for example, by referring to other members), there is reference to the process
3. Social intervention: an intervention that does not refer to the activity at stake but expresses a way to socialize. These interventions include reference to other members without additional contents or emotions (e.g., “I think like X”, “Great idea” or different kinds of curses)

Figure 3 displays the type of interventions that the students wrote during the electronic discussions. 588 interventions were analyzed (the titles of the shapes and the content they included were analyzed separately)
As can be seen, the types of interventions changed from the first to the fifth activity:

Closed interventions: There is a decline in these interventions. Contents analysis shows differences in their characteristics. At the beginning the interventions include mainly declarations of individual position (like – “my answer to the question is…”); Later on, there is evidence in the close interventions that the writer understands he/she is part of the group discussion (“I have already said my opinion, but I’ll repeat it…”).

Open interventions: These interventions increase over time. Contents analysis shows transition in the characteristics of the open responses: At the beginning it included mainly reference to previous answers (for example, : “I also think that…”); then it moves to call for response/ thinking (for example, “think again what will happen in case…”); And at the end, it included challenges in thinking of other cases (for example, “would you prefer to convert your religion and live or to…”)

Social interventions: There is a decline in such kinds of interventions. Contents analysis shows differences in the phrases characteristics. At the beginning it was social without contents (like “Hi all, how are you doing?”). It then moves to a social relation to an opinion “personal” (like “Response to Shai”); Social mapping (like “agree with Or”); At the end, there were Social comments promoting the discussion (like “Guys, if all would agree we will have no discussion”).

The second element of function of use concerns the usage of connections. As we mentioned earlier, the amount of connections increased. Figure 4 shows changes in the use of connections.

Figure 3. The types of interventions

As can be seen, the types of interventions changed from the first to the fifth activity:

Closed interventions: There is a decline in these interventions. Contents analysis shows differences in their characteristics. At the beginning the interventions include mainly declarations of individual position (like – “my answer to the question is…”); Later on, there is evidence in the close interventions that the writer understands he/she is part of the group discussion (“I have already said my opinion, but I’ll repeat it…”).

Open interventions: These interventions increase over time. Contents analysis shows transition in the characteristics of the open responses: At the beginning it included mainly reference to previous answers (for example, : “I also think that…”); then it moves to call for response/ thinking (for example, “think again what will happen in case…”); And at the end, it included challenges in thinking of other cases (for example, “would you prefer to convert your religion and live or to…”)

Social interventions: There is a decline in such kinds of interventions. Contents analysis shows differences in the phrases characteristics. At the beginning it was social without contents (like “Hi all, how are you doing?”). It then moves to a social relation to an opinion “personal” (like “Response to Shai”); Social mapping (like “agree with Or”); At the end, there were Social comments promoting the discussion (like “Guys, if all would agree we will have no discussion”).

The second element of function of use concerns the usage of connections. As we mentioned earlier, the amount of connections increased. Figure 4 shows changes in the use of connections.

Figure 4. Types of connections

Note: This figure does not include the first session because it barely included connections (see Fig. 1).
In all sessions, half of the connections that the students chose to use were connections without taking position (e.g., agree or disagree). However, during the implementation lessons there was a transition from connections of support to connections of opposition that expressed resistance. In other words, students learned to resist to their friends interventions, a behavior that was a priori considered as inappropriate in class.

The argumentation maps presented in Figure 1 sketch a deep change in the classroom practices. In the first session the students carried poor discussion (not many shapes), each student expressed his/her opinion, mostly without referring to other students’ arguments (not many connections). Further discussions, however, were rich in content. Students referred to their fellow-students arguments and shaped/change their opinions accordingly.

Discussion
We brought in this short paper glimpses on the deep changes that the introduction of the Digalo tool instigated in classroom practice through five discussions. Productive discussions developed. They included: raising and challenging different arguments; referring to each other by raising arguments; and utilizing previous arguments in follow-up arguments. Analyses of the class discussions show also changes: a) From a technical presentation of the tool (use of form) to a pedagogical (use of function) presentation; and b) from emphasis on expressing position to emphasis on explanations and contribution to the discussion. The five integrated lessons of the same technological tool (Digalo) in the same Grade 9 point at an evolutional process. Although in these lessons, teachers, students and subject matter varied, it seems as if the evolution of practices develops toward a more critical and dialogic kind of practices. How could this happen? The teachers participated to the same in-service program in which they learned about dialogical thinking but they did not try to act in the successive activities in a concerted way. They did not see the same students. We contend that the social process that enabled the appropriation of the use of form and function of the Digalo tool resembled a relay race. Some of the students participating in the n-th session participated also in the (n+1)th session. Also, the tool was present in all activities and enabled a dual stimulation (Engestrom, 2004), that made relevant for the discussants practices and understandings developed in previous activities. Some students were apparently agents of change in practice. Although the teachers felt threatened by the new technology, its appropriation was accomplished "in spite of them".

In this short paper we did not describe the in-service program in which teachers contributed with designers, researchers and educators in the design of activities and in the elaboration of new pedagogies. Therefore, these teachers participated in two activity systems, the in-service program and the classroom discussions. In both activities the Digalo was central. This bilateral consequential transition (King, 1999) enables the evolution of practices at the level of the individual teachers. In addition, the appropriation of technological tools comes from the fact that the teachers became part of a community, in their teachers training development program that supported and enabled them to change their position in the learning process, to ‘see’ their students’ needs, and to identify where they were, made this assimilation process successful. Another, possible reason to this successful integration can be the tool itself – Digalo. The tool afforded to capitalize on familiar face to face practices to develop new forms of productive discussions (Asterhan & Eisenmann, 2009; Schwarz & de Groot, 2007).

Acknowledgement
This research was partly supported by the KP-Lab EC-funded project (KP-Lab FP6-IST-2004, 27490).

References


