Learning Together with CSCL Tools in the Classroom

Reuma De-Groot(✉)

The Hebrew University of Jerusalem, Jerusalem, Israel
Reuma.de-Groot@mail.huji.ac.il

Abstract. The design of CSCL tools has long been a subject of research in the learning sciences community. To this end, theories like dialogic learning and argumentation led to new understandings that see the social context as means to organize learning through collaborative meaning-making. The Metafora and the Collaso learning environments aimed at developing technological tools to afford the smooth integration of inquiry and argumentation to foster learning to learn, L2L, and learning to learn together, L2L2 (in Metafora) and (collaborative) inquiry-based learning (in Collaso). Using three examples of learning activities in one of these environments revealed preliminary understandings and insights on the way tools' design influences group learning in the 21st century. Our preliminary observations show that the two learning environments achieved similar goals despite their different designs. This may shed light on the relevance of educational design for technological environments, suggesting also a closer look at classroom's enculturation and teachers' work when using CSCL co-located in the classroom in order to assess such design work (This paper is partially based on work done by the author and others which was published in Schwarz et al. 2015. The author wish to thank to MinCet Team especially Aviran Mor and Yogev Levy for their dedicated work on Collaso. Many thanks also to Dr. Gil Amit for opening the doors of the Ashkelon College to run our pilots).

Keywords: Dialogic learning · Learning to learn together · Collaborative meaning making · Inquiry based learning · Group reflection · Group agency

1 Introduction

Learning with computers needs a new way of thinking about studying learning. Among other things, Computer Supported Collaborative Learning (CSCL) locates learning in meaning-negotiation carried out in the social world rather than in individuals' heads (Stahl et al. 2006). Theories like dialogic learning (e.g., Hicks 1996) and argumentation (e.g., Andriessen et al. 2003) lead to new understanding of the learning sciences that see the social context as a means to organize meaning constructions (Stahl et al. 2006). The design of software for CSCL, therefore, must be coupled with analysis of the meanings constructed within emergent practices (Koschmann et al. 2006).

Previous work in CSCL suggests that the design of the tools should encourage the practices of reflection and criticism (Fischer et al. 1993). The effectiveness of some of these practices has been widely demonstrated.

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Learning To Learn (L2L) is a set of capacities and meta-strategies that help the individual learner face challenges for which he/she has to be specifically prepared (e.g., Claxton 2004; Fredriksson and Hoskins 2007; Higgins et al. 2006) These practice/skill were endorsed, recently, by policy makers (e.g., OECD 2003 and 2004)

Practices of inquiry and argumentation stand at the heart of the L2L (Kuhn 2005). These practices learnable but its' integration in classrooms is difficult.

The term *Learning to Learn Together* (L2L2) was first used by Rupert Wegerif based on work done with Marten de Laat (Wegerif and De Laat 2010). They conceived a combination of the space and time of networks ('the space of flows' as defined by Castells, 2004) and of the space and time of dialogues (the 'dialogic space', as defined by Wegerif 2007) towards an overall approach for teaching higher-order thinking skills in the networked society. The Bakhtinian dialogic perspective was applied to networked learning of students to claim that an appropriate pedagogical design can support students learning higher-order skills such as creativity and L2L (Wegerif 2007). This very general claim served as a working hypothesis in the EC-funded *Metafora*R&D project (*Learning to Learn Together: A visual language for social orchestration of educational activities*), led by the author. Metafora focused on the design of a platform for supporting L2L2 in the context of solving problems in mathematics and physics. Our starting point in the project was to clarify the meaning and scope of L2L2, which had been so far an unarticulated concept.

We saw in L2L2 an extension of L2L in the sense that it aims at promoting learning to inquire and learning to argue, as well as collaboration. We experienced that technologies are helpful for integrating inquiry and argumentation. The addition of collaboration as the third tenet of L2L2 naturally led us to posit that CSCL tools should facilitate L2L2 in group learning: Dedicated CSCL tools provide shared space for communication and co-construction of knowledge (Stahl 2006). They also provide constraints and affordances for collaborative behaviors.

At first sight, Scardamalia and Bereiter (1999) already did the job. They showed that with Knowledge Forum, the creation by students of representations of meta-classifications of contributions leads them to an awareness of collective agency. The objectified community knowledge space is necessary for students' ideas to be objectified, shared, examined, improved, synthesized, and used as "thinking devices" (Wertsch, 1998) to enable further advances. The general assumption that in order to take over high levels of social and cognitive responsibility students' ideas must have an "out-in-the-world" existence, and that inventions, models, or plans, should be accessible as knowledge objects to the community (Bereiter, 2002; Scardamalia and Bereiter 2006), is broadly accepted.

The two CSCL environments that will be presented here – Metafora (De-Groot et al. 2013) and the Collaso environment (recently under commercial development) aim at developing a technology-based setting to afford the smooth integration of inquiry and argumentation to foster L2L2 (Metafora) and (collaborative) inquiry-based learning (Collaso). Since inquiry and argumentation practices set different goals among participants, we envisaged the interweaving of inquiry outcomes into argumentation practices. Having argumentation and inquiry-based learning in mind with the aim of supporting L2L2, we designed the Metafora and the Collaso tools around two interwoven spaces:

(1) a dialogic, argumentative space and (2) an "open space" to expose ideas and plans to be accessible, negotiable and changed by the group. The different spaces of Metafora & Collaso can be seen in Figs. 1 and 2 (respectively).

In the next paragraphs we will describe the two environments.

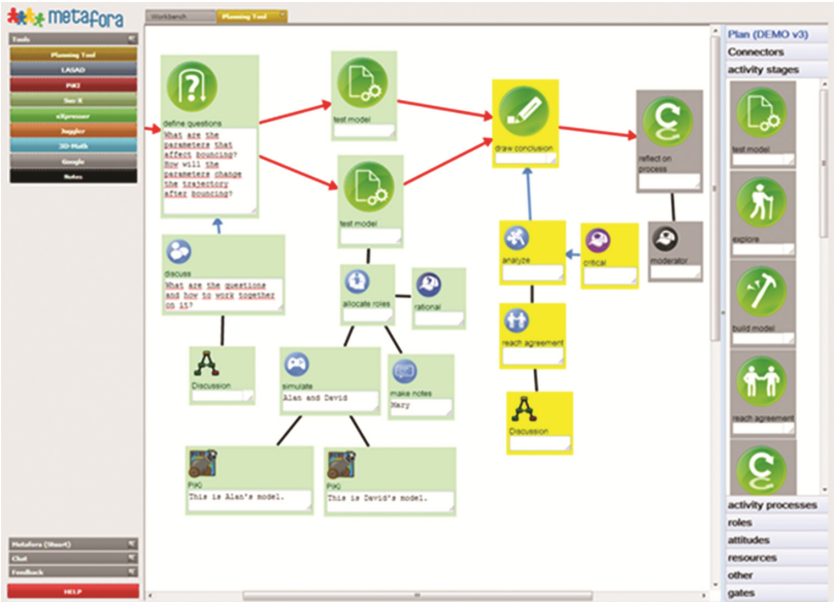

Fig. 1. The Metafora system. Green symbols represent stages of activities, blue symbols represent activities' processes "planning/reflection tool" and the argumentation dialogic space (a detailed description of the other spaces in Metafora may be found in Schwarz et al. 2015) (Color figure online).

Fig. 2. The Collaso system – the discussion open space –; buttons for the other features appear on the left-hand side.

2 The Metafora Environment for Promoting L2L2

The EU-funded Metafora project (EC/FP6/ICT, 257872; http://www.metafora-project.org/) enabled the development of a system and of an educational environment aimed at promoting L2L2 (De-Groot et al. 2013). The Metafora system comprises (1) a visual tool for planning and reflecting on group work, (2) microworlds for exp riencing phenomena and exploring problem spaces, (3) a space for dialogue and argumentation, and (4) a module for observing group work and possibly intervening by sending messages. In this presentation we will focus on the "planning/reflection tool" and the argumentation dialogic space (a detailed description of the other two spaces may be found in Schwarz et al. 2015).

Space 1. The Planning/Reflection Tool.
The planning/reflection tool offers a visual language that enables students to create and map representations of their work for planning their activities and reflecting on them (see Fig. 1). Cards and connectors are available for this purpose. The cards contain visual symbols and titles, as well as space to insert free text. Some symbols and the titles represent different stages of scientific inquiry learning (e.g., the "explore" card in Fig. 3, or cards for "experimentation", "building models", and "hypothesizing"). A third category of cards represents role assignments within the group (e.g., "evaluator" and "critical" in Fig. 3). The fourth and final set of cards allows access to different resources within the Metafora toolbox (e.g., the card entitled "discussion" in same figure, which allows access to the tool for structured discussion, or cards entitled "Piki" in Fig. 1, which serve as an entry point for a specific microworld, Piki). The connectors (lines and arrows) represent relational heuristics ("is next", "needed for" and "related to") to explicate how the various cards are related in the given plan. The different features of the planning/reflection tool were designed to afford collective reflection on inquiry/problem-solving and collective agency through mutual engagement.

Fig. 3. The visual language in Metafora

Discussion Tool.
Metafora provides tools that allow students to engage in discussion and argumentation. Apart from a chat tool, LASAD (Loll et al. 2012) enables the co-elaboration of argumentation maps (Fig. 4). The LASAD discussion tools promote students' discussions by using labelled cards (e.g. assumption, theory, question) and labeled connectors that define the epistemic nature of the connections between the two labels (e.g. proof and rebuttal). The tool was designed to promote argumentation and collaborative meaning-making.

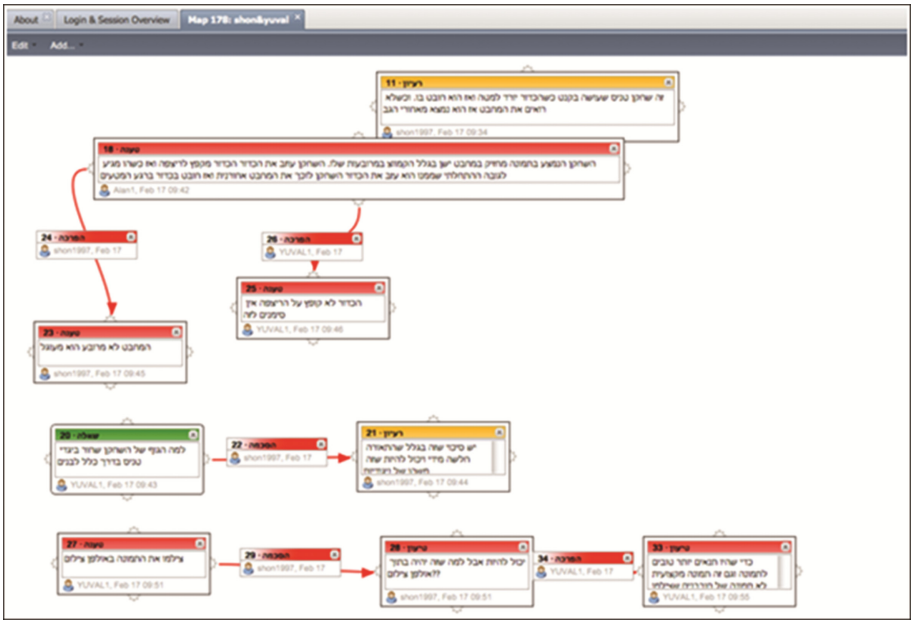

Fig. 4. The Lasad discussion tool

3 Description of the Collaso Tool

The *Collaso* environment - Educational collaborative space for supporting discussion and inquiry-based learning (Fig. 2) is being developed in the framework of a joint initiative between the Hebrew University of Jerusalem's knowledge transfer company, Yissum (http://www.yissum.co.il/), and MindCET, the Center for Innovation and Technological Development in Education, (http://www.mindcet.org/en/about-en/). The tool was co-designed by a team of researchers from the Hebrew University and developers from the company. The different features of the new environment build on 15 years-worth of research and implementation work of the Kishurim Group (http://www.kishur-imgroup.org/) from the Hebrew University. Kishurim's work has been focused on the design and implementation of CSCL tools that foster argumentation and inquiry-based learning in the classroom. The above Yissum-MindCET collaboration resulted in an updated combination of discussion tools co-developed by the Group in various EU-funded R&D projects with a chat-like presentation of discussion contributions that are modern in aspect and appear familiar to the students, and which can also be accessed and read through cellphones and tablets. The other desirable practices (e.g. reflective inquiry and collective agency) that promote L2L and L2L2 are embodied in two additional features: (a) the "bottom-line statement" – a space that enables a collaboratively-created summary of the groups' knowledge accumulated during the discussion, and (b) a "Bird's eye look", allowing teachers and students to see the rates of participation in the discussion. Collaso's design attempts to provide the necessary substructure for conducting a whole

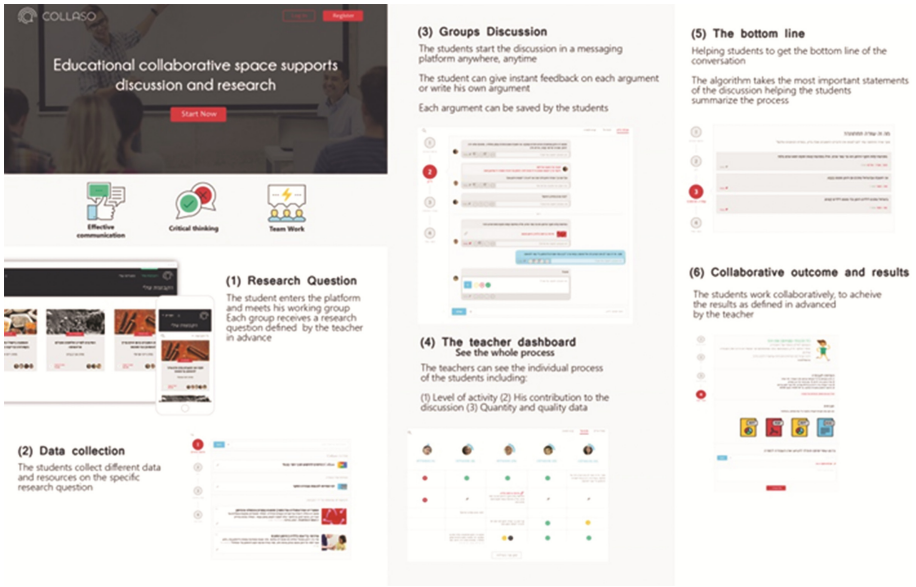

Fig. 5. The Collaso inquiry and discussion environment. (Color figure online)

sequence of inquiry-based activities (often spanning a few weeks; see Fig. 5), starting from (1) posing a rich research question, through (2) providing a repository for teachers and students of resources related to the problem in case, (3) carrying out a group discussion using (4) the teachers' dashboard, which allows visualizing the rate of participation in the discussion, (5) the *bottom line*, allowing students to collaboratively summarize the most important issues discussed, and (6) the collaborative outcome and results (submitting the joint product – e.g., an essay, a chart, a PowerPoint presentation, a video clip, etc. – to the teacher).

The discussion tool is central to the Collaso environment and we will therefore describe its features more in detail. The tool's user interface is similar to that of WhatsApp, with some additions supporting the dialectical/argumentative affordance needed for our educational purposes (as they appear in the Lasad tool, with different connectors). The additions are symbols of Support (green V), Contra (red X), or Accept (Yellow=), which users can add to each contribution. Furthermore, users may 'tag' the text contributions with a "pin" symbol when they see something that looks important for further elaboration via groups' *bottom line* (e.g., an essay; recall feature 5 above). When a user wishes to react to a specific contribution he/she may click on "react" and that specific contribution is copied into his/her text contribution. This way the chronological sequence of the discussion is kept (the newest contribution is the last one), and users may referrer to others' contributions in more detail. The number of reactions, their nature (Pro, Con, Accept) "Pin" and reactions appear by mouse hover on each contribution.

In the following sections we will show how the different design of the two learning environments influenced the groups' practices related to reflective inquiry (entitled to group reflection) and collective agency which describe the way the individuals in the

group takes responsibility as a group. As mentioned above, our approach to L2L was initially based on iterations of argumentation and inquiry learning. A design-based research approach in the design of our tools reveals that the discussion spaces Lasad (see above) and Digalo (Schwarz and Glassner 2007) identified meaning-making through dialogue without interfering too much with the "proper" use of the argumentative terminology suggested (Schwartz and De-Groot 2007). Keeping this in mind, we will present two examples of inquiry-based learning in physics using the Metafora environment and one example of inquiry learning around a dilemma in the social sciences using the Collaso environment.

Although the setting and the issues discussed were taken in a different way in the two environments, some insights related to collective agencies and reflective inquiry that emerge from the different designs of the tools can be detected.

Example 1. The case took place in a high school in a large city in Israel. Twenty-three Grade 9 students participated in the study. They were divided into two groups of 16 and 7 students each. The groups participated in a one-year long course based on weekly 90-minute sessions in which the Metafora environment was used extensively. Typically, students worked in groups of 2–4 peers. In most cases, students in the same group sat close to each other, with each student at an individual computer. Students were introduced to challenges (inquiry problems that were planned to be solved by them in 2–4 lessons) in mechanics around the lever principle and laws of ballistics. We focus here on a group of three students in a challenge related to ballistic motion.

Fig. 6. Stroboscopic picture

Students were first presented with stroboscopic snapshots (Fig. 6) and were asked to describe what they see in the picture. The students were guided to generate concepts relating to motion, in particular the concept of velocity.

Figure 6 shows a tennis player during a serve. The challenge posed by the teacher was "to identify the motion represented in the photograph, and to characterize it". The students split in small groups and began discussing the photograph. After several minutes, the teacher invited the groups to continue their discussion with the LASAD tool. The students did their best to reconstitute the serve, taking into account details such as whether the hand passes between the player and the camera or on the other side of the player, etc. Following the LASAD discussion, students were asked to plan an inquiry activity leading towards a deeper exploration of the photograph: they were asked to follow the ball in the snapshot and to characterize the velocity at each stage. For this endeavor the students were asked to divide the photograph in different parts and to assign roles within the group on how to carry out their work exploring the motions of the ball and the racket. After finalizing their plan the students were asked to share their work with the other groups in a plenary discussion guided by the teacher.

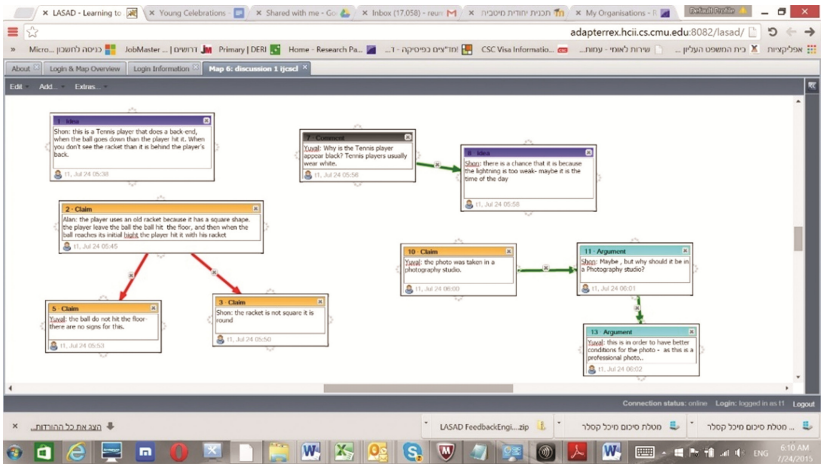

Fig. 7. A Lasad discussion map.

We focus here on the first stages of the work of Ely, Sami and Yaron, discussing their assumptions in the LASAD map. Figure 7 shows a clear disagreement between Yaron and Ely regarding the way the tennis ball reaches the player's racket: Ely thinks that the player first hit the ball on the ground; when the ball bounces to the same height and starts to fall down, he hit it. Yaron claims that the ball does not reach the ground and that the player throws it up, and then hits it. He also challenges Ely's claim that there is no sign that the ball reaches the ground. Interestingly, Ely at this stage does not try to answer Yaron's challenge; rather, he contributes to the ongoing discussion on the lighting conditions that affected the photos of the tennis player and exact measurement of the racket. The Lasad map of the discussion shows that students presented to each other their interpretation of their part of the photo, leading by such doing to the

interpretation of the picture as a whole. At some point, Yaron asks Sami whether he also sees the ball jumping on the floor, and Sami answers that he cannot see it. Figure 7 displays a partial view of the map (the full map includes 36 contributions).

Following the LASAD discussion, the students were asked to use their ideas to elaborate a plan for exploring the movement of the tennis ball with the planning tool.

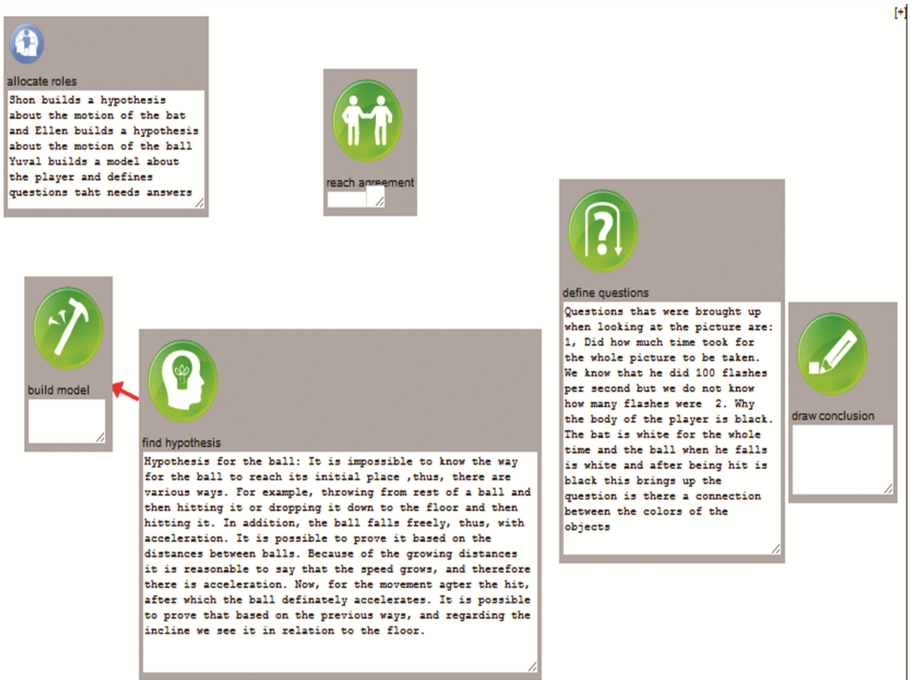

Fig. 8. The initial plan of the group

The triad used three cards only to make their plan (Fig. 8): (1) "Role allocation" (proposed by the teacher), (2) "pose questions" and (3) "find hypotheses". In the "role allocation" card they wrote: "Sami builds a hypothesis about the motion of the racket, Ely builds a hypothesis about the motion of the ball and Yaron builds a hypothesis about the player and poses interesting questions that should be answered". Indeed, Ely raised reasonable hypotheses and Yaron elaborated interesting questions such as "how much time it took for the whole picture to be taken?" Although the students were sitting next to each other, they hardly spoke with each other, but rather filled their planning map to explain what they were about to do. When the teacher saw their plan in the next session, she asked them to turn it to more executive, and asked them to shorten the text in the cards.

The triad then changed the plan to the one shown in Fig. 8. In the "Blank Stage" the triad explains how the photograph was divided in three regions: the trajectory of the ball before it is hit, and after it is hit, and the movement of the hand/racket. This new plan is based on the previous plan. When Eli describes his hypothesis about the movement of the ball he splits it into two phases: first, when the ball falls (he writes "the ball is in

free fall, thus accelerates. It is possible to prove it based on the distances between the [stroboscopic captures of the] balls. Because of the growing distances it is reasonable to say that the speed increases"); secondly, when it is hit (he writes "Now for the movement after the hit… the ball accelerates. It is possible to prove it based on previous ways, and regarding the incline we see it in relation to the floor"). The second plan of the group (Fig. 9) shows that Ely beautifully describes the movement through "build a model" cards: the first describes the ball in free fall. The second card is devoted to the movement of the ball after it is hit. The footprints of the role allocation inscribed in the first map are visible in the third and fourth "build model" card: card 3 describes the movement of the racket behind the leg; card 4 describes the movement of the racket to the leg ("We can see that the rocket moved accelerating from the rest of the movement"). This suggests that the group reflected over their previous plan towards the completion of their descriptions.

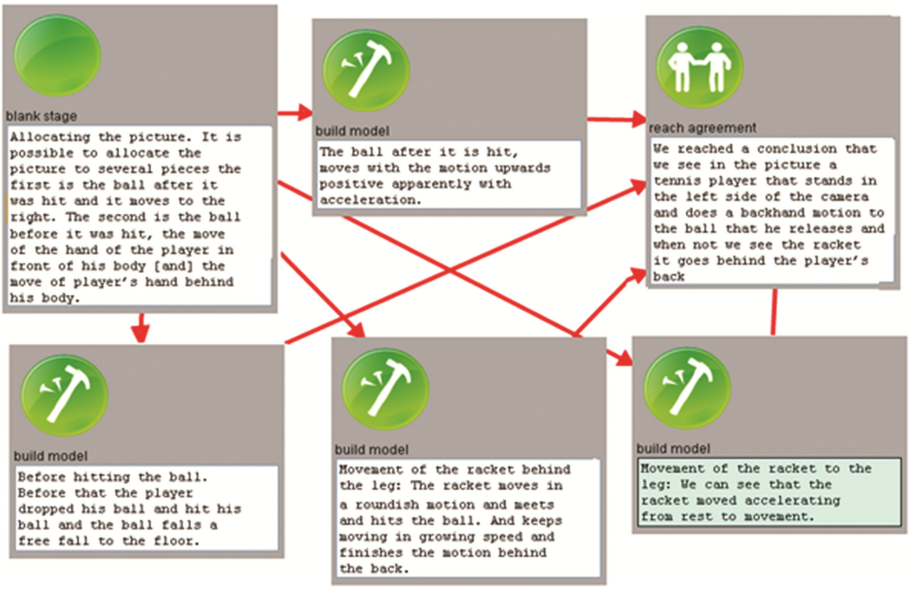

Fig. 9. The second plan of the group

Furthermore we should notice that the students added a "Reach Agreement" card, where they describe their joint explanation regarding what can be seen in the stroboscopic pictures. "We reached a conclusion that we see in the picture a tennis player that stands in the left side of the camera and does a backhand motion to the ball that he releases and when we don't see the racket it goes behind the players' back". Interestingly this explanation does mention the information written in the other cards.

In this example we can detect the move from the discussion tool to the plan supported the group to be more focused on things they should actively carry out together. Although they disagreed on how to interpret the tennis ball's move in their discussion in Lasad, in the plan this dispute does not appear and the group only reports on actions taken with

further exploring the picture and the ball's movement. The red arrows put in the plan all point to the final joint agreement of the groups' work. We argue that the plan supported the groups' collective agency with the wish to express their unity with fulfilling their mission together.

Example 2. In this example we present a dyad work, participating in the same activity as above. In the Lasad discussion map the students pose their assumptions regarding what can be seen in the stroboscopic picture. We bring here a few excerpts of their discussion[1].

Yigal: It's probably a woman tennis player that wears shoes with heals and long skirt; that's why there is a certain segment where you can't see the racket.
Don: It can be a woman tennis player, how can we really check that? If you have this hypothesis it should be a woman player that wear heals, and this is not logic.
Yigal: maybe it is a woman model that only takes a pose of a tennis player.
The dyad continues to elaborate their interpretations about the gender of the tennis player and the reasons why the shoes look the way they look in the picture.
Don: OK; so according to our assumptions, what do we already know about this picture? Is it possible at all to make assumptions here?

The Lasad discussion we brought here shows that students exchange ideas around one possible interpretation of what was seen in the stroboscopic picture. Their discussion reveals a last move of reflective inquiry cited by Don: "is it possible at all to make assumptions here?"

The Metafora plan of the same dyad showed a different learning behavior[2].

In the map[3] the two students used four cards: 'Role allocation', 'Build a model', 'Check the model' and 'Reaching agreement'. In this map the students report on what they did in the group work. In the 'Allocate role' card they wrote: "Yigal thinks on what we should find and Don writes what the conclusions related to these findings are." In the 'Build a model' card they wrote: "description: in the beginning the player dropped the ball to hit it, than he hit it and we can see the move of the racket to the ball, then we see the movement of the ball after it was hit by the racket."

In the 'Check the model' card they wrote: "the explanations we arrived to fit the pictures as we explained and checked and arrived to the conclusion that the photo was taken in less than a second time as the acceleration fall is 10 m in one second…". In the 'Reaching agreement' card they wrote: "we arrived to the conclusion that what we see in the picture is a tennis player dropping the ball and then hit it with a racket". In this example we see that the move from the discussion space to the planning tool supported the students' move from exchanging general ideas and interpretations of what they see in the picture, to working together on their assignment and reporting on it. Surprisingly,

[1] The example we bring here is in Hebrew – and as the Lasad tool is not accessible by us at the moment; we can use only a free translation here.

[2] It should be noted that the students illustrated the map after the teacher asked the group to divide the picture into three parts and explore the movement of the ball in each part separately.

[3] As the Metafora planning tool is not accessible by us at present so we couldn't translate the map.

the agreement they report on "refers"] to their previous discussion on what can be seen in the picture. We may say with some caution that the use of the planning tool supported the dyads' collective agency towards the mission at stake. Their final 'Reach agreement' statement might be seen as the exposure of their wish to show unity or solidarity when reaching a joint understanding after the vagueness of their first session, as it appeared in the discussion space.

Example 3. In this example we present first insights of the use of the Collaso tool as currently undertaken (Winter 2016–2017) with college students in Israel. Collaso was piloted in a computer lab with 2 groups of 32 and 34 students (63 women and 3 men) through two interventions of 1.5 h lesson each, during two weeks. The students were asked to work with the tool as part of their bachelor studies in education as a social sciences discipline. We designed an inquiry-based activity for the pilot dealing with the subject of vaccination. The question we posed was "Should we always take a tetanus vaccination after being wounded by a rusty nail?" As a start, we discussed the vaccination dilemma with the students prior to the discussion in Collaso. After an introduction session the students were divided into groups of 3–5 students each and were asked to start the discussion in the Collaso tool. To inspire their thoughts and arguments we put a few links and relevant references in the Data Collection repository (see Fig. 2 above).

We further asked the students to write a short essay regarding their joint decision whether to vaccinate or not.

We will now follow the thread of one discussion held between 3 students- and follow their conclusions.

S1 - One can't know if this is going to be fine [to get the tetanus vaccination]; there are cases and there are cases. If one gets a deep scratch from a nail I think it is better not to take the chance.
S2 - This vaccination is obligatory so it is very difficult to say if it is necessary – or one can overcome the Tetanus disease without it.
S3 - The main problem with vaccination is that the vaccination contains the bacteria.
S1 - Indeed in our country one cannot trust the doctors anymore.
S3 - [brings an excerpt from a health insurance company about the disease] […] Tetanus is an infectious disease of the central nervous system. The disease is caused by the bacterium Clostridium Tetani. This bacterium is common in nature, especially in agricultural land cultivated landscapes, but it is also in urban land, house dust, animal intestines and human and animals' stool. The bacterium is anaerobic […]. The bacterium enters the body through a wound, and after the intrusion secretes a toxin, who is led to the bloodstream, lymphatic system and central nervous system […]
S3 - So what is the part of the population that is really exposed to the disease?
S2 - It is really interesting [to know] if the body has its own antibodies to struggle with the disease.
S1 - We are all exposed.
S3 - Let's check your question in other sources.
S1 - Tetanus is a serious disease and is often fatal. It is caused by the effect of a toxin produced by the bacterium Clostridium Tetani. Tetanus is a pathogenic bacteria. Infection is usually caused by a wound. Common symptoms are cramping in the

muscles of the jaw which are followed by difficulty in swallowing and stiffness of the muscles in the body. Infection can be prevented by a vaccine suitable for prophylaxis after exposure to the bacteria.
S1 - What can be seen here is that in general it is better to be vaccinated. I can't believe that this may cause damage.
S3 - The problem is that all the existing resources were written by agencies that have commercial interests with the vaccination.
S1 - You are right! This is exactly why I chose Wikipedia which is also not 100% reliable.

Bottom Line.
(Following is the content accumulated in the "Bottom Line Space" – see stage 3 in Fig. 2)

We are for Tetanus vaccination; we understand that it is an important vaccine recommended by the ministry of health.

Copied here is the citation from Wikipedia brought in the previous discussion.

"Bottom line" contains what comes up as our main understanding from the information we read and from our discussion on the subject. We understand that it is important not to take the chance, there are many different opinions about the subject but all recommend taking the vaccine. Peoples get the vaccine and call others to be vaccinated more than once in their lives.

From the excerpts we brought here we can see that Collasos' discussion space promoted a coherent thread dealing with the pros and cons of vaccinations. The three students carried out a coherent argumentative discussion, posing questions and searching for more data to support their views (e.g., S3 put a question on the percentage of the population that was really exposed to the disease, S2 put a question regarding people's ability to fight the disease naturally, and S3 suggested to check S2's question in other sources). The discussion in the "Bottom Line space" ("groups' space") was clearly organized by S1, as she went through the discussion and "pinned" what she thought to be the most important contributions. Wisely enough, she brought all pro and con arguments that arose in the discussion[4] - and she actually managed to summarize it shortly with the overall statement that it is better to be vaccinated despite the different opinions that arose. Here she assumed the coordinator's role, summarizing the group's consensus.

4 Discussion

Tackling the relations between software designs and learning outcomes is a difficult task as the effectiveness of collaborative learning depends upon multiple conditions that interact with each other in such way that it is not possible to guarantee learning effects (Dillenbourg et al. 1996). Despite the limitations of the present work (especially because we do not refer to the teachers' role in the classroom and the design of the learning activities) we could identify the role of the planning tool in concretizing the group's work towards reporting on past activities and planning next steps. Furthermore, the use

[4] For space limitations we presented only the group's summary without all the annotations from the discussion.

of the plan suggested actions to be taken by the group on the front stage, resolved disagreements and facilitated meaning-making -in the discussion space. We argue that this shift in the group's work occurred because the special design of the plan and the use of the visual language supported that shift also by using scientific concepts like evaluation and exploration, to explore and be an evaluator.

The design the group's space in Collaso (the Bottom Line feature) aimed to allow the crystallization of the group's joint opinion.

In the example we brought above we showed how the discussion space promoted literacy knowing and understanding the joint opinion of the group. In other examples we reviewed from the pilot we could identify different usages. In two examples (out of the 12 groups that reached this stage) the group reflected also on the way they collaborated and on who organized the work and contributed to its success. Our preliminary observation here shows that the Bottom Line space allowed the emergence of group reflection whereas reaching a joint comprehension for the final group's decision was taken by some of the groups as raising collective agency through identifying who did what. We may conclude that the Collaso design supports literacy and the associated collective agency, while Metafora promoted tasks design and role allocation for a work needed to be done.

As for the Discussion Space in Collaso, it served the purpose of carrying out argumentative discussion in a similar fashion to that taking place with the Lasad tool. This observation is interesting, because we know that discussion-supporting tools of the kind of Lasad (e.g., Digalo) usually build on the map-like representation of students' discussions to promote connectivity amongst the discussants. Moreover the Collaso approach allow chronological discussion- (newest contribution appear always in the end of the thread), whereas the Lasad approach allows a- chronological appearance, and therefore focusses users' attention to connect their contributions to others, and by that support the discussions' coherency.

Furthermore, our preliminary observation also shows that users hardly utilized the icons of pro/con and indifference we made available in the Collaso discussion space. Also the PIN was used only after the discussion took place and not during it. This may hint that these orientations are not needed by the users or that they need more time to get used to use them.

Our preliminary observation shows that students use a discussion space with a different representation in a similar way. The underlined assumption that the map appearance would support coherency and thus richer discussions wasn't supported in the present work, having quite similar discussions' threads (in the context of connectivity). These preliminary observations call for further work with the two environments.

What we brought in this paper was actually a partial view of using CSCL tools in the classroom as we did not refer to the teachers' role in the design of the activity. The latter is crucial for the success of the work as it shows also classroom enculturation (Cob 1995) and the impact of the tool's design on its use. Our research on the use of the Metafora tools (see Schwarz et al. 2015) shows how group's collective agency inspired a talented mathematics student to step back with his mathematical solution – waiting for the rest of the group to arrive to the conclusion together. In another example we showed how the teacher mediated the classroom discussion with three students (example

1 above), pushing one of them- to clearly state his mind, which he did by reporting not on his own opinion regarding the balls' movement but on the group's disagreement about the trajectory of the ball in the stroboscopic picture. In both cases the students put the group's collective agency before their own success and individual opinions. These two examples tell also about the classroom orchestration associated with the use of the CSCL tools co-located in the classroom (Asterhan 2016).

To summarize, Metafora and Collaso are two learning environments that were designed with the purpose of combining argumentative discussion with inquiry-based learning. The environments aim at promoting L2L (Collaso) and L2L2 (Metafora), supporting mainly group reflection (reflective inquiry) and collective agency. Our preliminary observations show that the different design of the tools- especially with relation to the discussion space wasn't influential over the students' dialogue. This may shed light on the relevance of educational design to computer mediation of educational goals, suggesting also a closer look on classroom enculturation and teachers' work with CSCL tools co-located in the classroom to assess pedagogical design of such tools.

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