



PROMOTING ONLINE COLLABORATIVE LEARNING ON MOODLE PLATFORM WITH THE “QUICK CHAT” PLUGIN

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KEYWORDS

*E-learning
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ABSTRACT

In recent years, several Vygotskian computer-based learning activities (VCBLAs) were designed in the context of (mathematics) education and implemented on Moodle platform. However, Moodle does not allow users to visualize all chats on a single browser page, and they are forced to open multiple browser windows and switch among them very frequently. This paper describes the features of a plugin for Moodle, called “Quick Chat,” which allows to manage in a single browser window both the narrative flow of a VCBLA and all chats. Some results of an experimentation with PhD students, engaged in solving two mathematical tasks, are shown.

PALABRAS CLAVE

*E-learning
Entorno digital
Aprendizaje colaborativo
Educación matemática
Interfaces gráficas
Moodle
Quick Chat*

RESUMEN

En los últimos años, se han diseñado varias Vygotskian computer-based learning activities (VCBLAs) en el contexto de la educación y se han implementado en Moodle. Sin embargo, Moodle no permite que todos los chats se muestren en una sola página del navegador. Este artículo describe las características de un plugin para Moodle, que permite gestionar tanto el flujo narrativo de un VCBLA como todos los chats en una única ventana del navegador. Se muestran algunos resultados de un experimento con estudiantes de doctorado, dedicados a resolver dos tareas matemáticas.

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1. Introduction

In recent years, especially due to the Covid-19 pandemic, the world of education has changed profoundly and there has been an abrupt shift toward an online mode of teaching and learning. The transition from in-presence education to online education has not been painless for teachers. Employing the same materials, tools or methodologies used during in-presence classes was ineffective (with respect to the context of mathematics education, see e.g., Albano *et al.*, 2021a). For promoting meaningful learning in students in online environments, it was necessary to redesign educational activities appropriately to foster student engagement, but more importantly, collaboration with each other. Indeed, research shows that collaborative learning promotes critical thinking and argumentative skills (Coob, 1998; Fung, 2014; Leitão, 2000; Warsah *et al.*, 2021; Webb, 1989), even in computer-based environments (Andriessen *et al.*, 2013; Baghaei *et al.*, 2007; Noroozi *et al.*, 2012; Vogel *et al.*, 2016; Weinberger *et al.*, 2002). However, collaboration should be explicitly proposed and structured appropriately to foster deep learning (Laurillard, 2013), especially in computer-mediated environments. From this perspective, collaborative scripts can be effective because they allow to regulate the interaction among participants by establishing the roles to be taken and the actions to be performed (King, 2007). From a cognitive psychology perspective, a script is an internal memory structure that helps an individual understand events and act effectively in response to them (Kolodner, 2007; Schank & Abelson, 1977). In the educational context, script is used with a different meaning, to describe an external structuring of collaborative learning with the aim of engaging students (through specific roles and activities) to foster cognitive, social-cognitive, and metacognitive processes (King, 2007). In computer-mediated collaborative learning environments (Dillenbourg *et al.*, 2009; Weinberger, *et al.*, 2002), the term “collaboration scripts” is used to refer to externally imposed scripts with the aim of fostering social interaction and co-construction of knowledge (Fischer *et al.*, 2013). However, collaborative learning mediated by external scripts is effective only if they are internalized by students, to be then used by them in similar situations through autonomous actions (Rogoff, 1990; Vygotsky, 1980).

We have named Vygotskian Computer Based Learning Activities (VCBLA) “educational activities designed and implemented through computer-based collaborative scripts that promote peer interaction, with the goal of being internalized by each student” (Dello Iacono *et al.*, 2021c, p. 24). The aim of a VCBLA is to foster learning, first socialized among peers and then internalized by each student (Dello Iacono *et al.*, 2021a; Dello Iacono *et al.*, 2021b) in accordance with a Vygotskian approach (Vygotsky, 1980). A VCBLA consists of a narrative flow (guiding educational activity) and collaborative tools. It can also include digital applications integrated within the online platform (Albano & Dello Iacono, 2019). More specifically, a VCBLA involves students engaging in (mathematical) learning activities. Students work in small groups and take on specific roles. They communicate with each other at different levels (among peers in small groups, among peers in extended groups, among peers and the teacher), using different communication channels. Interactions usually take place through chats. A VCBLA certainly provides the possibility for each student to communicate with their group mates through a *Group Chat*. Furthermore, it can foresee the interaction among several groups, through a *Chat among Groups*, the interaction with the expert, through a *Chat with the Expert*, or among all the students, using a *General Chat*. Typically, VCBLAs are implemented using the Moodle e-learning platform, which natively provides all the tools to manage both narrative flow and collaboration and communication among students and with the expert.

In recent years, several VCBLAs have been designed in the context of mathematics education and implemented on the Moodle platform. A first example is the DIST-M (Digital Interactive Storytelling in Mathematics) (Albano *et al.*, 2020a; Albano *et al.*, 2020b; Dello Iacono *et al.*, 2021d; Polo *et al.*, 2019), in “which learning activities are organized into episodes and students take on roles that represent the cognitive functions that come into play when a mathematician is engaged in argumentative and problem solving activities” (Albano *et al.*, 2021b, p. 35). Another example of VCBLA is the DITG (Digital Inquiry Through Game) (Albano *et al.*, 2021c). This is an online game mode that involves competition/collaboration between two teams, each consisting of two players (students) who have predetermined roles. A third example is represented by a specific computer-based environment, designed to facilitate the move from argumentation to proof in geometry (Albano *et al.*, 2019; Albano *et al.*, 2021d). It consists of several work areas that propose promote different types of interaction among students. For each VCBLA described above, multiple communication channels are provided, and the same student can be involved in multiple chats.

Moodle offers many advantages for implementing VCBLAs. However, it also has some limitations, especially with regards to the graphics aspect. One of the problems is the inability to view all the tools on a single browser page once they are activated. Students and the teacher are forced to open different browser windows at the same time (Dello Iacono *et al.*, 2021c): a window for the narrative flow, a window for each chat and (possibly) other windows for additional tools, such as digital applications integrated within the platform. The biggest disadvantage is certainly linked to the management of chats. Indeed, Moodle is not able to handle chat notifications effectively. Thus, students and the teacher are not only forced to open multiple browser windows, but also to switch from one window to another very frequently to view new messages in each chat (Dello Iacono *et al.*, 2021c). At present, finding a better platform than Moodle to effectively implement VCBLAs is difficult, and Moodle remains the best

possible choice. However, it is necessary to improve its usability, its graphic aspect, and the chat management to allow students and teachers to use the platform more easily. In this way will it be possible to promote the diffusion of VCBLAs in schools among students and teachers.

2. Aims

This research work is part of the LIME (Learning Interface for Mathematics Education) project at University of Campania “L. Vanvitelli” in the framework of V:ALERE 2020. The aim of the project is to implement user-friendly graphical interfaces for VCBLAs that are intuitive, easy to use, and pleasant for students and teachers to facilitate the dissemination of VCBLAs in the school. As part of that project, a plugin for Moodle, named “Quick Chat”, was designed and implemented with the aim of overcoming some of the above-mentioned graphical limitations of the platform. The aim of this paper is, on the one hand, to describe the main features of this plugin and, on the other hand, to analyze its advantages both from the student’s point of view (e.g., fostering collaboration and interaction among participants within small groups) and from the teacher’s point of view (e.g., being able to visualize/manage conversations within each group). In this regard, some results from an experiment involving PhD students, who worked on the Moodle platform on solving two mathematical tasks, were presented.

3. Method

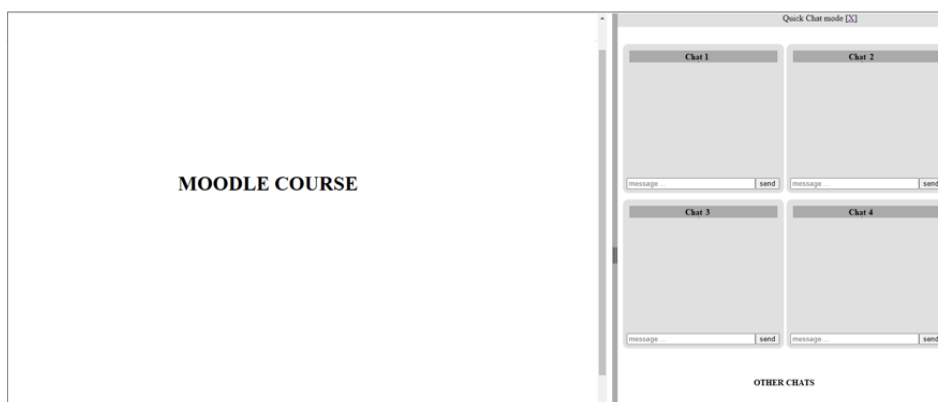
In this section, the features of the “Quick Chat” plugin, the participants and the experimentation setting are described.

3.1. The “Quick Chat” plugin

Quick Chat is a plugin for Moodle. It was designed to allow users (students or teachers) to view (and thus manage) in a single browser window all the tools provided for a VCBLA, i.e., the narrative flow and all communication channels (chats) in which users are involved according to their role within the collaborative script. The plugin was implemented using Javascript and PHP languages for client- and server-side programming, respectively. HTML and CSS languages were used for structural and graphical definition of the site, the web template system Mustache to facilitate server-side HTML processing, and SQL language for managing data in the database. For avoiding conflicts with existing platform chats, the plugin uses the database structures provided by Moodle.

Once the plugin is installed in Moodle, the label “Quick Chat” appears among the “Navigation” menu items on the Moodle page. By clicking on this menu item, the plugin is activated, and the browser window splits into two parts. The current Moodle page is loaded in a window (iframe) on the left of the web page, so that the user can continue to navigate in Moodle. The Quick Chat section is loaded and set up in another window (iframe) on the right of the web page. Thus, in the left part of the page, the Moodle course is shown, while the right part of the page shows the chats (Figure 1).

Figure 1. Moodle page after activating the “Quick Chat” plugin



Source: 2022, Own elaboration.

The chats window has a title bar with an exit button (X) to exit the “Quick Chat” mode. For each chat, the user sees the name of the chat, a scrolling item for viewing incoming and outgoing messages, a text box in which to write the message, and a button “send” for sending the message. Between the two iframes is the slicer bar, which the user can move to individually set the size ratio of the two iframes. In this way, he/she can expand or contract the parts of the web page in which the chats and the Moodle course are respectively shown. The chats are independent of each other, and it is possible to consult them and send messages separately. They are updated sequentially, in five-second increments. After the update, the focus of each chat goes to the last message sent.

Students can view all the chats they are involved in according to their role or the groups they belong to, while the teacher can view all of them.

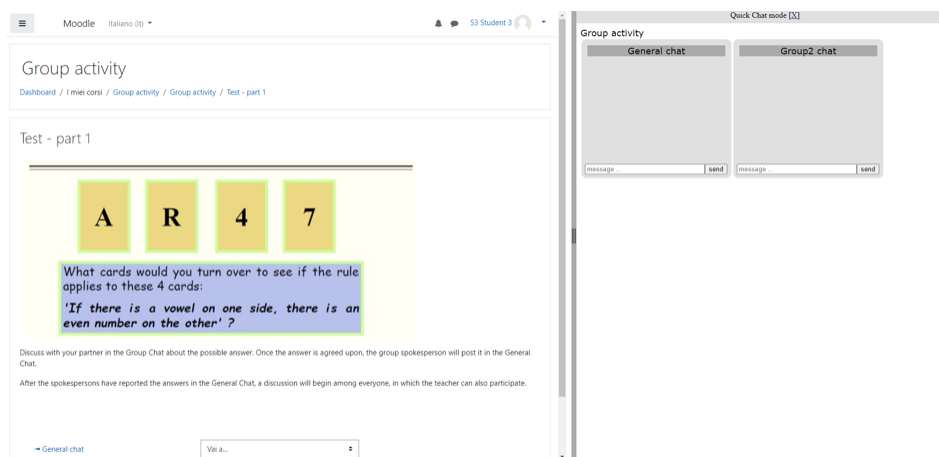
3.2. Participants and setting

Four participants were involved in the experimentation. Three participants (S1, S2 and S3) were Ph.D. students in Mathematics, Physics and Applications for Engineering at the University of Campania “L. Vanvitelli”, in their first year of doctoral studies. They attended the doctoral program “Research in mathematics education”. Another participant (S4) was a secondary school teacher, formerly a research fellow at the same University. All participants communicated with each other in English. They were divided into two groups of two members each. The first group (Group1) was composed of S1 and S2, the second group (Group2) of S3 and S4.

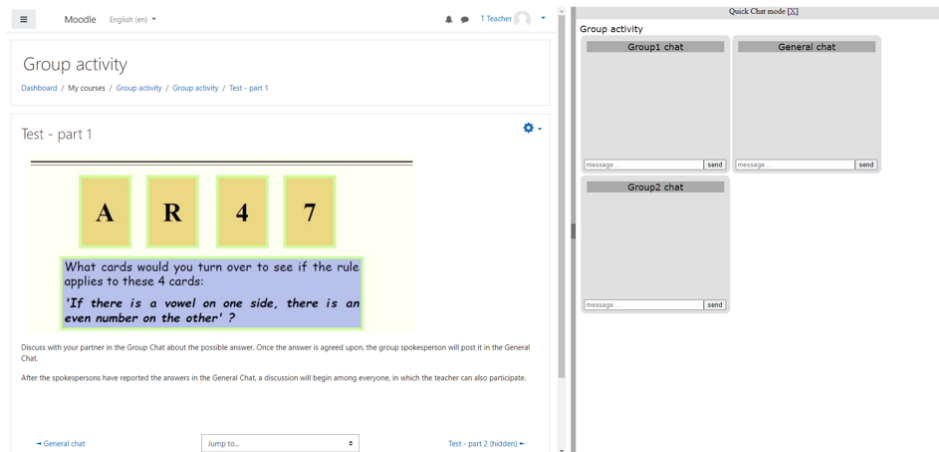
Each group had to answer two tasks. The first task (Test -part 1) was the Wason’s selection task (Wason, 1966). Each participant visualized 4 cards: the first card shows the letter A, the second card the letter R, the third card the number 4 and the fourth card the number 7. Each group was asked, “What cards would you turn over to see if the rule applies to these 4 cards: ‘If there is a vowel on one side, there is an even number on the other?’”. The second task (Test – part 2) was the variation to the Wason task proposed by Griggs and Cox (1982). Each participant visualized 4 cards: he/she drinks beer; he/she drinks water; he/she is over 16; he/she is under 16. The question for participants was as follows: “If a person drinks beer, he/she must be over 16 years old. What cases should you check?”. The two tests have the same logical structure. The difference between them is that the second one refers to a real context. They were proposed to make participants think about the role of context in students’ responses.

However, in this paper we focus on aspects related to the use of the “Quick Chat” plugin to facilitate interaction among participants. Participants worked on Moodle platform, on which the “Quick Chat” plugin was installed and were enrolled in a course on the platform (named “Group activity”). Members of each group communicated with each other through a Group Chat to reach a shared answer to both assigned tasks. For each group and each task, a spokesperson was designated. The spokespersons of each group reported on a General Chat the conclusions reached within their group. In the same chat, all participants discussed with each other. Each participant had both the Group Chat and the General Chat at his/her disposal. All chats were available and visible to the teacher. Each group first responded to the first task and then to the second one. The second task was viewed by participants only after completing the first one. For each task, the prompt for each group was, “Discuss with your partner in the Group Chat about the possible answer. Once the answer is agreed upon, the group spokesperson will post it in the General Chat. After the spokespersons have reported the answers in the General Chat, a discussion will begin among everyone, in which the teacher can also participate.”. The following Figures 3 and 4 show, respectively, the Moodle page displayed by one of the participants (S3) and the teacher regarding the first task.

Figure 2. Moodle page referring to the first task (Test – part 1), viewed by S3



Source: 2022, Own elaboration.

Figure 3. Moodle page referring to the first task (Test – part 1), viewed by the teacher

Source: 2022, Own elaboration.

At the end of the activity, participants individually answered to a questionnaire with the following two open questions related to the mode of work they experienced:

As a perspective teacher, what do you think about the activity you carried out, from an educational point of view?

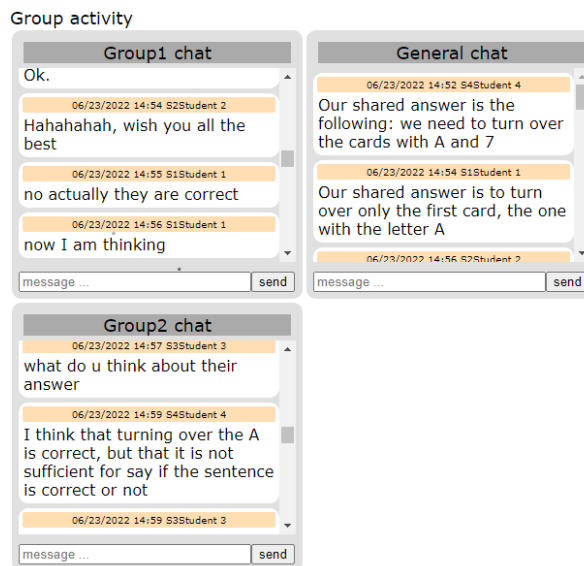
As a student, what do you think about the activity you carried out, from a technology and graphical interface (GUI) point of view?

The questionnaire was designed to investigate how the device was perceived by participants both from an educational and technological and graphical interface point of view, both as students engaged in solving the task and as potential future mathematics teachers who might use the device in their teaching practice. The questions were open to allow participants to comment freely without constraint or direction of any kind.

4. Results

Regarding the first task, i.e., Test-part 1, the discussion within each group in the Group Chat lasted about 20 minutes. The first group produced 41 messages in chat (S1 typed 24 messages and S2 typed 17 messages) and the second group produced 28 messages (14 messages typed by both S3 and S4). S4 was the first student to report the group's answer in the General Chat. She wrote: "Our shared answer is the following: we need to turn over the cards with A and 7". Two minutes later, S1 also reported in General Chat the answer, agreed within her own group: "Our shared answer is to turn over only the first card, the one with the letter A". The answers reported in General Chat show that the two groups disagreed on the answer to the question. A discussion among all the participants started in the General Chat (13 messages were typed by participants in the General Chat). At the same time, the members of each group continued the discussion among themselves in the Group Chat, commenting on the messages reported by members of the other group in the General Chat. This can also be observed from the following Figure 4, which shows the "Quick Chat" mode available to the teacher, with some messages from the different chats: Group1 Chat, Group2 Chat, General Chat. Looking in Figure 4 at the times of sending each message in chat (which appear above each message) it can be seen that some of the messages sent in Group Chats are subsequent to the responses sent in General Chat. The discussion in General Chat was crucial in making Group 1 members better understand the task. At the end of the discussion in General Chat, even the members of Group 1 agreed with those of Group 2 that they needed to turn over the card with the number 7 as well. Indeed, S1 wrote: "[...] we need to turn over 2 cards. The first card (A) and another one with the number 4 or 7".

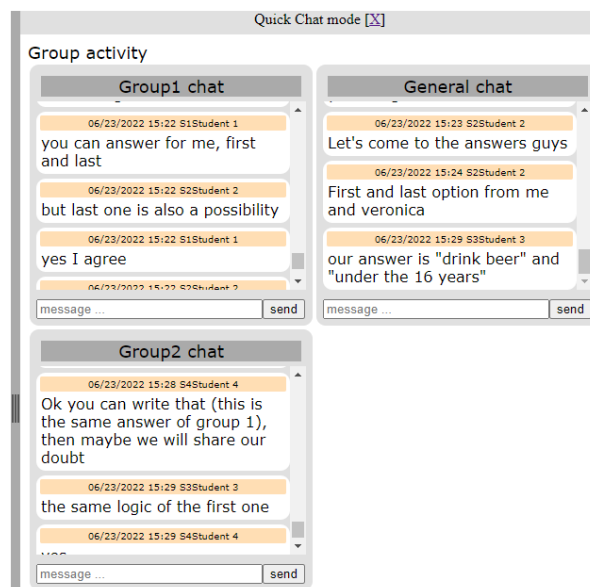
Figure 4. “Quick Chat” mode available to the teacher regarding the first task



Source: 2022, Own elaboration.

With regard to the second task, i.e., Test-part 2, the discussion in each group lasted less than in the first task (about 10 minutes). This is explained because the students had already reflected on the first task and the second task was simpler than the first since it was contextualized in the real world. However, many messages in Group Chats were typed. The first group produced 28 chat messages (S1 typed 22 messages and S2 typed 17 messages) and the second group typed 18 messages (S3 typed 8 messages and S4 typed 10 messages). Figure 5 below shows the “Quick Chat” mode available to the teacher, referring to the second task, with some of the discussions that took place among the participants in each group and the responses reported by the spokespersons in the General Chat. The messages reported in the General Chat by the spokespersons of each group show that the two groups immediately agreed on the response to the task.

Figure 4. “Quick Chat” mode available to the teacher regarding the second task (own elaboration)



Source: 2022, Own elaboration.

From the data analyzed, it seems that the device facilitated interaction both within each group (in Group Chats) and among all participants (in General Chat). This occurred even without teacher intervention in the chats.

In answering the first question of the final questionnaire (see the last part of Section 3.2), participants emphasized the benefits offered by the plugin from an educational point of view both as students and as teachers.

From a student perspective, all participants highlighted that the plugin encourages interaction and collaboration among participants:

- S1 The activity carried out impressed me very much. Although it was a telematic activity, I think it allowed a high level of comparison [...]
- S2 [...] It also allow the students to critical thinking about the question and to defend their answers. It also help the students to built their communication skills and the ability to do the team work.
- S3 I think that this kind of activity could stimulate the collaboration among students and promote a constructivist learning [...]
- S4 It's very interesting to see how your students can interact with working on groups and also how they can discuss their ideas.

From a teacher perspective, participants highlighted some advantages offered by the plugin:

- the possibility for the teacher to observe what happens in each work group. For example, S2 wrote, “[...] With the help of these kind of activities, teachers can find the level of the students, their complications and their thinking capacity because it also allow the teacher to look to the group chat as well as the general chat. As, this was a psychological observation of the students, therefore, it allow the observer (the teacher in this case) to observe the students that how they understand the question and how they try to solve the problem”;
- the ability for the teacher to interact within the groups. For example, S1 wrote, “[...] Furthermore, the ability of the teacher to create small groups and interact with them individually, I believe, can be very useful in not neglecting any student”.

In answering the second question (see the last part of Section 3.2), participants highlighted the benefits of the plugin from a graphical interface point of view. S2 dwelled on the possibility offered by the plugin to visualize on a single browser page all available chats: He wrote, “It was a good attempt to allow the students as well as the teacher to see all the activities in a single browser. In a single browser, they are allowed to chat individually or with the group and also the teacher was allowed to observe the students individually or as a whole. The platform was very easy to use and interesting”. In his response, S2 highlighted some advantages for both students (“they are allowed to chat individually or with the group”) and the teacher (“the teacher was allowed to observe the students individually or as a whole”). In particular, S2 highlighted the potential of the plugin for the teacher, who can observe all student’s conversations in each group and at the same time. Finally, S2 emphasized the platform’s ease of use. This is also highlighted by S1, who wrote: “The graphical interface was simple and clear”.

S4 pointed out not only the benefit offered by the plugin of simultaneously viewing all chats, but also the advantage of simultaneously seeing both chats and the task at hand on the same browser page. She wrote, “I think that it is important to simultaneously visualize both the activity and the chats to carry out this kind of activity. It seems to me a good interface that allows to work on a task in group”. Finally, S3 reported a reflection on the use of technology to foster communication among teachers and students and promote learning: “[...] So technology and graphical interface are used to create good communication between teachers and students during the learning process”.

5. Discussion and conclusions

This paper is part of a broader research (LIME project) whose aim is to identify what aspects and acceptability characteristics a Graphical User Interface (GUI) should have to satisfy the expectations of teachers and students. In computer-based learning environments, the use of GUIs could be effective in amplifying the positive effects of other types of scripts, i.e., stimulating discussion among students, and enhancing the effect of text-based instruction (Schoonenboom, 2008). Moreover, GUIs can reduce students’ cognitive load and promote the acquisition of new knowledge (Hron & Friedrich, 2003). Certainly, a GUI should not neglect critical factors such as students and teachers involvement (Puri, 2012), active students learning, cooperative learning, and flexibility (Nokelainen, 2006).

In this regard, a Moodle plugin, named “Quick Chat”, has been designed and implemented. The plugin allows to manage in a single browser window all the tools required to handle a Vygotskian computer-based learning activity (VCBLA). In particular, the plugin allows to visualize in a single browser page both the narrative flow of a VCBLA and all the chats in which users (students and teachers) are involved. In this paper, the features of the “Quick Chat” plugin were described (see Section 3.1).

The plugin was experimented with four participants, divided into pairs and engaged in solving two mathematical tasks, that is, the Wason selection task and the variation to the Wason task proposed by Griggs and Cox. Afterwards, they individually answered a questionnaire designed to investigate how the device had been perceived by them from an educational and technological and GUI point of view. The results of the experimentation (see Section 4) seem to show some advantages offered by the plugin. In answering the first question of the final questionnaire, participants emphasized that the plugin

- encourages interaction and collaboration among participants (many messages were exchanged in both Group Chats and General Chat and the discussion in Group Chats continued even after students reported their shared response in the General Chat).
- allows the teacher both to observe what is happening in each working group and to interact in each group.

The participants were able:

- to discuss within the small group in a Group Chat to agree on a common response to the proposed tasks;
- to view the other group's responses in the General Chat;
- to meditate on those responses and to discuss both again in Group Chat and General Chat to reach a shared response.

The simultaneity of the discussions fostered interaction among participants and, thus, learning. For example, in reference to the first task, all participants reached a concordant result (which was the correct answer to the task) at the very end of the discussion in General Chat. This occurred without teacher intervention in the chats. However, the plugin gave the teacher the possibility to view all the discussions in each group and the general discussion among all participants at the same time on the same browser page. In this way, he/she was able to follow in real time everything that is happening in the groups with the ability to intervene in each chat. This would obviously be impossible in a non-digital environment, but still complex even in a digital environment without the use of the plugin. The benefits offered by the plugin from a graphical point of view were also emphasized by participants in their answers to the second question in the final questionnaire.

In the future, we want to investigate in depth what characteristics a computer-based environment should have to be accepted by users, that is, to be perceived as useful and easy to use. More specifically, we would like to collect and analyze data on participants use the technology and the difficulties they may encounter while using it (Dello Iacono *et al.*, 2021c). The idea is to use the LIAQ (Learning Interface Acceptance Questionnaire), i.e., a version of the VAAQ (Virtual Agent Acceptance Questionnaire) (Esposito *et al.*, 2019; Esposito *et al.*, 2020) adapted to the evaluation of learning interfaces. The LIAQ can also be a valuable tool for assessing the pragmatic and hedonic qualities of the graphical interface as well as its attractiveness.

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