DEDOS-Editor

The authoring tool DEDOS–Editor has been developed to allow teachers to create card based single and multiple selection activities in an easy way. It can also allow the update of previous educational projects. The authoring is based on using cards with text or images. To increase the potential of the tool, cards can be grouped in areas. There are two possible areas: the board and the student area. All students share cards in board areas, while those in student areas are specific to each student and, consequently, automatically replicated so that every student at the table has their own. Activities are then grouped into a project to create a coherent learning set that can be later used in the classroom.

The authoring tool is structured in three main areas. A project area for navigation purposes is displayed on the left hand side of the interface, showing the thumbnails of all activities in the project. In the upper part, a toolbar offers the necessary tools to create areas, cards and objectives. Finally, the centre of the screen is the working area, dedicated to editing purposes, in which the teacher will design the activities.

An example of activity creation using DEDOS-Editor can be seen in Figure 1, a project named "Where are the animals?" with two activities: a learning activity opened in the working area and a blank one. If you want to add a new activity to the project, you only have to press the button at the bottom of the thumbnails.
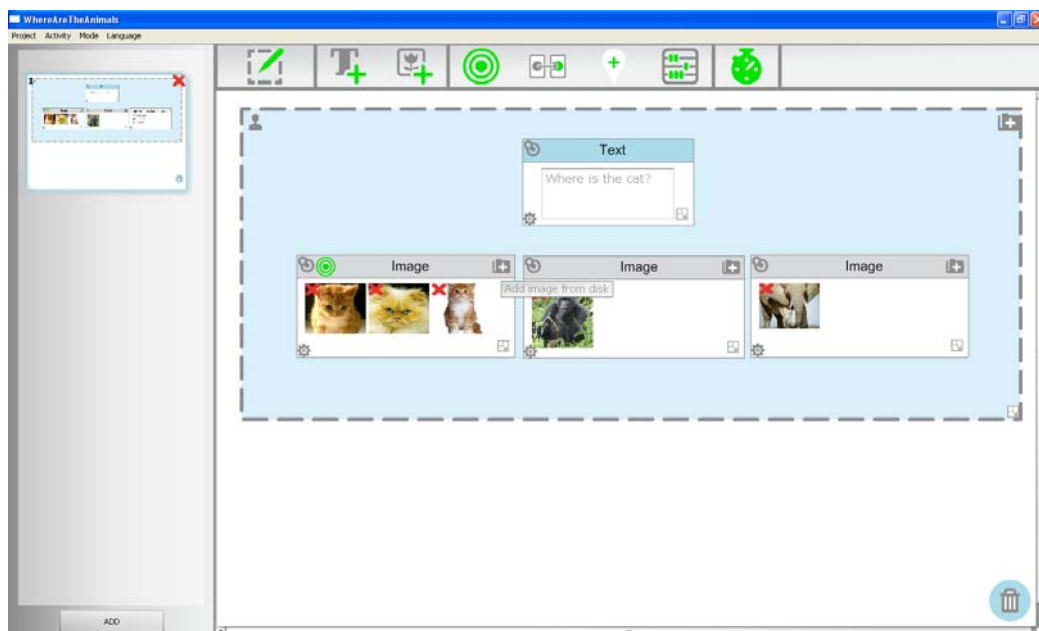

Figure 1.   DEDOS-Editor - Example of selection activity

Above the figure, the toolbar shows the elements that can be included in the current activity. The elements have been separated into three groups in the toolbar: areas, which allows grouping and organizing cards; cards (i.e. text and image), that are the main building components; and goals (i.e. selection, pair matching, follow paths and mathematics) which determines the purpose of the activity and the time limit to specify if the activity has to be

perform in a specific time. Elements are manipulated by dragging and dropping as if they were physical pieces.

All three cards of this figure have been dropped over a student area: i) a text card with the activity's statement, and ii) three image cards (cats, elephants and gorillas) as possible solutions of the activity. Each image card can contain one or more images so when presented to the student in a multitouch tabletop, one of them may be randomly selected, showing every student the same exact activity or slight variations of it. These images are selected from the hard drive by clicking on the folder icon at the top right corner of the card (see the option on the cat image card).

Every object of the activity is built using cards and, while the teacher must be able to move around every object when designing, some of them will be fixed when presented to the students. The pin in the left top side of each card is a natural representation and interface to determine whether that object must be fixed or movable in the player.

Finally, to define the solutions of the activity, selection goals are dragged from the toolbar and dropped over the card or cards that have to be selected to successfully solve the activity (see the icon with three circles on cat image card). In the simple selection activity of the example, the correct answer is the left image card with the cats. However, the teacher can create multiple selection activities as, for example, if the question of the activity was "Which animals are herbivorous?" by dropping selection goals both over the elephants and the gorillas cards (see Figure 2). In this case, students will have to select both cards to solve the activity correctly.

Figure 2.   DEDOS-Editor - Example of multiple selection activity

Every card has advanced properties hidden in the back of the card. These options can be configured by clicking on the gear icon at the bottom left corner of the cards. When clicked, the card flips over itself showing its advanced options. The Figure 3 shows the gorilla card and the elephant card flip over. The gorilla card shows the three interaction options the card will show in the tabletop: selectable, rotatable and resizable. The first option indicates if students can select this card or not. The other two options are advanced features to determine whether the rotation and zoom gestures will have any effect on the card shown in the player. In addition, the teacher can specify a feedback to be shown when the student wrongly chooses that card (see second tab of elephant image card). And finally, it is possible to include a numeric value for each card in the third tab (for example, if three cats appear in the same

image, it is possible to define the value 3 for this card with the purpose to do maths activities. This last option will be used in conjunction with mathematics goal.
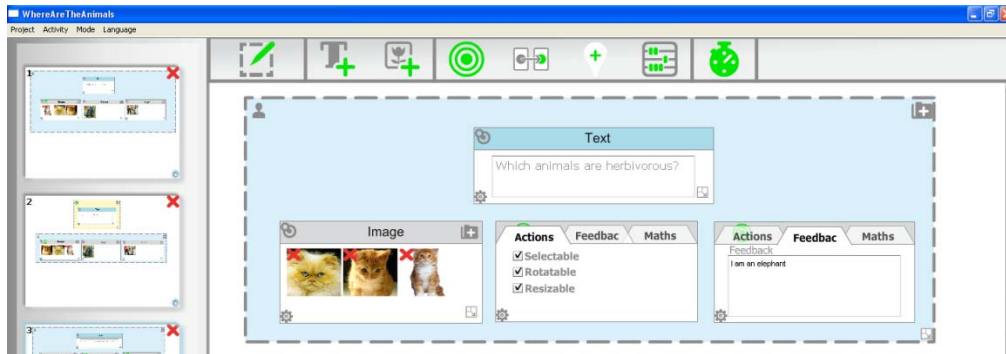

Figure 3.   DEDOS-Editor - Example of advanced options

Regarding the use of board areas and student areas, we can build a similar selection activity to the first one ("Where is the cat?") but including only one statement of the problem. In this case, we should drag two areas to the editing panel. We have to click over the icon placed in the left upper side of the area to change the type of the area (board areas are represented by ⚇ icon and student areas by 👤 icon). The statement will be placed on the board area and the three answers will be dragged on the student area. Finally they should put the selection objective on the correct answer. When students will perform this activity, the statement of the problem will be placed in the middle of the tabletop owing to it is included in a board area. Figure 4 shows this activity in DEDOS-Editor.
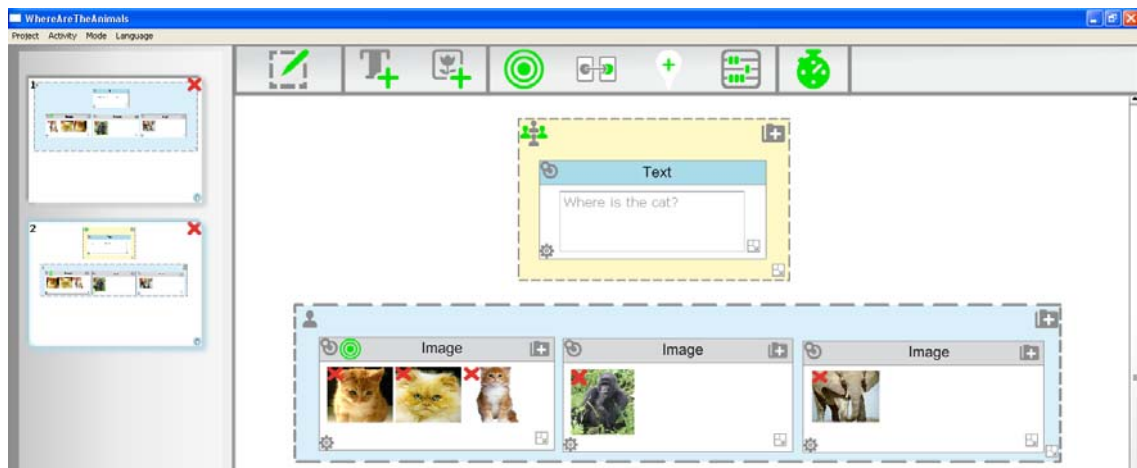

Figure 4.   DEDOS-Editor – Second example of selection activity

Another type of activity is pair-matching ⊡. To design this type of activity, you have to drag two areas and establish relationships with this goal between two cards. For example, imagine you want to create the activity presented in Figure 5. This activity is composed of a board area with the types of animals, and a student area with the statement of the problem and three images of animals. The goal is that the student will classify the images depending on the animal type. They must drag the animal to the corresponding type. Arrows between images

and text establish a relationship between these two cards. Teachers can combine text and images cards in the order they need.
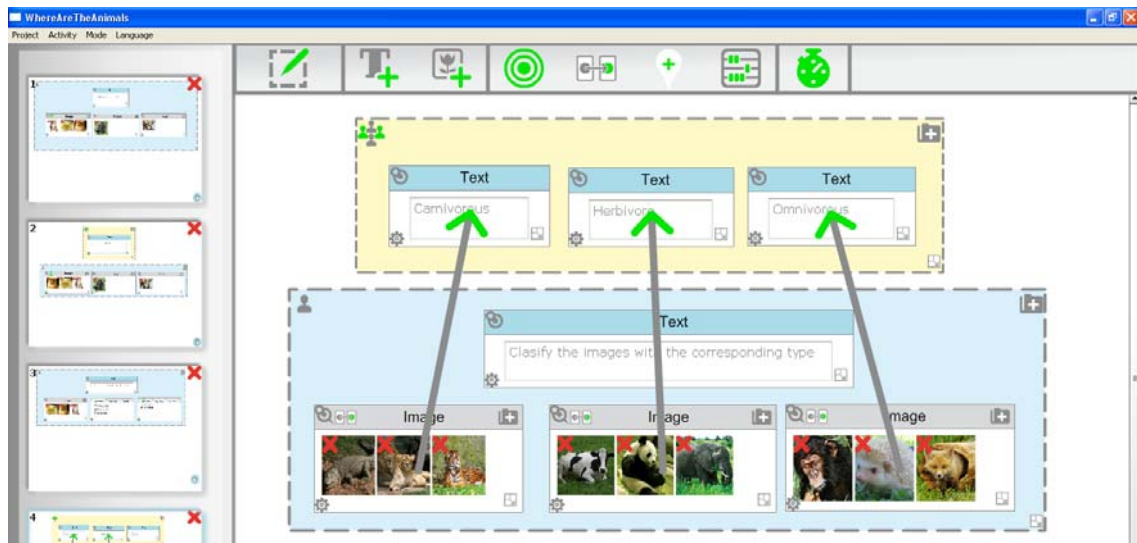

Figure 5. DEDOS-Editor – Example of pair-matching activity

Anther type of activity, is the maths activity. Figure 6 presents an example of this type of activity. The goal is to drag 10 cats to Mary. The images included in the cards are classified depending on the number of cats showed. Each image card has associated a numeric value in advanced options (see the left bottom card with the numeric value 4). Mary has the goal maths with a value of ten. Therefore, the activity will finish when Mary obtains the 10 cats.

Figure 6. DEDOS-Editor – Example of pair-matching activity and maths

DEDOS-Player

Once designed, activities need to be played on a tabletop, and software is needed to interpret and execute the teachers' designs on a multitouch surface. This software is called DEDOS-Player. The player is in charge of automatically adapting the activity layout to the number of students around the tabletop as well as of providing easy on-execution playing modes to adapt a single design to various educational scenarios. This is of special importance since, while in the design process, teachers rarely know how many students will be using the activity and in what scenario.

We have identified several modes of execution whose combination reshapes the collaborative use of the designed activities. These modes or variables are configured in playing time, allowing changing the behaviour of a design to create multiple educational experiences:

- **Players:** Depending on users around the table, DEDOS-Player adapts the individual and collaborative spaces on the tabletop.

- **Answer control - feedback**: In order to provide feedback to the student actions through the activity elements, two options are available: immediate feedback and delayed feedback. On one hand, the player continuously inspects whether the student has reached a correct solution or not. Once the correct solution is provided the activity automatically ends, and the feedback is showed to the student if the immediate feedback option was selected (this is the option by default). On the other hand, delayed mode allows the student to perform actions before confirming that he is satisfied with his answers and therefore he has finished the activity. The player will include a confirmation button for each student area in order to confirm his actions.

- **Answers dynamics**: to determine whether students interact simultaneously (all at once), one by one by taking turns by activity or by action in the activity.

- **Number of required answers:** It is possible to consider an activity as finished when all the students around the tabletop have to provide an answer or not.

- **Successful answer:** This option determines a correct answer needed to consider the activity as finished.

- **Score mode**: Since the activity outcome is measured as winning points, this mode determines how points are assigned. In competitive mode each student receives points personally, while in cooperative mode, points are rewarded to the group as a whole.

- **Answer consensus**: determining whether the activity ends when all students reach a consensus and provide the same answer or it is not required consensus for finishing the activity. By default, it is not needed consensus between students around the tabletop.

These options are available in DEDOS-Player before starting to do an educational project. They are organized depending on their use. First three options can be showed after selecting the educational project (see Figure 7). They are the basic options: number of players around the tabletop, answer control and answer dynamics.

Figure 7.   DEDOS-Player – Basic modes

If the teacher wants to configure the advanced options, he can press the "Advanced" button of Figure 7 and the advanced options appears: number of required answers, successful answer, score mode, and answer consensus (see Figure 8). When the teacher has configured the options of the player, students can start to perform the activities by pressing the start button.

Figure 8.   DEDOS-Player – Advanced modes

Depending on the options selected before beginning the educational project, the tabletop will present slightly differences in the user interface and its behaviour has small differences. Figure 9 shows the student view of the previous example "Where is the cat?" In this figure, it is presented the view for two students with the value delayed selected from answer control option. For this reason, a conformation button on the right side in the student area appears (see ✅). On the right-hand side, the student has chosen the elephant (which, therefore, is highlighted in yellow). On the left hand side, the student has selected the cat. Since the feedback will be delayed, the student can change his answer until the confirmation button is pressed. Then, the D2-player checks the answer of the student against the solution provided by the teacher and provides feedback accordingly.

Figure 9.   DEDOS-Player – Example of selection activity

For wrong answers, the feedback provided by the teacher in the editor (if it is specified in DEDOS-Editor) is shown in the card along with a small version of the original image of the card, as shown in Figure 10. In our example, when the student fails the answer, feedback appears in the wrong answer highlighted in red. If the student provided the correct answer, this answer will be highlighted in solid green.
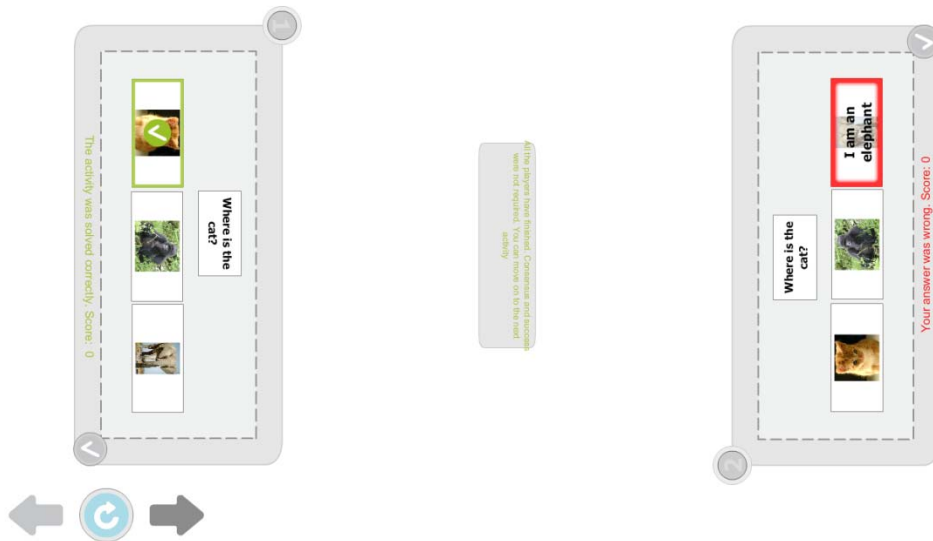

Figure 10.   DEDOS-Player – Example of feedback in a selection activity

Another example of selection activity is presented in Figure 11. This activity corresponds to the activity designed in Figure 4. The statement of the problem is in the middle of the tabletop because it is contained inside a board area.
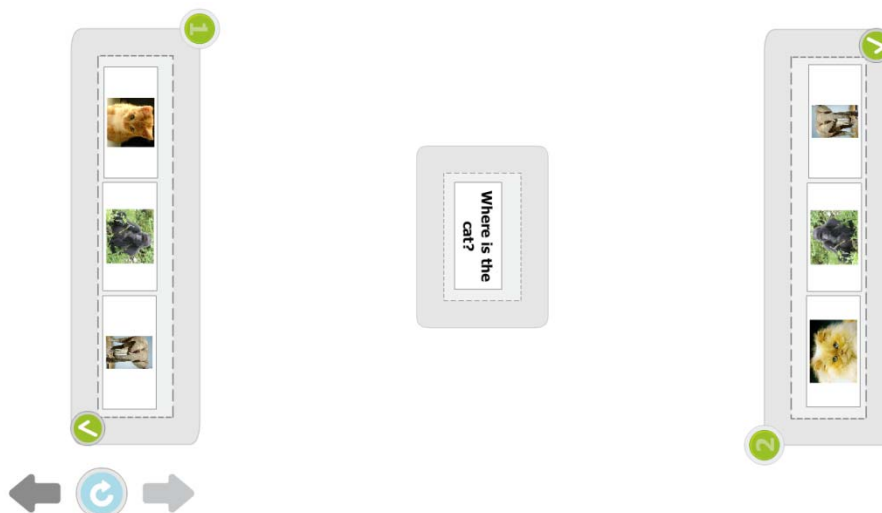

Figure 11.   DEDOS-Player – Second example of selection activity

Figure 12 presents the example of multiple selection activity (the activity designed in Figure 3). In this activity, the student has to select two answers between the three possible options.
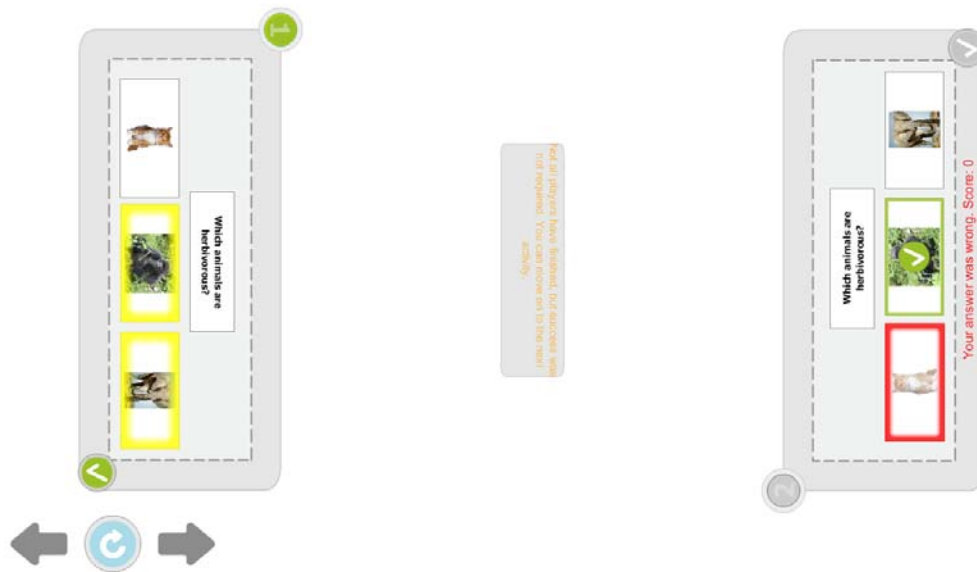
Figure 12.   DEDOS-Player – Example of multiple selection activity

Let us present the last activities (pair matching and maths) for four students and the default options selected. Figure 13 presents the pair-matching activity designed in Figure 5. Students must drag the images to the animal type in the middle of the tabletop. On the other hand, Figure 14 presents the pair-matching activity combining maths designed in Figure 6. In this question, each student must obtain the elements drag from his personal area to the board area are equal to 10. When student drop a cat image card over Mary, the numeric value associated with the card appears. Thanks to the design of this activity, students can solve this activity correctly in a few different ways (there are a few combinations to obtain the number 10 – see Figure 15).
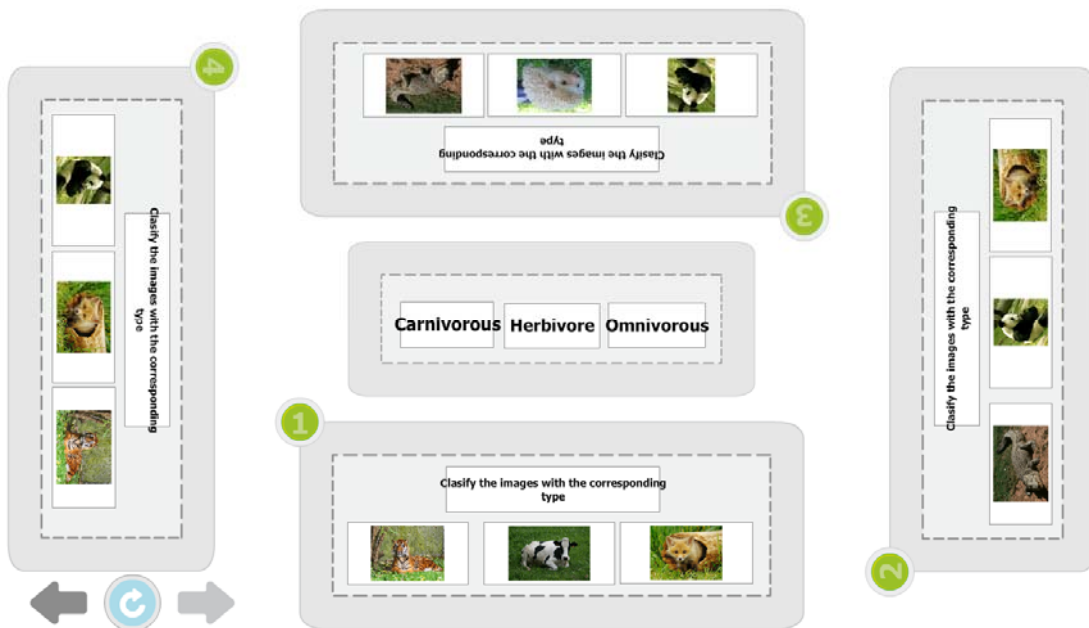

Figure 13.   DEDOS-Player – Example of pair-matching activity

Figure 14.   DEDOS-Player – Example of pair-matching activity and Maths

Figure 15.   DEDOS-Player – Example of pair-matching activity and Maths - Different solutions