Next-Lab

Next Generation Stakeholders and Next Level Ecosystem for Collaborative Science Education with Online Labs

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First releases of the 21st century apps as well as self- and peer assessment apps

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Executive Summary

This deliverable is the accompanying document for the first releases of the 21st century apps as well as self- and peer assessment apps, as these were defined in D3.1 (Specifications, mock-ups and/or prototypes of 21st century apps, self- and peer assessment apps, ePortfolio, and modelling app), delivered in M9.

To facilitate the 21st century skill of *collaboration*, SpeakUp was created. SpeakUp enables communication between students, not only through a browser on their PC or laptop, but also using mobile devices. Using SpeakUp as communication channel, a new type of collaboration, asymmetric collaboration, has been introduced to the Go-Lab ecosystem. The apps that were developed for the 21st century skill *reflection* concern student processes (time spent in phases, transition of phases, activities in apps) or products (e.g., individual concept maps compared to aggregated concept maps). In each of these apps a visualization of students' products or processes is available, students a represented a norm to which they can compare their own product or process and dedicated reflection questions can be added to the app. For *peer assessment* an app has been developed that enables students to ask for feedback on a product they created in an ILS (e.g., the hypothesis scratchpad) and also to give feedback to other students on these products.

The document gives a brief impression of each of the apps and the description will be used as a first step towards user guides for the apps. It accompanies the delivery of the apps at the Golabz sharing platform. The final releases of the apps and additional apps will be described in D3.6 (Final releases of the 21st century apps, self- and peer assessment apps, and modelling app), which will be delivered in M36.

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1. Introduction

One of the goals of Next-Lab is to extend and update the apps (learning tools) that were available after the Go-Lab project. A major effort has been a full restructuring of the internal architecture of all apps to simplify and streamline them. The common app code has been rewritten to make it easier to use in different apps. In more detail: the whole code base has been converted from untyped CoffeeScript and JavaScript to fully typed TypeScript. This all results in a uniform collection of apps, which are faster to create and easier to maintain. In addition, we designed and created a set of new and revised apps to support the acquisition and application of 21st century skills by students. The skills concern: collaboration, reflection, peer assessment, and modelling. The initial specifications of these apps were already described in Deliverable D3.1, the current deliverable presents the actual implementation and release of these apps. In order not to repeat too much information from D3.1, we have chosen to let the current deliverable present a description that comes close to a user manual for these apps. The actual deliverable concerns the apps themselves as they have been made available at www.golabz.eu. The app for creating models by students (Gomodel), as it was specified in D3.1, has been released. However, its release and manual type of description is not presented here, but in the accompanying Deliverable D3.4.

To facilitate collaboration SpeakUp was created, an app that is fully integrated in the Go-Lab ecosystem. SpeakUp enables communication between students, not only through a browser on their PC or laptop, but also using mobile devices. Using SpeakUp as communication channel, a new type of collaboration, asymmetric collaboration, has been introduced to the Go-Lab ecosystem. In this form of collaboration, students have different versions (variations) of the same lab and therefore need to exchange information to successfully solve the task at hand. Two labs (each with two variations) have been developed now for this kind of asymmetric collaboration. Besides enabling collaboration, we also developed an app that helps students to acquire good collaboration skills. This app, the RIDE app, named after the collaboration rules[1] it includes, supports students in assessing their own and their fellow-students collaboration skills, visualizes these skills and helps students to plan improvements for collaboration. For a first try-out version that was tested with a larger set of students, results showed that the app helped students in acquiring collaboration skills and it also supported them in acquiring a higher level of knowledge. However, so far this app is only a proof of concept. The technology used needs to be made more robust, before it can be officially released and applied in teaching settings in classrooms. This app is therefore released later, as part of Deliverable D3.6 (M30).

The apps for reflection are based on presenting students a view of their own processes or products and asking them to compare these with some kind of norm (e.g., a teacher set baseline, or the processes of their fellow students). The apps developed for reflection, therefore, concern student processes (e.g., time spent in phases, transition of phases, activities in apps) or products (e.g., individual concept maps compared to aggregated concept maps). Several of the 21st century reflection apps have a teacher and student version. The teacher version (teacher dashboard) provides the teacher with an overview of ILS usage (Learning Analytics) by students, including their names. The student view basically has the same interface, but here a student can only see his/her own name in full, the names of the other students are not shown. In the student view the learning analytics

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[1] The RIDE rules refer to: respect, intelligent collaboration, deciding together, and encouraging, see Saab, N., van Joolingen, W. R., & van Hout-Wolters, B. H. A. M. (2007). Supporting communication in a collaborative discovery learning environment: The effect of instruction. *Instructional Science, 35*(1), 73-98. doi:10.1007/s11251-006-9003-4

data is accompanied by a set of, teacher configurable, reflection questions. These apps are a combination of work in Task 2.2 (learning analytics) and Task 3.1 (21st century skills).

For peer assessment an app has been developed that enables students to ask for feedback on a product they created in an ILS (e.g., the hypothesis scratchpad) and also to give feedback to other students on these products. The teacher can configure which apps will have the peer assessment facility in an ILS, select different options in the way feedback can be given (textual, smileys, both), and can assign students to each other for giving and receiving feedback. In the app in the authoring platform, the teacher can see an overview of all feedback given and received together with the relevant learning products.

The apps as presented in this deliverable and available at Golabz were based on extensive co-creation and input from teachers (see Deliverables D4.1 and D4.3 for details). Now, having them released, we can gain further experience with these apps in their actual use in ILSs and update them when needed. The final release of the apps will be in M30 (Deliverable D3.6). For this final deliverable we also have a few additional reflection apps planned, for example an app to reflect on the hypotheses created in a group of students (similar to the aggregated concept map as released together with this deliverable).

2. 21st century apps

2.1 Collaboration

For the 21st century skill of collaboration we have developed an app called SpeakUp that enables students to communicate with each other. Teachers can use this app to examine the communication process and to pose questions to their students. This section describes the functionalities and application of SpeakUp.

2.1.1 Using SpeakUp as a support app in a learning space

If a teacher wishes to offer a collaborative chat application to enable discussions between all students of a class, the relevant inquiry learning phase should be selected and the "+" button to add an app should be pressed (Figure 1). Then, SpeakUp should be selected from the list of available apps.
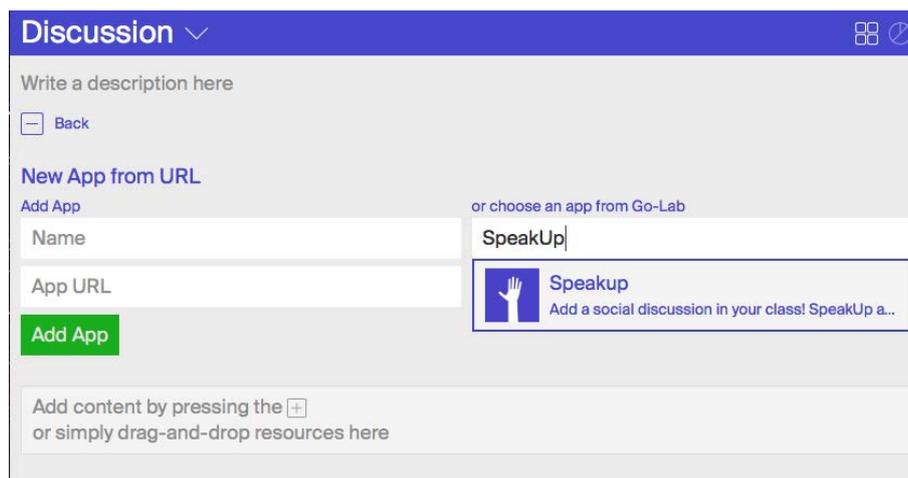

Figure 1: Adding SpeakUp to the Discussion phase of a learning space

An alternative location for the SpeakUp app is at the top level of the learning space in Graasp, which will make it appear in the Toolbar of the standalone (student) view, where it is accessible from all the inquiry learning phases (at the bottom of the ILS screen). The Toolbar for students is only visible if an app, such as SpeakUp or the Calculator, is present at the top level of the learning space.

Also note that students or teachers using the mobile app version can communicate with users using the version embedded in a learning space providing they are connected to the same room (using its name, location, or ID). This is helpful to support the BYOD (bring your own device) scheme.

After clicking on SpeakUp, a room can be created (Figure 2). The anonymous mode can be activated or not. If active, all messages will be completely anonymous. If inactive, the nicknames of the students will be added with their contributions. Note that this usage of SpeakUp embedded in a learning space is not yet compatible with Safari on Mac or iOS devices.

In SpeakUp, students can post messages, vote on messages of others (using the up or down thumb), or add comments on them (Figure 3). The messages can be sorted either according to the number of votes (Best) or to when they were posted (Recent).
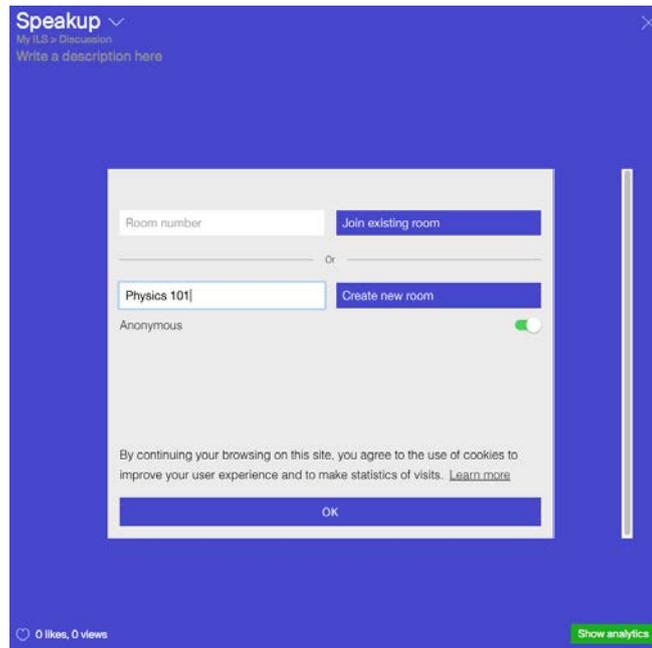
Figure 2: Creation of a room in SpeakUp
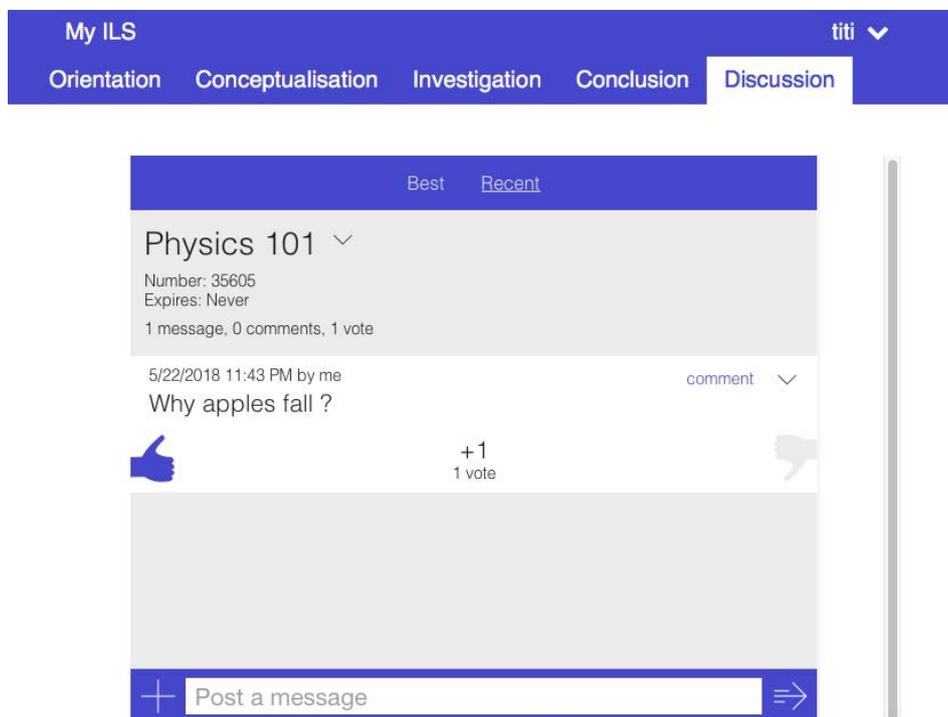
Figure 3: The view of a SpeakUp room in the standalone student view

When clicking on the chevron next to the name of the room, the teachers or students can get additional features, like the display of the room analytics (Figure 4). The creator of the room, typically a teacher, can delete it or share an admin key with a colleague or a teaching assistant to grant him or her the right to delete inappropriate posts or to add multiple choice questions.
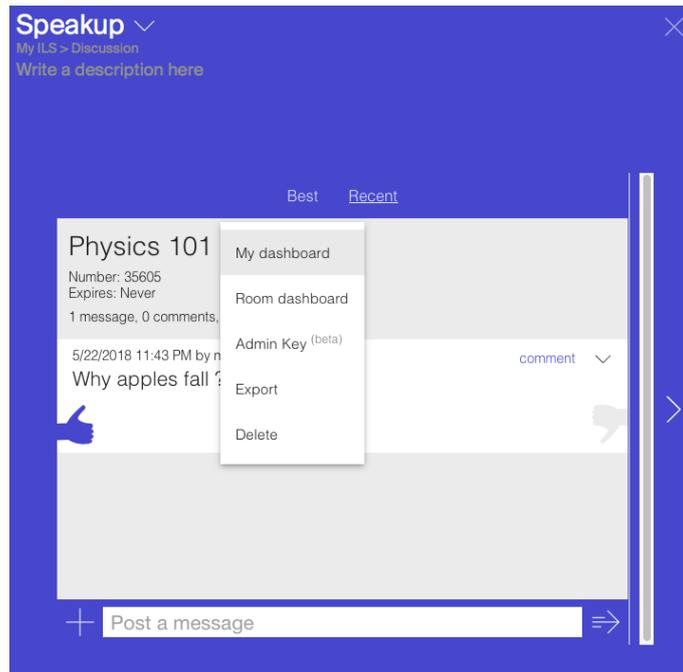
Figure 4: Display options as a popup menu for the teachers and students

The teachers can create multiple choice questions using the "+" button at the left-hand side of the message input field (Figure 5) with a few options (allowing multiple answers, revealing the right solution(s) or not, and displaying immediately the results to students who already answered, while others are still answering).
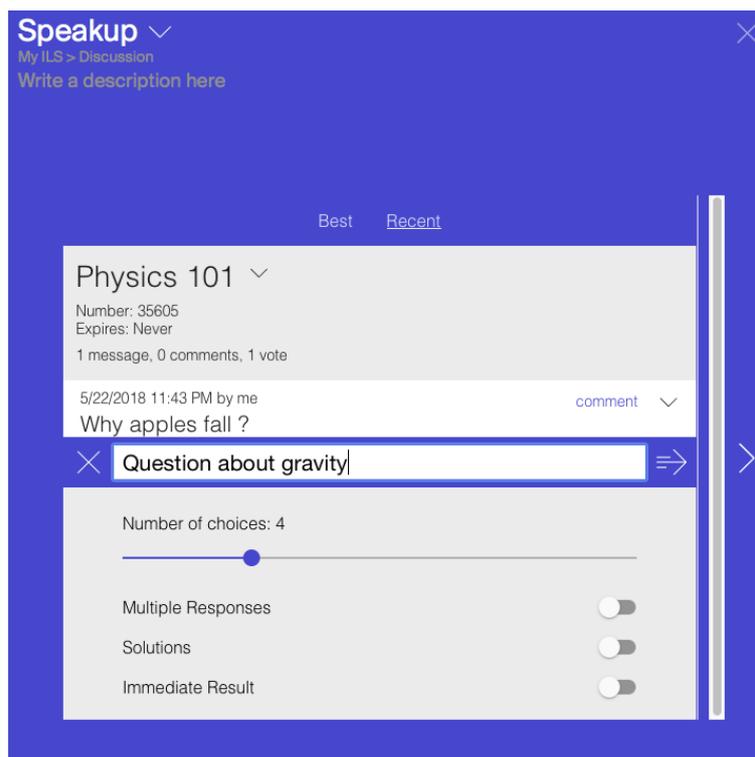
Figure 5: Creating a multiple choice question in SpeakUp

The question is displayed until the teacher closes the poll with the green switch button and clicks on the grey eye to show the votes of the class to the students (Figure 6).
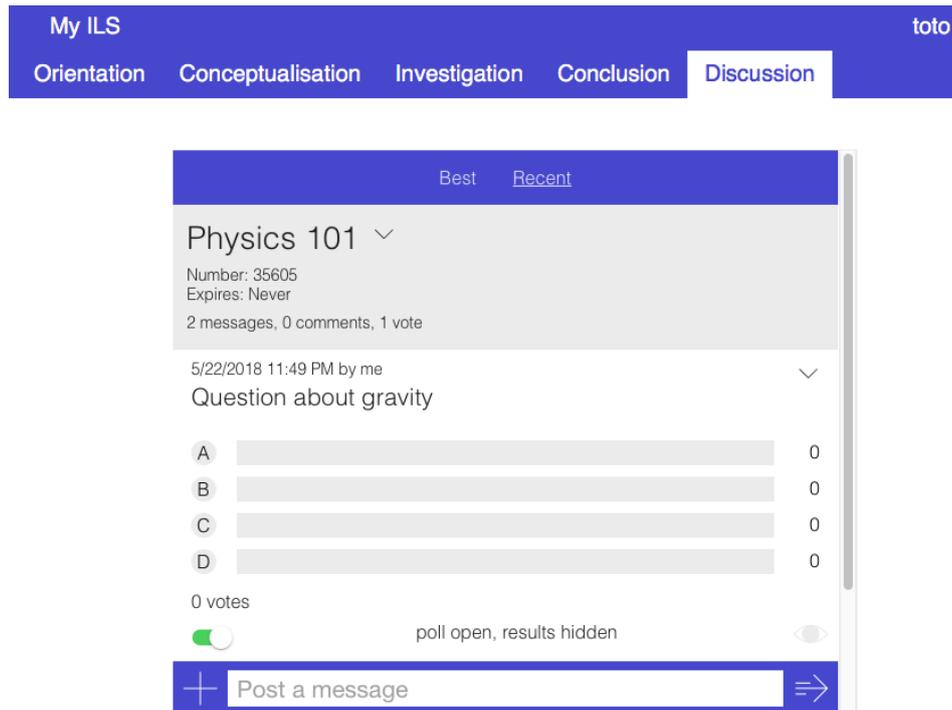
Figure 6: A multiple choice question in SpeakUp

2.1.2 Advance use case of SpeakUp for asymmetric collaboration

In Deliverable D3.1 an innovative type of lab for collaboration, now called asymmetric collaboration, was introduced. This type of lab is designed to have at least two variations that offer different functionalities to students working in the different variants. For example, the Seesaw Collaborative Lab allows a student in one variation (version) to place masses on only the left side of a seesaw. Thus, this student cannot balance the seesaw by him- or herself because he or she lacks the functionality to place masses on the right side of the seesaw. The Rate of Photosynthesis Collaborative Lab allows a student in one variation to control only the lamp intensity, whereas a student in the other variation controls only the season of the year. In asymmetric collaboration, both students see changes made to a variable in the lab simultaneously, but must work collaboratively to successfully explore the influence of several variables in the lab.

One way for a pair of students (or two groups of students) to communicate when using a lab for asymmetric collaboration is by text-based messaging. To support this use case, the SpeakUp app can be configured for pairwise communication, rather than classwide discussion between a teacher and students. This requires the creation of multiple rooms and distribution of the unique room numbers to pairs of students. The design of the asymmetric collaborative labs discussed above was based on the SpeakUp app design, in that before a student sees the simulation, he or she has to "Enter a chat room number" and click on a "Join" button. A pair of students who enter the same number in their respective variations of the lab are then able to control variables and see the effects in the same lab.

Assigning chat room numbers to pairs of students can be practically done in several ways. One way is to print a table where instructions are given to each student about their assigned

room number and how to access their variation of the asymmetric collaborative lab (see Figure 7). After printing the table, the instructions for each individual student can be cut out and the slips of paper distributed to different students. For students using tablet computers it is often convenient to add a QR code, so that they can quickly open the web link without having to type the url address. An alternative way to assign chat room numbers is to use a cloud-based document where students enter their name (or find their name already listed their) and click on a link which leads them to instructions similar to the ones shown in Figure 7.

VERSION A INSTRUCTIONS		VERSION B INSTRUCTIONS	
You have been assigned the number 81052. Open the link lingid.ee/versionA and enter 81052 when asked to enter a nickname for login.		You have been assigned the number 81052. Open the link lingid.ee/versionB and enter 81052 when asked to enter a nickname for login.	

Figure 7: A table to be printed out and used for assigning chat room numbers to pairs of students who will work in different versions of an asymmetric collaborative lab

To set up the different variations of an asymmetric collaborative lab in Graasp it is important to realize that when such a lab is added using the 'Add Lab' button, then both variations of the lab are added to the ILS. Therefore, one variation should be deleted and the ILS renamed appropriately (e.g., variation A). To create variation B of the ILS it is convenient to make a copy of variation A, delete the previous variation of the lab in your copy and again select the asymmetric lab using the 'Add Lab' button. Again both variations of the lab are added, but this time you simply delete the variation of the lab for which you already have an ILS and rename the ILS appropriately (e.g., variation B).

2.1.3 Using SpeakUp as a standalone solution (mobile app)

The SpeakUp app can also be used outside the Go-Lab context. SpeakUp can be downloaded from the Apple Store or Google Play. See the online tutorial available for more details and best implementation practices.

2.2 Reflection

In Go-Lab we make a distinction between reflection on content/product and reflection on processes. One of the apps refers to a reflection on a product (the aggregated concept map), but most of the apps in this section refer to process reflection (time spent, activities performed, sequences followed). To support students in the reflection process the apps described in this section have three additional features: a) they visualise a product or process, b) they present students with a norm to which they can compare their own products (content) or process. This norm can be set by a teacher or can be the individual products or aggregated product or process(es) of their fellow students and c) a set of (teacher configurable) guiding questions for reflection.

2.2.1   Aggregated concept map

In this section we describe the application of the aggregated concept map (ACM) for reflection on content. The aggregated concept map makes it possible for students to switch between an individual concept map and the aggregated view as illustrated in the figures below (Figures 8 and 9).
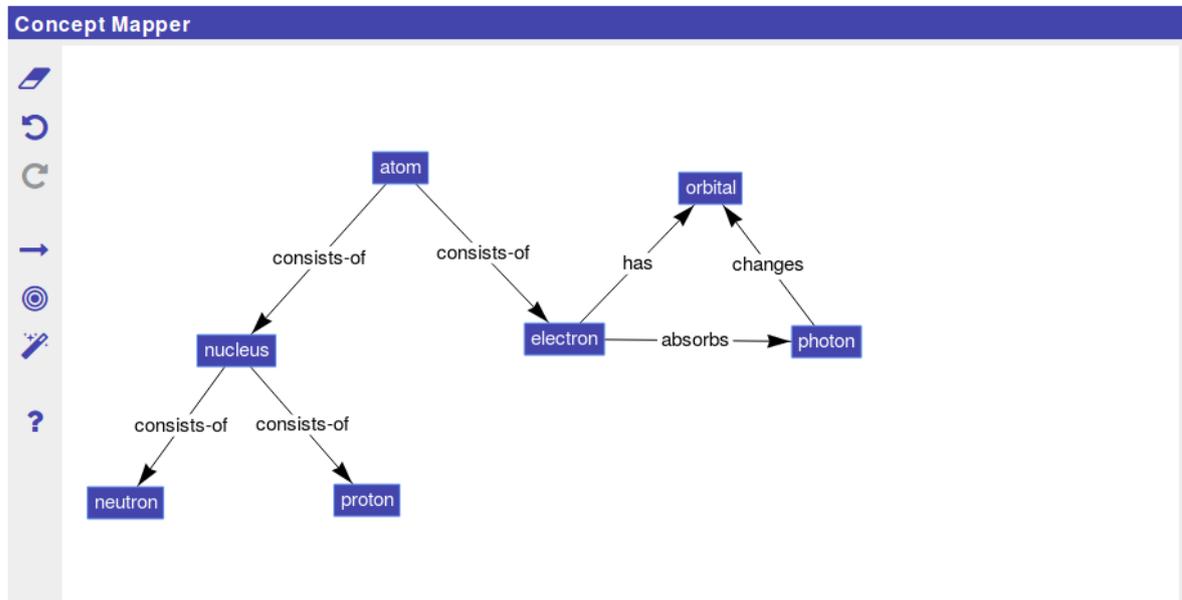

Figure 8: The concept mapper

Figure 8 shows a concept map created by a student on the topic of the atomic structure. Concepts are shown as blue boxes and links are shown as labelled arrows between the concepts.

The same student who created the concept map shown in Figure 8, has opened the ACM and gets a view as in Figure 9. This student now sees the concepts and links in his or her own concept map (blue) as well as the concepts and links other students in the same ILS have used. In this example, another student has created two additional concepts called **wave** and **particle**. The student can now reflect on whether these two concepts he or she did not include, should also be in his or her own concept map. A possible approach to stimulate reflection on the difference between a student's map and the aggregated map are questions in which the student is asked which concepts he or she did not use and why (see Section 3.2.5).
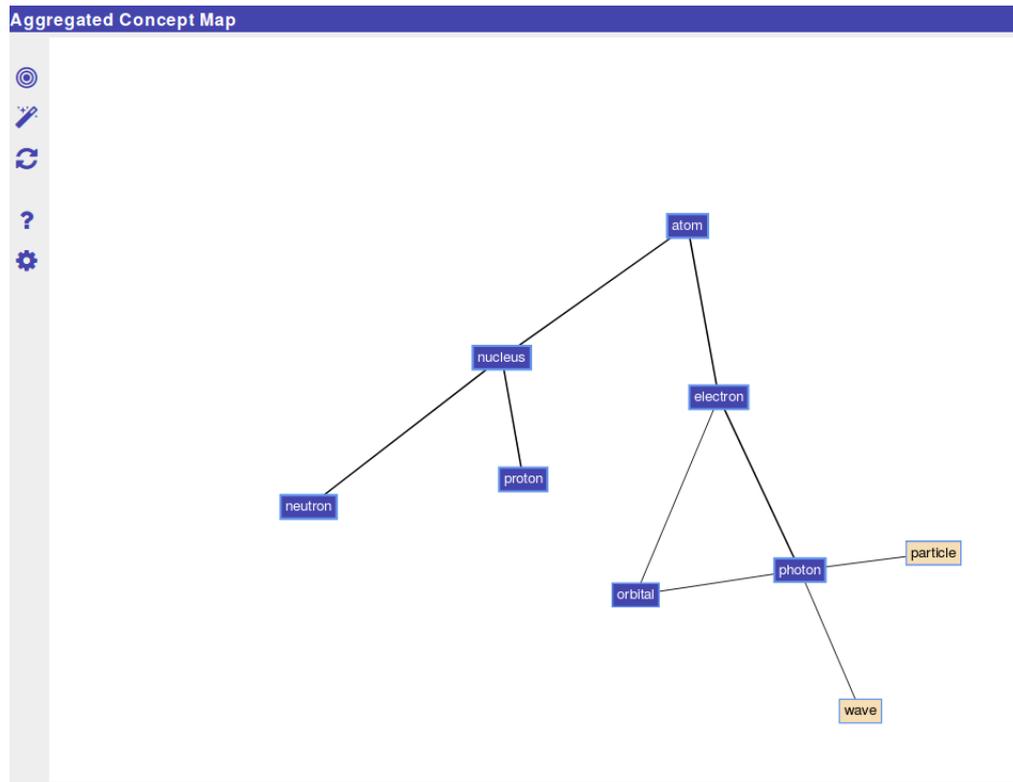
Figure 9: The aggregated concept map

The figures above (Figure 8 and 9) are examples of what the student sees when using the concept mapper. Figure 10 represents the view of the teacher in the aggregated concept map dashboard.
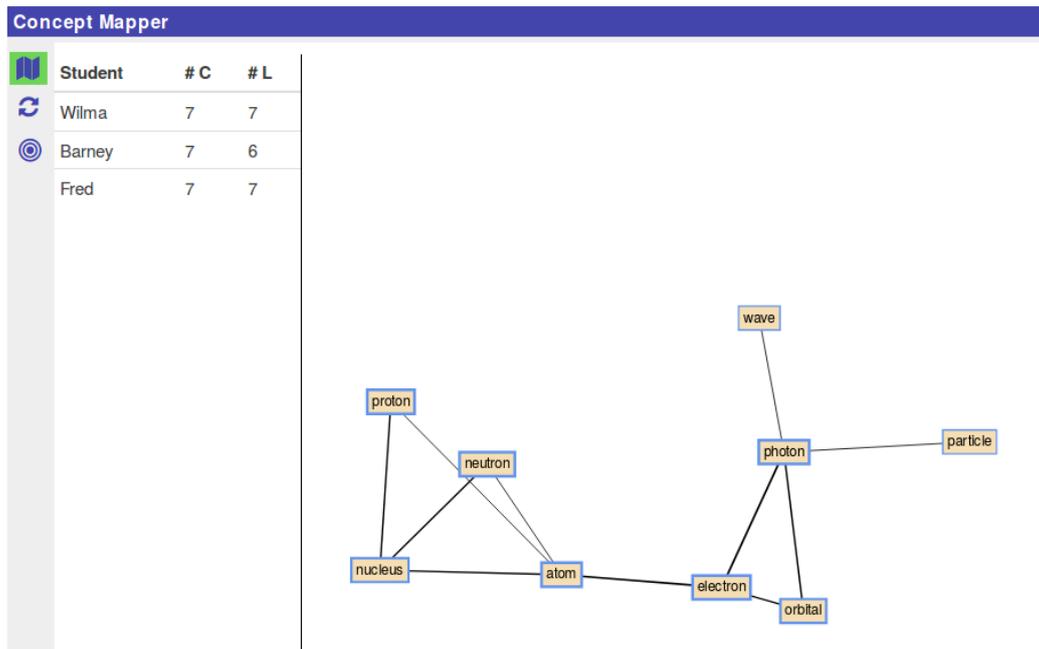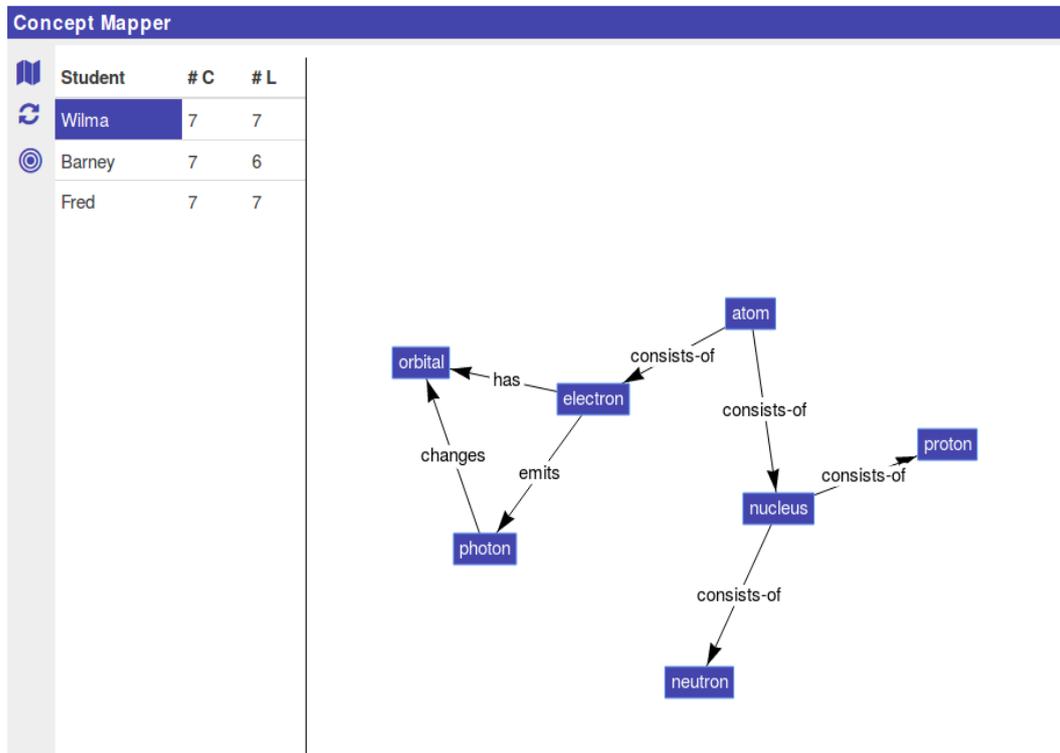

Figure 10: Concept map dashboard (teacher view)

The concept mapper dashboard for teachers shows a list of students as well as the ACM. In the ACM, the thickness of the borders for concepts, and lines for links indicates how many students used these concepts and the links between them.

Figure 11: Concept map in teacher view with one student selected

In Figure 11, the teacher has selected one of the students and can now see the concept map created by that student. The teacher can also select a concept, which then causes all the students who used that concept to become highlighted.
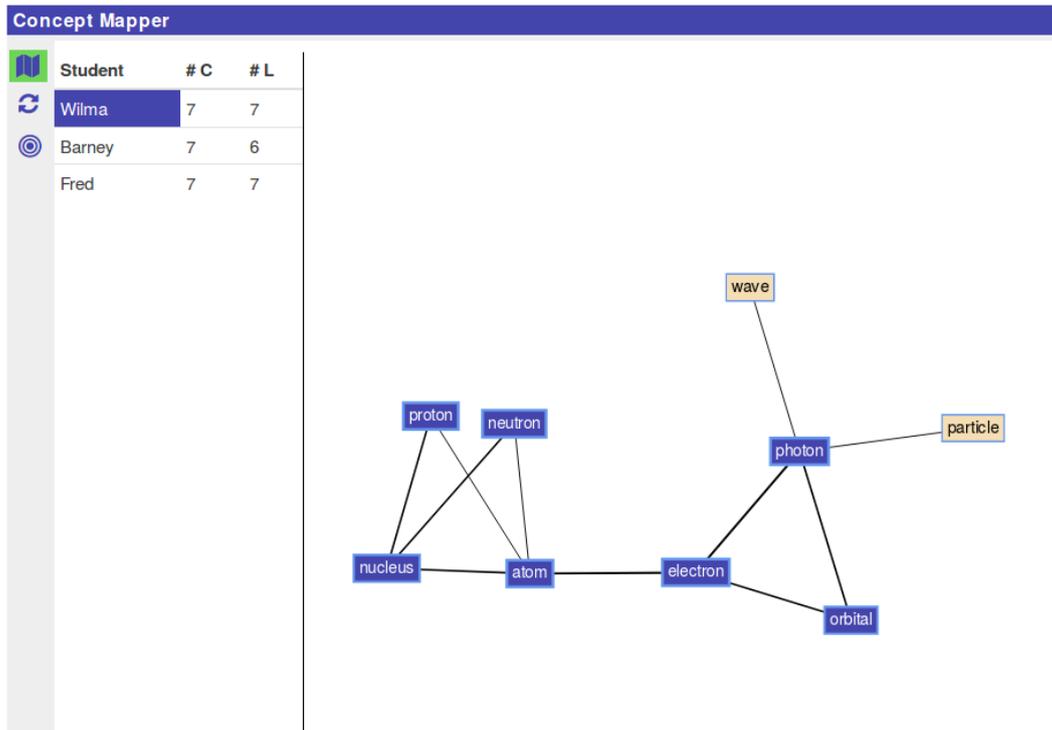
Figure 12: Aggregated concept map in teacher view with one student selected

The teacher can also select a student and then see the difference between the selected student and the aggregated concept map (Figure 12).

2.2.2 Timeline

The Timeline app displays a timeline of the student activities in a linear time scale (Figure 13). It shows the times during which the students were active in the different phases and apps of the ILS. The visualisation indicates at the same time how many times and in which order the students accessed the different phases and apps. This way the timeline also gives the students an insight on how the other students performed in the ILS.
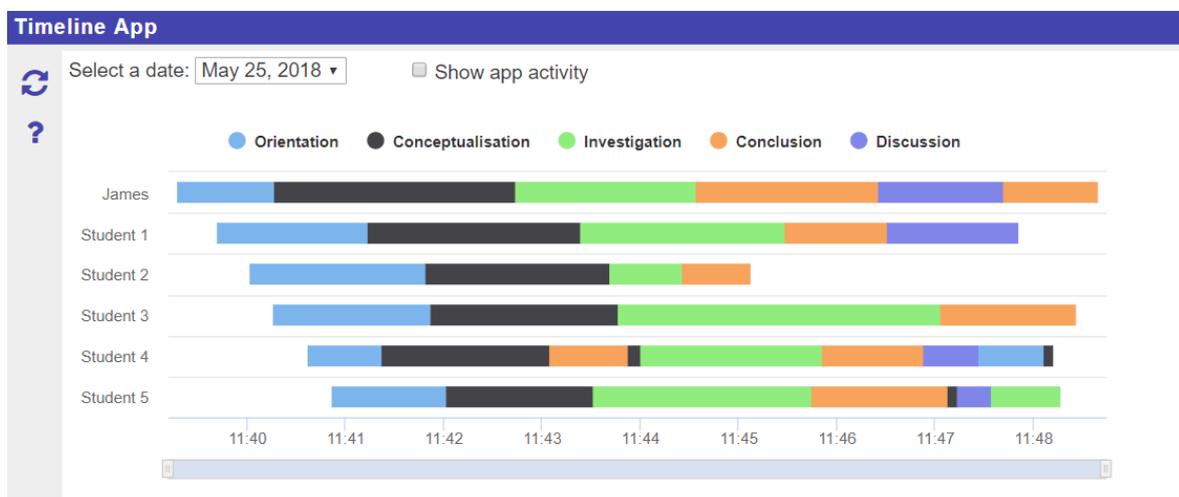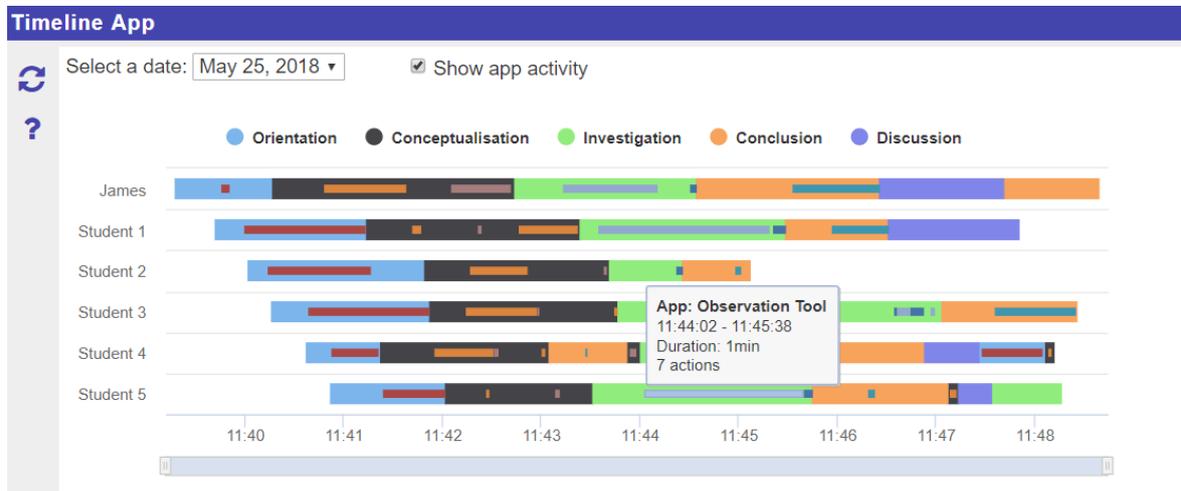

Figure 13: Timeline

The timeline shows the list of students on the y-axis and the time intervals on the x-axis. In the student view, the activities of all the students are shown but the names of the other students are anonymous.

Initially, only the phase activities are displayed in the timeline. Each phase is represented by a unique colour throughout the timeline. The student can then choose to also display the app activities by toggling the "Show app activity" checkbox. The app activities are shown as thinner bars within the corresponding phase activity (Figure 14). Hovering on any bar in the timeline displays more information about that activity, such as phase/app name, start and end times, and duration.

Figure 14: Timeline with app activities

The legend (above the timeline) gives an indication of which colour is used for which phase. Clicking on any of the phases in the legend will show/hide the corresponding phase from the timeline. This feature allows the students to better extract activity information by visually focusing on a subset of the phases. The students can also use the navigator at the bottom of the timeline to zoom in on a certain time interval so that they can have a better view of the activities during that period.

The Timeline app also has a teacher view that is very similar to the student view, the only difference being that the teacher view shows the names of all the students in the list (Figure 15).

Figure 15: Timeline teacher view
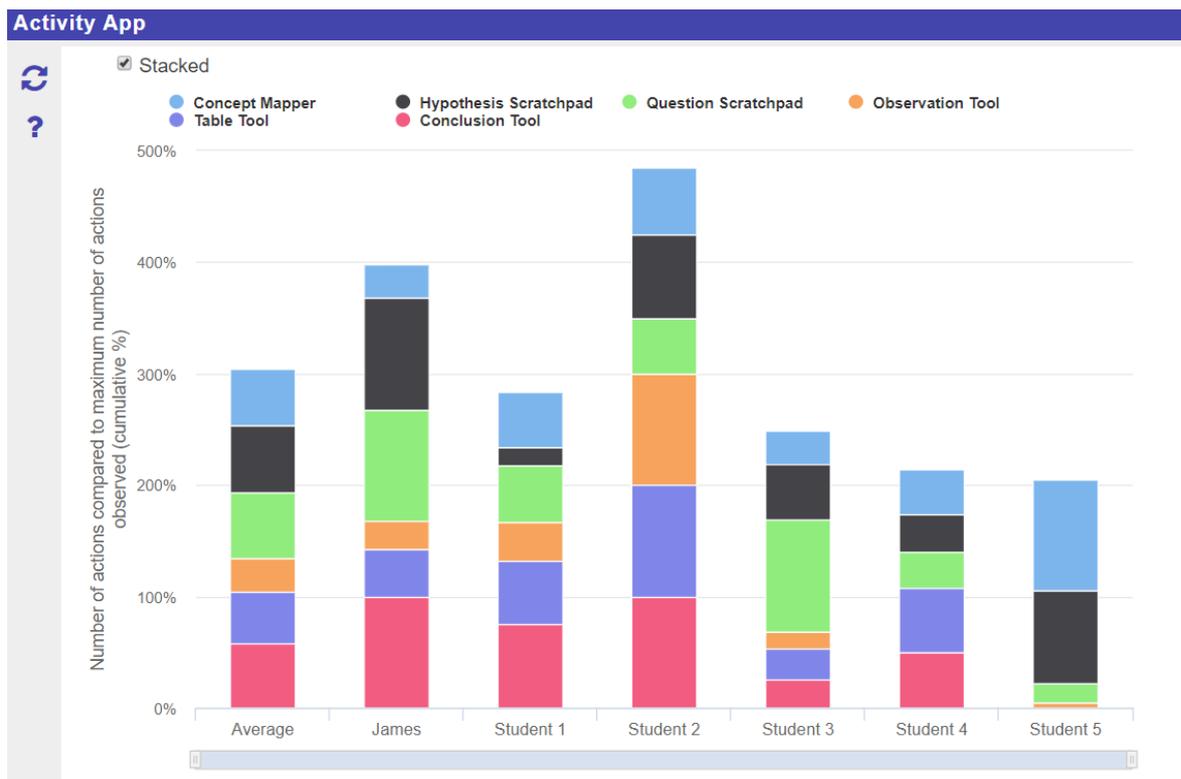
2.2.3 Activity plot

The Activity plot app presents a summary of the number of actions performed by the students in the different apps found in the ILS (Figure 16). Students can use it to compare their app activities with those of the other students and the average. In the student view, the names of the other students are hidden.

Figure 16: Activity plot

The summary of app activities is represented as a column chart, where each column represents the actions performed by a student in a specific app. The columns have percentage values. The number of actions by each student in each app is converted to a percentage relative to the maximum number of actions performed by all students in that particular app. Since some apps generally require more actions than others, the number of actions to percentage conversion is necessary to normalize between all the apps and allow the students to easily compare actions done in each app separately. Hovering on any column will display more information about it, such as the name of the app, the phase in which the app is found, number of actions, and percentage relative to the maximum number of actions performed.

Students can also switch between regular mode and stacked mode by toggling the "Stacked" checkbox (Figure 17). In the stacked mode, the columns are added up to one cumulative column for each student.

Figure 17: Activity Plot in stacked mode

The legend at the top indicates which colour is used for each app and clicking on an app in the legend will show/hide it from the chart. The students can also use the navigator at the bottom of the chart to zoom in and out.

The Activity Plot app also has a teacher view that functions similarly to the student view, but instead shows the names of all the students (Figure 18).
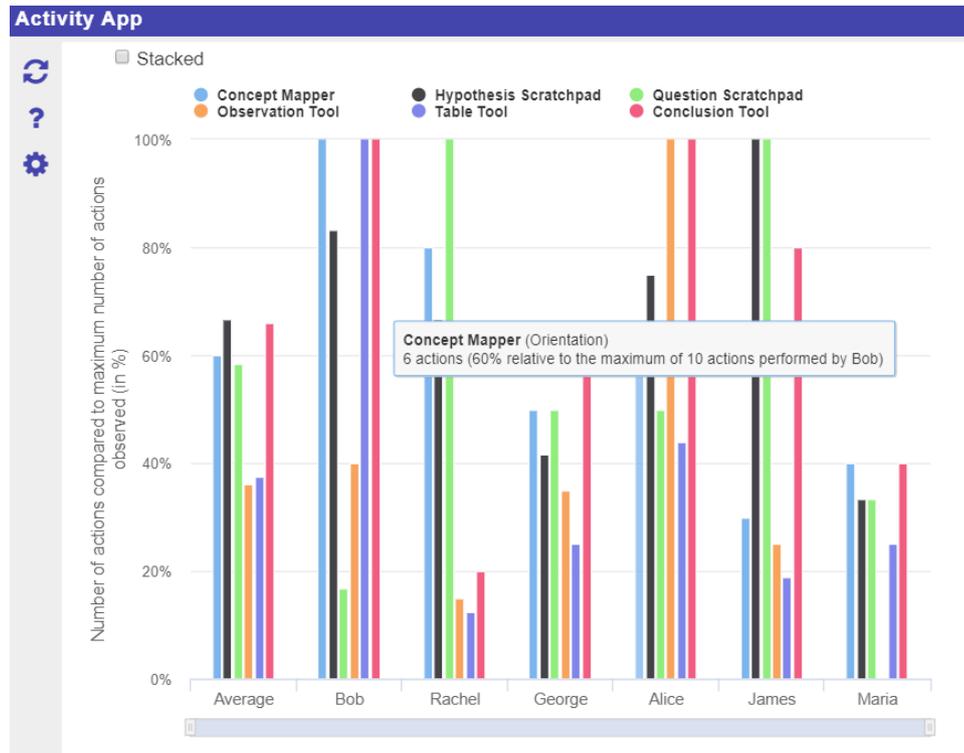
Figure 18: Activity Plot teacher view

2.2.4 Phase transitions

The phase transitions app (Figure 19) shows to the student which phases he or she visited and in which sequence. The transitions between phases are shown as a bar chart in which time is on the x-axis and the phase names are on the y-axis. The visualisation is slightly different from the timeline teacher view (Figure 15), because for the phase transitions tool there is only a single student and there is room for a separate bar for each phase. An example is shown in the screen below. Reflection questions can be added, see Section 2.3.5.
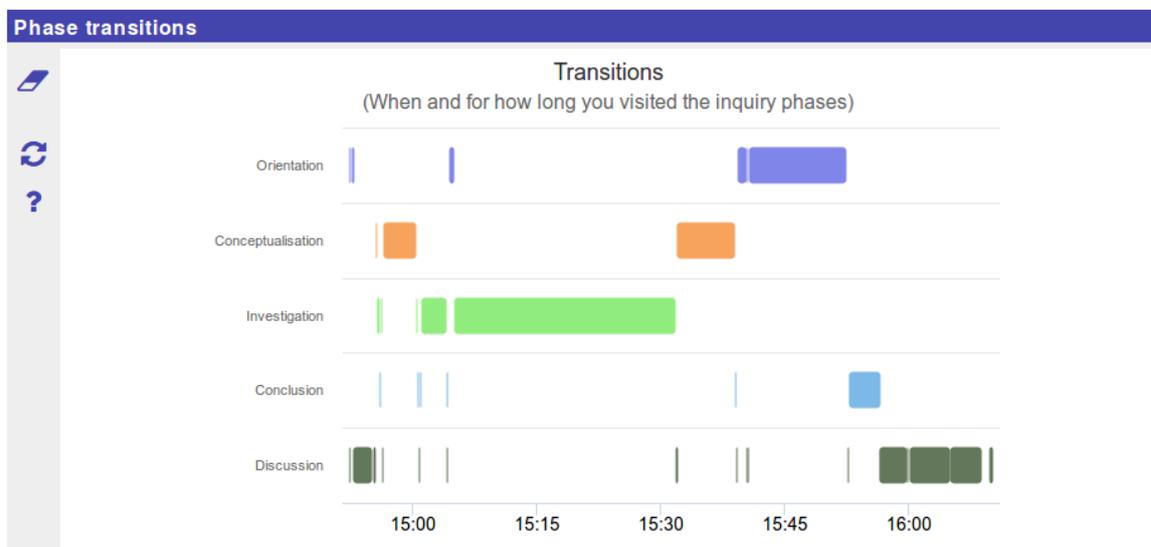

Figure 19: Phase transitions

2.2.5 Time spending apps

The Time spending apps show the total time spent in an ILS, and the time spent in the individual phases as a bar chart with the total amount per phase on the x-axis and the phases on the y-axis. For reflection purposes the actual time spent can be compared to a norm (either a percentage per phase, or total time per phase). Further, the norm can be specified by either the teacher for all students (this is the Time spent app, see next section) or by the student. In the latter case, the student has to plan his or her time in advance and this is done with the time planner tool (see Section 3.2.4.2).

2.2.5.1 Time spent

Figure 20 shows how the teacher can set the norm for the time spent in phases, as either a percentage or the total (absolute) time norm. When a phase is assigned a value of 0, it is ignored by the app. Usually, this is done for the phase in which the time spent tool itself resides.

Figure 20: Teacher configuration screen of the Time spent app

The student view of the time spent tool is given below (Figure 21). The tool allows the student to compare the norm time set by the teacher (Suggested) and the actual time (Yours).
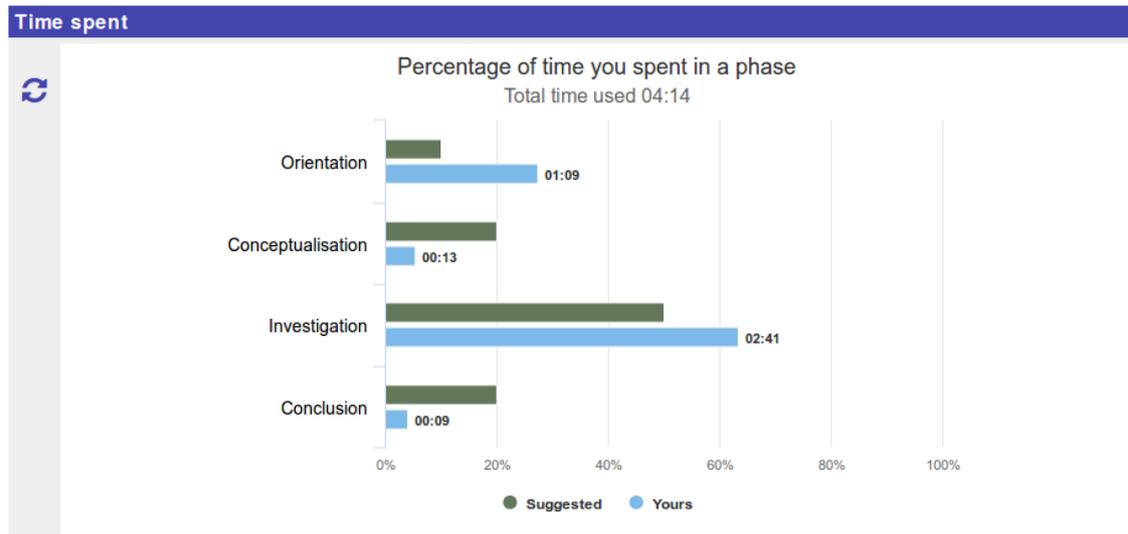
Figure 21: Time spent app (student view)

2.2.5.2 Time planner/checker

The time planner is an app in which the student plans how much time she or he will spend in each of the phases. This contrasts with the time spent in phases tool described in the previous section, which only displays the amount of time they actually spent. Because the time planner only makes sense when used by students the following "splash" screen is shown to the teacher (Figure 22).
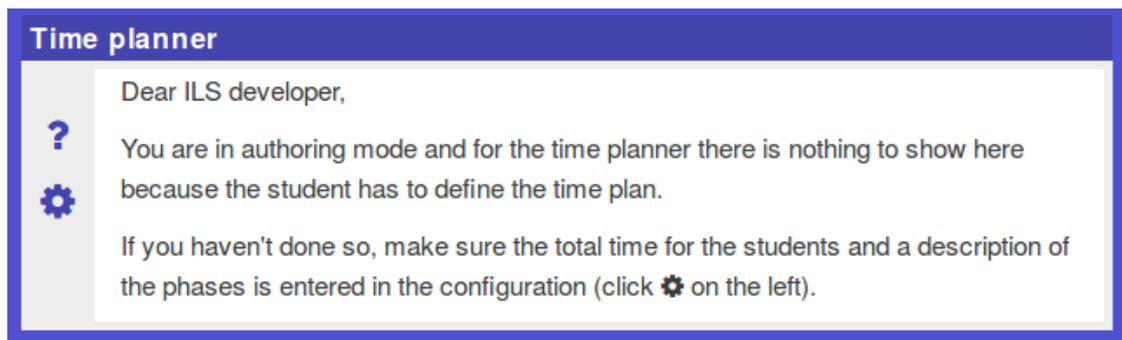

Figure 22: Teacher message in the Time planner app

In the configuration, the teacher specifies the total amount of time recommended/planned/... for working through the ILS. Additionally, a description is entered for each phase of the ILS. The latter is necessary for the student to be able to make a plan at all (given that he or she never used the ILS before). Figure 23 gives an example of a complete configuration. When a phase description is empty, Discussion in the example, the student is not expected to spend time there.
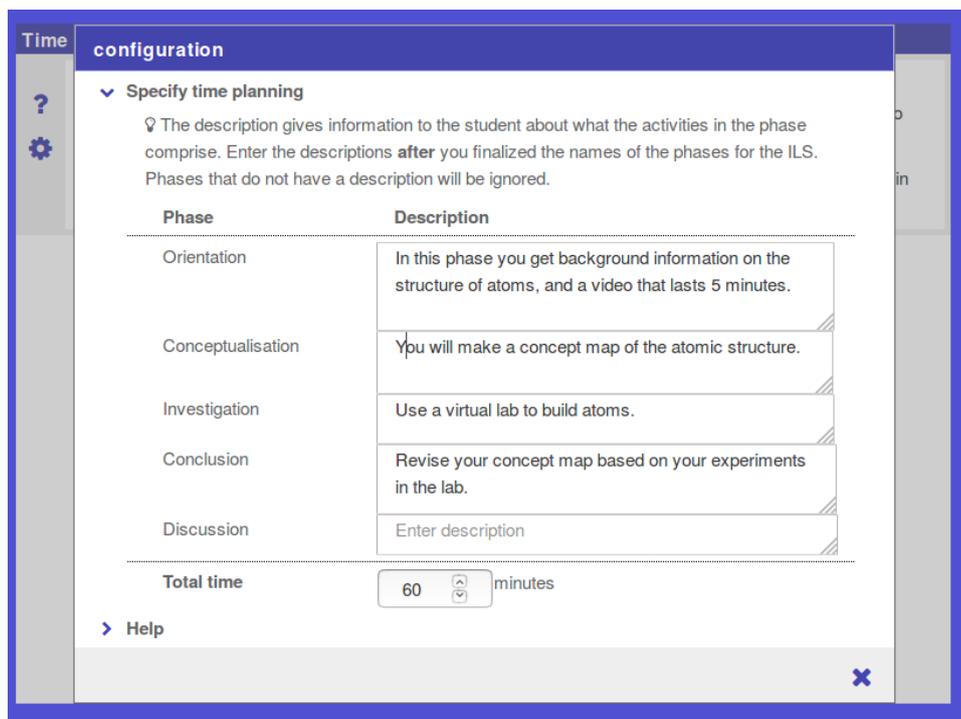
Figure 23: Teacher configuration of the time plan/checker app

The student view of the time planner tool is shown in Figure 24. For each of the phases he or she sees the description and can indicate the amount of time he or she expects to spend in this phase. The total amount turns green when it is equal to the total time specified by the teacher (60 minutes in this example).
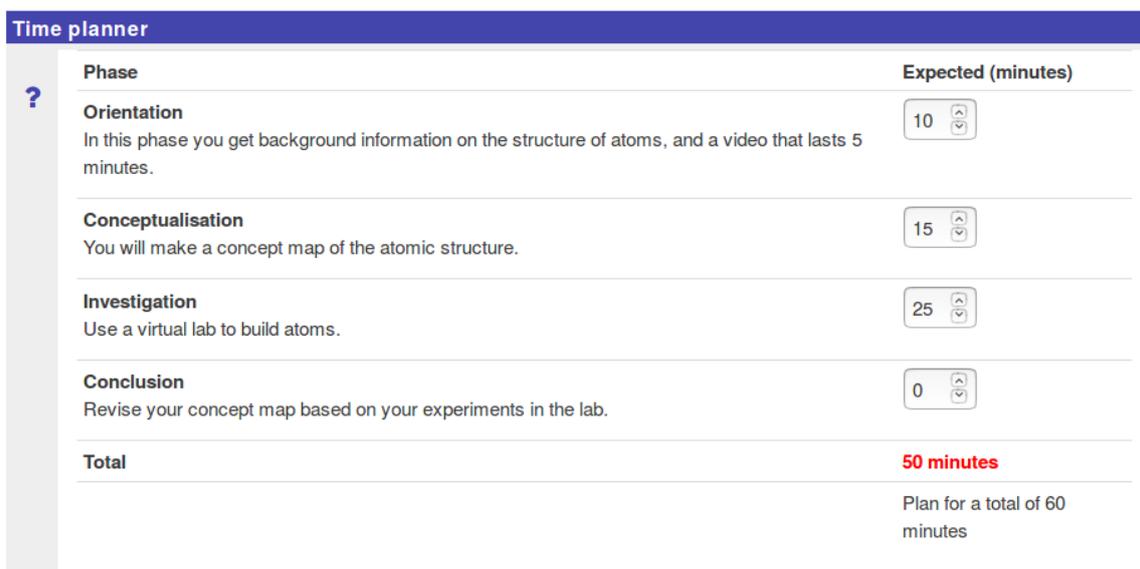

Figure 24: Time planner app (student view)

In one of the final phases of the ILS, here the Discussion phase, the time checker tool can be used to show the actual time spent and time planned by the student. See Figure 25 for an example. The students can then use this visualisation to reflect on their planning.
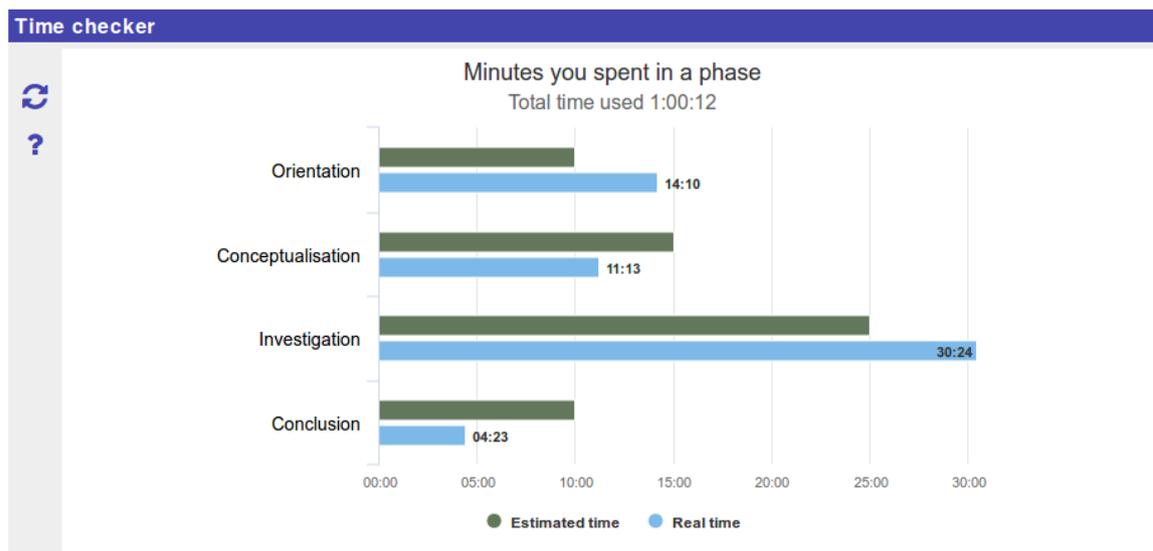
Figure 25: Time checker
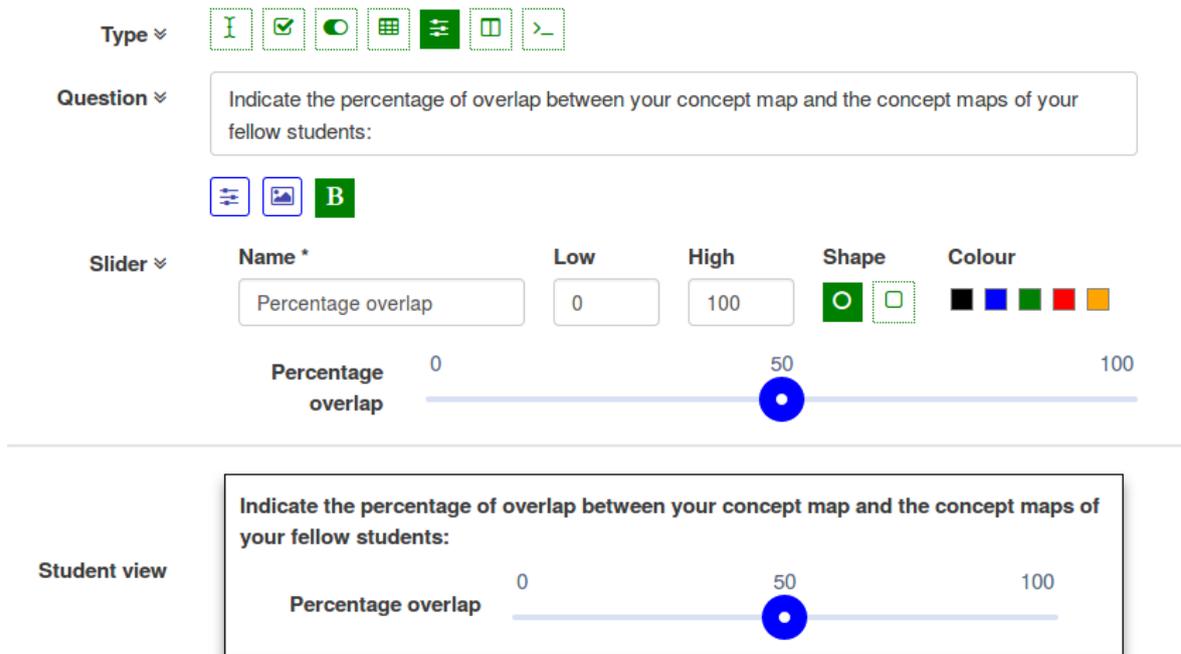
2.2.6 Reflection questions

Each of the apps in the preceding sections provided students with a visualisation of their product or process and in most cases (with the exception of the phase transition app) presented a norm with which students could compare their own product or process. To further guide the reflection process, a teacher can choose (in the configuration of the app) to add reflection questions which students have to answer. An editor to create these questions is provided and for each of the apps a set of dedicated default questions is given.

Reflection questions editor

Reflection questions prompt the student to reflect. A question consists of the text of the question, an optional image, and interface elements through which the student can provide an answer. The question text is entered either as plain text or using a rich-text editor. Although not very likely for reflection questions, the question editor supports scientific notation: sub- and superscripts for mathematics and chemistry. The answer options depend on the type of question. The following question types are currently available:

- *Open question.* Let's the student type a plain text answer.

- *Left/right or yes/no question.* The student has to choose between two options. Optionally the teacher can provide feedback when an answer is selected.

- *Multiple choice question.* The student has to choose between several answers. For each choice, the teacher can set correctness and provide optional feedback.

- *Pick from a list.* The student is presented with a list of options, and can select zero or more options from this list. An example would be "Which of these particles are not in your concept map?" with the list of answer options being "neutron, electron, proton, photon, etc."

- *Select a value.* The student is presented with a slider or multiple sliders, and drags these sliders to enter numerical values. Common usage in reflection is a confidence interval (0-100%) or rating one's performance on a task.

- *Tabular question.* The idea for this type of question is that the student creates a table in which each row reflects on a "thing". An example is the question on identifying important concepts in Figure 26. In the editor the teacher configures the columns of the table with fields for an open answer (where the student can then type the name of a concept for example), a choice between multiple values (checkbox) and a yes/no answer. When the student fills in the last open answer field, an empty row is added automatically.

- *Fill in the blanks question.* In this type of question the teacher inserts blanks inside the question text for the student to fill in.

- *Likert scale.* Not implemented yet.

Figure 26: Impression of the reflection question editor

An example of the user interface of the reflection question editor with the tabular question is given in Figure 27.

Figure 27: The tabular question editor

Aggregated concept map

In the aggregated concept map students can compare their own concept map to the aggregated concept map of all students (see Section 2.2.1 for details). The default reflection items are:

Figure 28: Default questions for the aggregated concept map

Timeline

With the Timeline students can compare their own process/approach to the process/approach of other students (see Section 2.2.2 for details). The default reflection items are:

Considering the timelines and the most common pattern. To what extend would you consider your approach an average approach?

not average - average

0   50   100

Pick two students who used considerably different approach than each other and you. Describe the approaches and explain why these students might have followed this approach:

student	discription of approach	explanation

Figure 29: Default questions for the Timeline app

Activity plot

With the activity plot students can see their activity in the apps, relative to the most active student in that app and the average number of activities for each app (see Section 2.2.3 for details). The default reflection questions are:

If you score >80% for an app you were among the most active students. Indicate in which apps you scored >80% and explain why:

app with score >80%	reason for my high activity score

If you score <40% for an app you were among the least active students. Indicate in which apps you scored <40% and explain why:

app with score <40%	reason for my low activity score

Consider your own activities and the activities of the other students. How can you improve your app use in the future?

Enter your answer

Figure 30: Default questions for the Activity plot app

Phase transitions

With the phase transitions app students can see how they navigated through the Inquiry Learning Space (see Section 2.2.4 for details). The default reflection items are:

Indicate to what extend you agree with these statements:

	0	50	100
I used a structured approach		●	
My approach was ideal		●	
In comparison to other students, my approach was average		●	

Describe your approach and reason what you would do the same and what you would change if you had to do something similar again:

Enter your answer

Figure 31: Default questions for the Phase transitions app

Time spent

With the Time spent students can see how much time they spent in each phase in total and compare it to an expert defined norm (see Section 2.2.5 for details). The default reflection questions are:

Compare the time you spent in each phase to the norm time for that phase. Write down each phase where your time deviates >2 minutes from the norm time, explain why this might have happened:

phase	deviation in minutes	explanation

Compare the time you spent in each phase to the norm time for that phase. Write down each phase where your time spent matches the norm or deviates <2 minutes. Provide for each a situation in which a deviation from this norm might be desirable:

phase	situation in which deviation might be desirable

Do you think that all inquiry projects will follow the general distribution as indicated by the norm times, explain why/why not:

Enter your answer

Figure 32: Default questions for the Time spent app

Time planner/checker

With the Time planner/checker students can see how much time they spent in each phase in total and compare it to their own planning (see Section 2.2.5 for details). The default reflection questions are:

Figure 33: Default questions for the Time checker app

3. Peer assessment

3.1 Main goal

The Peer assessment app can be used to engage students in the peer assessment procedure. This may include a reciprocal arrangement involving two roles for all students: The role of peer assessor, where students use peer assessment criteria to assess the learning products of their peers; and the role of peer assessee, where students will receive the peer feedback produced from their peers and review it to improve their learning products. This interchange between the two roles is beneficial and insightful as long as it promotes comparison between own and peer learning products and reflection upon one's own work. The learning products that can currently be assessed by means of the Peer assessment app (currently) include concept maps created with the Concept Mapper, student hypotheses formulated in the Hypothesis Scratchpad, and tables created using the Table Tool.

3.2 Workflow

The workflow of a peer assessment procedure involves a series of subsequent steps and engages students and the teacher. This sequence of activities needs to be timely planned and carefully orchestrated, since each next action is dependent upon one or several prior actions that precede it.

3.2.1 Creating learning products as a main prerequisite

A main prerequisite before starting the peer assessment procedure is that students will need to have constructed the learning products to be assessed. This will provide them with the necessary experience to act as peer assessors (i.e., they have been familiarized with the challenges of the relevant tasks) as well as the necessary motivation for acting as peer assessees (i.e., they will expect input from peer feedback to improve their learning products themselves).

3.2.2 Training for enacting peer assessment

Before engaging students in a peer assessment procedure, the teacher should have planned for a training session, especially if students are novices. Even in the case of students with experience in peer assessment, a training session may be necessary to elaborate on assessment criteria if new learning products are to be assessed, which have not been assessed in previous peer assessment procedures.

3.2.3 Asking for feedback

For the apps for which peer assessment is available, students can ask for peer feedback. This is done in the respective app, for instance in the Hypothesis Scratchpad, after having formulated one or several hypotheses. When students ask for peer feedback, they act as peer assessees (their learning products are to be assessed).

3.2.4 Giving feedback

Students can use a series of criteria to score learning products created by peers and provide comments supporting their scores. When giving feedback, students act as peer assessors (they assess learning products of a peer which have been assigned to them). A prior action before giving feedback and after students have asked for feedback is that the teacher has to assign learning products to be assessed to peer assessors.

3.2.5 Revising learning products

After peer feedback has been received, students should review it and decide which recommendations and suggestions of their peers are instrumental for improving their learning products. In this case, students act as peer assessees and make use of peer feedback to revise and increase the quality of their learning products.

3.3 Procedure

Teachers first need to add the Peer assessment app to the ILS, for example, to the teacher dashboard in Graasp. Second, teachers need to select the app(s) for which peer assessment will be available in the ILS. This will also determine the type and number of learning products to be assessed and influence the total time that needs to be invested in peer assessment. After selecting them in the Peer assessment app, the individual apps used to create the learning products to be peer assessed will get an additional entry in their configuration to activate and customize the peer assessment. Figure 34 presents the configuration in the Hypothesis Scratchpad, where teachers can choose the option to enable peer assessment (Peer feedback options; Use peer feedback checkbox). Teachers can have an overview of the menu with explanations presented to students and assessment criteria to be employed. Both can be adjusted by the teacher if this is considered necessary.


Figure 34: Activating the option for peer assessment in the Hypothesis Scratchpad

When a student intends to ask for peer feedback on the hypothesis he/she has formulated, then he/she should click on the icon with the bubbled question mark and submit the request (Figure 35).

All requests for peer feedback are forwarded to the Peer assessment tool on the teacher dashboard in Graasp, where the teacher can assign learning products to peer assessors (Figure 36).
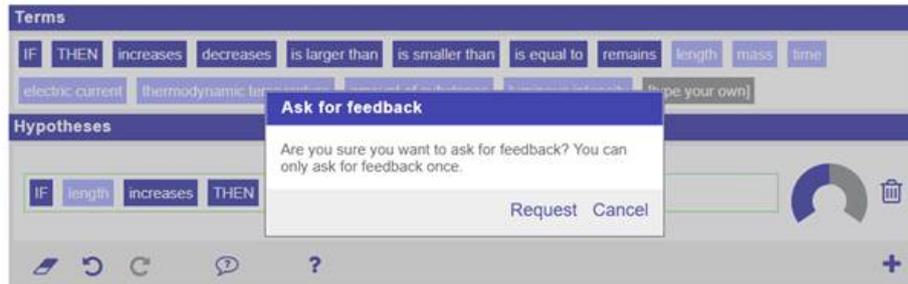

**Figure 35: Asking for feedback in the Hypothesis Scratchpad**
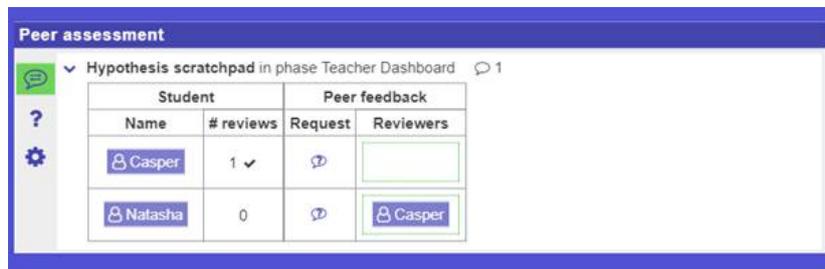
Figure 36: Assigning learning products to peer assessors

After learning products have been assigned, peer assessors receive a notification that a peer feedback request has been assigned to them, which is shown as a browser alert message (Figure 37; text and appearance of notifications will be improved later on). In the future, a notification system will also be operationalized to provide a general overview of peer feedback requests across the entire ILS.
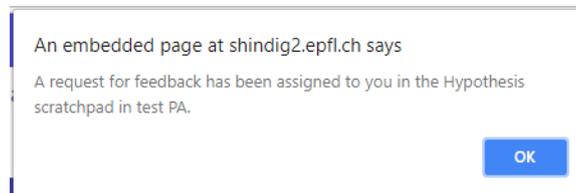

Figure 37: Notification indicating that a peer feedback request has been assigned

To review the learning product to be assessed and go through the assessment criteria, the peer assessor needs to click on the icon with the pen in the app where the request has been assigned, in our example, the Hypothesis Scratchpad (Figure 38). By clicking on the "pen" icon, peer assessors are presented with the learning product to be assessed and the assessment criteria to be used to provide peer feedback (Figure 39).
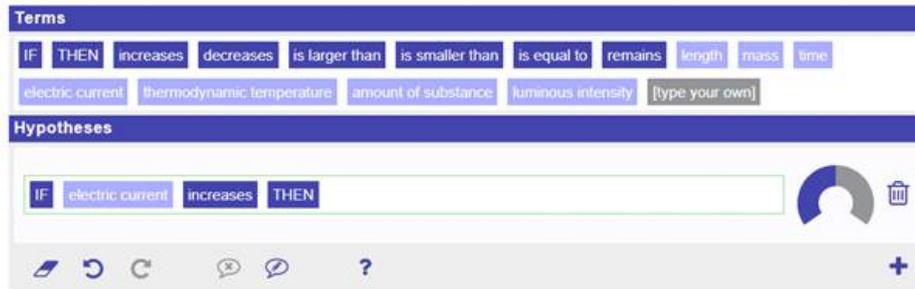
Figure 38: "Pen" icon in the bottom bar bubble of the Hypothesis Scratchpad notifying the peer assessor that a peer feedback has been assigned to them
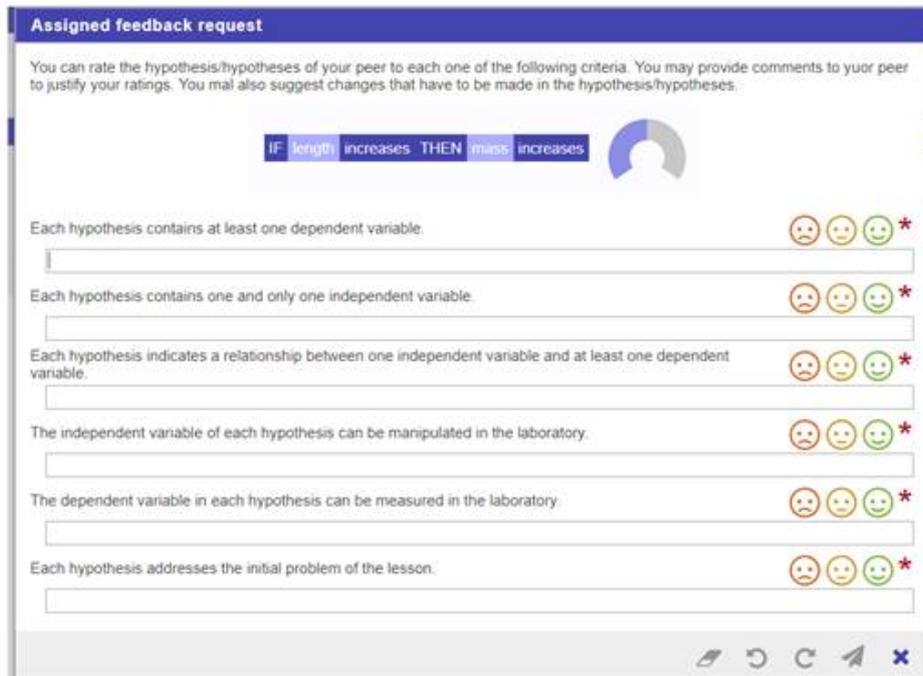
Figure 39: Learning product to be assessed (hypothesis) and assessment criteria to be used by peer assessors

Another notification is given to the peer assessee, when the requested feedback has been submitted by the peer assessor. To review peer feedback, the peer assessee needs to click on the "eye" icon (Figure 40). Then they can change their product based on the feedback, if they want to.

The teacher can have an overview of the original learning product of the peer assessee, the peer feedback that has been submitted by the peer assessor and the revisions that were made by the peer assessee. This overview is given in the Peer assessment app in Graasp by clicking the "question mark" icon (Figure 41).
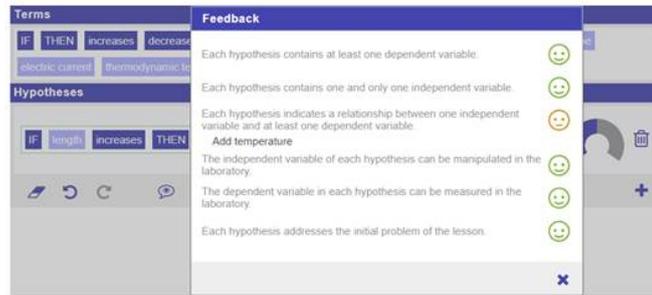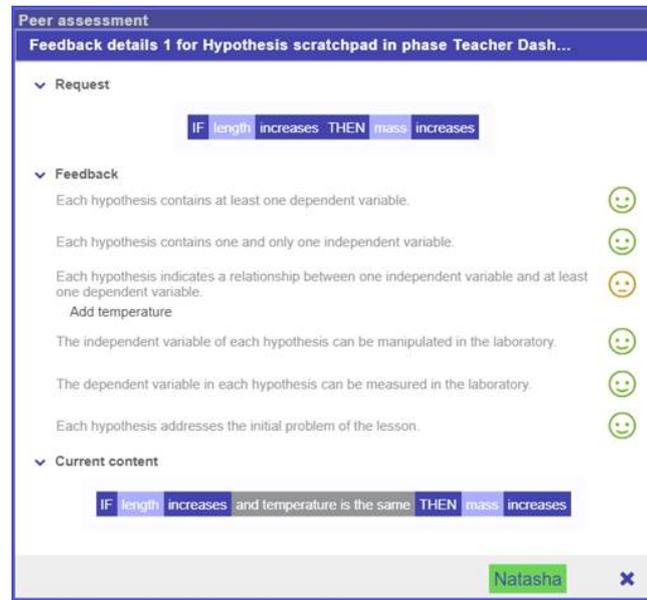
Figure 40: Viewing received feedback

Figure 41: Teacher's overview of the original learning product, peer feedback, and the revised learning product

It is a significant amount of work for the teacher to assign all the feedback requests, especially if it has to be done in real time during the lesson. We are considering to add automatic assignment options. There are multiple ways to assign feedback requests, such as first come, first serve; pairing students based on student level, product properties, etc. There are also the corner cases such as the last feedback request, where all other feedback requests have been assigned and all the other students have already got the number of designated feedback requests. Perhaps in this case the teacher should act as a peer assessor and give the feedback him-/herself. If multiple feedback requests can be assigned to each student, this makes automatic assignment even more challenging.

4. Accompanying icons and videos

To display the new apps on Golabz a set of new icons has been designed (see Figure 42).

Figure 42: Icons for the apps

To support the users of the new apps a series of new instructional videos have been developed. The instructional videos can be divided into two larger group. The first group of videos will show the teacher how the app can be used. The second group of videos focusses on configuring the apps. They are available at Golabz.

5. Outlook

The majority of the apps described in this deliverable have been released (sometimes in updated form) in June 2018. Some of the apps (like SpeakUp) have been tested with a large set of users, for some apps data with initial versions have been gathered (like the Peer assessment app) and for other apps still limited user data are available. In the coming reporting period we will gather user experiences for all the apps (e.g., in Task 4.4) and use these date for updated versions that will be released in M36 (D3.6). D3.6 will also include a final version of the RIDE app (collaboration) and the results of our exploration of possibilities for additional apps for reflection on products.