



Purpose of the study	Hypothesis	Participants	Instruments and Data Analysis	Design and Procedures	Findings
<p>The study was designed to identify of online tool designed to support students in their self-regulation process promoted students' regulatory activities and learning. The scaffolds implemented through the online support tool aimed at helping students to:</p> <ul style="list-style-type: none"> Set goals that reflect the phases of scientific learning Form a strategic plan by setting sub goals Highlight strategies to achieve such sub goals Monitor progress by taking notes per each goal and sub goal Evaluate the inquiry learning process Evaluate students' model utilizing a report template and standards implicit in goal hierarchies. 	<p>It was expected that groups who were provided with the support tool with the regulative directions embedded would achieve higher learning outcomes and produce more instances of planning, monitoring, and evaluation than the groups who were not provided with regulative directions.</p>	<p>Participants included 61 high-school students ages from 16 to 18 working in 19 triads and two dyads. The groups were randomly assigned to both conditions. At the end due to technical difficulties and students absenteeism complete data was retrieved from three groups from the experimental condition and two groups from the control condition.</p>	<p>The instrument for collecting the data were the log files of the co-Lab tool. Models created by the students were used to identify their conceptual domain knowledge as well as their scientific reasoning overall model structure. Therefore, learning outcomes were assessed from the number of correctly specified variables and relations in the models created by the groups.</p> <p>For assessing knowledge: one point was awarded for each variable named correctly, one point was awarded if that variable was of the correct type, one point was awarded for each correct link between two variables, and up to two more points could be awarded for each correct link between two variables.</p> <p>For assessing students' actions associated with planning the researchers focused on:</p> <ul style="list-style-type: none"> -Viewing of specific goals -Adding goals or sub goals -Viewing hints and -Viewing the goal descriptions <p>For assessing monitoring the researchers focused on:</p> <ul style="list-style-type: none"> -Adding notes to goals, -Marking goals complete -Checking the history <p>For assessing evaluation researchers focused on:</p> <ul style="list-style-type: none"> -Generating the report -Writing within the report <p>In addition the logs from the chats were used to assess verbal interaction. The analysis was done using an iterative approach: the first unit of analysis was determined by segmenting chat messages into utterances (a collection of words with a single communicative function) then they created classifications according to its function in the dialogue (e.g. cognitive, regulative, affective, procedural, and off-task utterances)</p> <p>With the initial coding the authors proceeded to group similar utterances into episodes. Regulative episodes were further subdivided as regulation for collaboration and regulation of the learning task.</p> <p>Data analysis was conducted looking at on between-group differences in learning outcomes and activities, and between-group differences were analyzed by non-parametric Mann Whitney U-tests. In addition, correlations were computed between learning activities and learning outcomes. Qualitative data was further analyzed (?)</p>	<p>The design was experimental with a posttest control group involving two conditions. Both conditions utilized a support tool called the Process Coordinator (PC). In the experimental condition regulative directions were embedded within the tool. In the control condition no regulative directions were embedded with the tool.</p> <p>The experiment was conducted over three weekly one hour lessons. The first lesson was a guided tour through the software called Co-Lab. an introduction to modeling, and instruction on how to plan, monitor and evaluate their learning according to the support tool they were assigned to.</p> <p>In the next two sessions students worked with the inquiry task. The communication among the groups were done by chat.</p>	<p>The results of this study were consistent with researchers' expectations for the portions of model quality and planning actions.</p> <p>Learning outcomes.- most of the groups were unable to attain complete models. However, and after applying the Mann-Whitney U-test, the authors demonstrated that the groups exposed to the online scaffolds on average achieved significantly higher model quality scores than those groups who were not exposed to the online scaffolds.</p> <p>Learning activities.- Were assessed in terms of number of verbal interactions. The students exposed to the software scaffolds performed more actions associated with planning. These results were reported in terms of descriptive statistics. Monitoring actions were performed less frequently by all students in both conditions.</p> <p>Evaluating actions were almost not performed by all students in both conditions. Since models developed by students were not at the point to be evaluated, the researchers excluded the evaluation activities from the analyses.</p> <p>The analysis of the instructional condition demonstrated that it had an effect on cognitive episodes where the students exposed to the scaffolds showing higher frequencies of these episodes than the groups not exposed to the scaffolds. In relation with the affective and procedural episodes, both were comparable across conditions.</p> <p>Relationship between model quality scores and learning activities. For this purpose Correlational analyses were conducted. Model quality was not associated with the use of the software Process Coordination in both conditions in the activities of planning and monitoring. Significant correlation between cognitive talk and model quality was found only in the case of the groups not exposed to the scaffolding hints.</p> <p>The qualitative analysis of the verbal interaction reveals that for the case of the students exposed to the scaffolding hints, it was reduced the need to discuss about regulative aspects. As a result this created more opportunities for discussions related to the cognitive task.</p>

For the case of learning outcomes, most of the groups were unable to attain complete models. However, further analysis demonstrated that groups exposed to the online scaffolds on average achieved significantly higher model quality scores than those groups who were not exposed to the online scaffolds. For the case of learning activities the researchers argued that students exposed to the software scaffolds performed more actions associated with planning, monitoring actions were performed less frequently by all students in both conditions, and evaluating actions were almost not performed by all students in both conditions. The analysis of the instructional condition demonstrated that it had an effect on cognitive episodes where the students exposed to the scaffolds showing higher frequencies of these episodes than the groups not exposed to the scaffolds. In relation with the affective and procedural episodes, both were comparable across conditions. After further analysis, researchers found that model quality was not associated with the use of the software Process Coordination in both conditions in the activities of planning and monitoring. Significant correlation between cognitive talk and model quality was found only in the case of the groups not exposed to the scaffolding hints. The qualitative analysis of the verbal interaction reveals that for the case of the students exposed to the scaffolding hints, it was reduced the need to discuss about regulative aspects. As a result this created more opportunities for discussions related to the cognitive task.

Description	Data Analysis Process	Results and Discussion
<p>Learning Outcomes Referred to students' conceptual domain knowledge and their scientific reasoning of the overall model structure. Models created by the students were used as the data collection instrument The learning outcomes were assessed from the number of correctly specified variables and relations in the models created by the groups.</p>	<p>For assessing knowledge: one point was awarded for each variable named correctly, one point was awarded if that variable was of the correct type, one point was awarded for each correct link between two variables, and up to two more points could be awarded for each correct link between two variables. The Mann-Whitney U test was used to test between group differences.</p>	<p>Most of the groups were unable to attain complete models. However, after further analysis the authors demonstrated that the groups exposed to the online scaffolds on average achieved significantly higher model quality scores than those groups who were not exposed to the online scaffolds. The authors concluded that providing regulative guidelines helped students create models of higher quality.</p>
<p>Learning Activities Referred to students' actions associated with planning, monitoring and evaluation. For assessing students' actions associated with planning the researchers focused on: a) viewing of specific goals, b) adding goals or sub goals, c) viewing hints and d) viewing the goal descriptions For assessing monitoring the researchers focused on: a) adding notes to goals, b) marking goals complete, and c) checking the history For assessing evaluation researchers focused on: a) generating the report and b) writing within the report</p>	<p>The analysis of the learning activities performed by students was done in terms of frequency of verbal actions related to planning, monitoring, and evaluation. Furthermore inferential statistics were conducted and results were reported in terms of P values.</p>	<p>The students exposed to the software scaffolds performed more actions associated with planning. The authors concluded that providing regulative guidelines helped students for planning purposes. The regulative directions in the regulated group gave them a head start devoting less time to develop task understanding and strategic plans. Monitoring actions were performed less frequently by all students in both conditions. Evaluating actions were almost not performed by all students in both conditions. The authors concluded that this may be due to the lack of time to conclude the task. Since models developed by students were not at the point to be evaluated, the researchers excluded the evaluation activities from the analyses. The analysis of the instructional condition demonstrated that it had an effect on cognitive episodes of groups exposed to the scaffolds; while for the case of the groups not exposed to the scaffolds it did not have an effect. In relation with the affective and procedural episodes, both were comparable across conditions.</p>
<p>Correlations Correlational analyses were performed to reveal how model quality scores related to learning activities.</p>	<p>Correlational analysis were performed as well as significant tests were conducted. The results were reported in terms of P values</p>	<p>Model quality was not associated with the use of the software Process Coordination in both conditions in the activities of planning and monitoring. Groups which engaged in more regulation of their group work also had lower model quality scores. Groups with lower instances of regulation of the learning task talk tended to achieve higher model quality scores.</p>
<p>Verbal Interaction This portion of the study was analyzed through qualitative approaches to provide more insight of the quantitative portion. The logs from the chat tool were used as the data collection method.</p>	<p>The analysis was done using an iterative approach: the first unit of analysis was determined by segmenting chat messages into utterances (a collection of words with a single communicative function) then they created classifications according to its function in the dialogue (e.g. cognitive, regulative, affective, procedural, and off-task utterances) With the initial coding the authors proceeded to group similar utterances into episodes. Regulative episodes were further subdivided as regulation for collaboration and regulation of the learning task.</p>	<p>For the case of the students exposed to the scaffolding hints, it was reduced the need to discuss about regulative aspects. As a result this created more opportunities for discussions related to the cognitive task.</p>