Implementation of learning analytics to online inquiry learning system under development

UNIVERSITY OF TURKU
Faculty of Education

Johanna Koho, Mirjamaija Mikkilä-Erdmann, Norbert Erdmann, Tuomas Mäkilä

Introduction

The formal definition of learning analytics is that "It is the measurement, collection, analysis and reporting of data about learners and their contexts, for purposes of understanding and optimizing learning and the environments in which it occurs." This definition was agreed on during the first learning analytics and knowledge conference in 2011 [4]. Learning analytics is a field that has during the last decade been growing rapidly with yearly publications going from few hundreds to several thousands. Despite the large amount of publications implementation of learning analytics is not yet routine design. One way of seeing learning analytics implementation is to think of it as a new from of assessment and to align it with learning design as part of assessment design. [3]

Online inquiry and scientific literacy are important parts of multi-literacy that is one of the transversal competences in the finnish national core curriculum. The importance of learning these skills has grown significantly as the development of internet and social media has made all kinds of information more readily available. Online inquiry is a process that requires a complex set of skills, that are difficult to both learn intuitively and require various evaluations from the teacher. Implementing learning analytics into the learning system designed to teach online inquiry will help the teacher to evaluate the learning process of each student so that the teacher can efficiently support individual learning.

Aim and methods

The aim of this study is the implementation of learning analytics into a new online inquiry learning system called Kidnet. Both the learning system and learning analytics are still under development. The implementation of learning analytics has been aligned with assessment. In assessment five questions of what, why, how, who and when are considered and in learning analytics a sixth question of where is added to the group[1], [3].

Table 1: Learning analytics "six W" questions

where	online inquiry learning environment
what	how well and progression
why	to identify difficulties and individual needs for guidance
how	process oriented descriptive analytics
who	teacher
when	after completing inquiry task

At this first stage of development the focus has been in gaining understanding of the online inquiry learning process and in obtaining measurements that can be used for aiding the teacher to identify the individual needs for guidance during the process. Kidnet is a closed learning environment and provides all necessary tools and sources for teaching online inquiry like search engine, bookmarks, evaluation forms, clipboard and word processor. For now, the information sources available in the learning system are only textual.

During the online inquiry process the student needs to understand the task, to search for information by using efficient search strategies, to evaluate both search results and relevance of sources, to select the main ideas and concepts from the relevant sources and to structure them and write a synthesis [2].
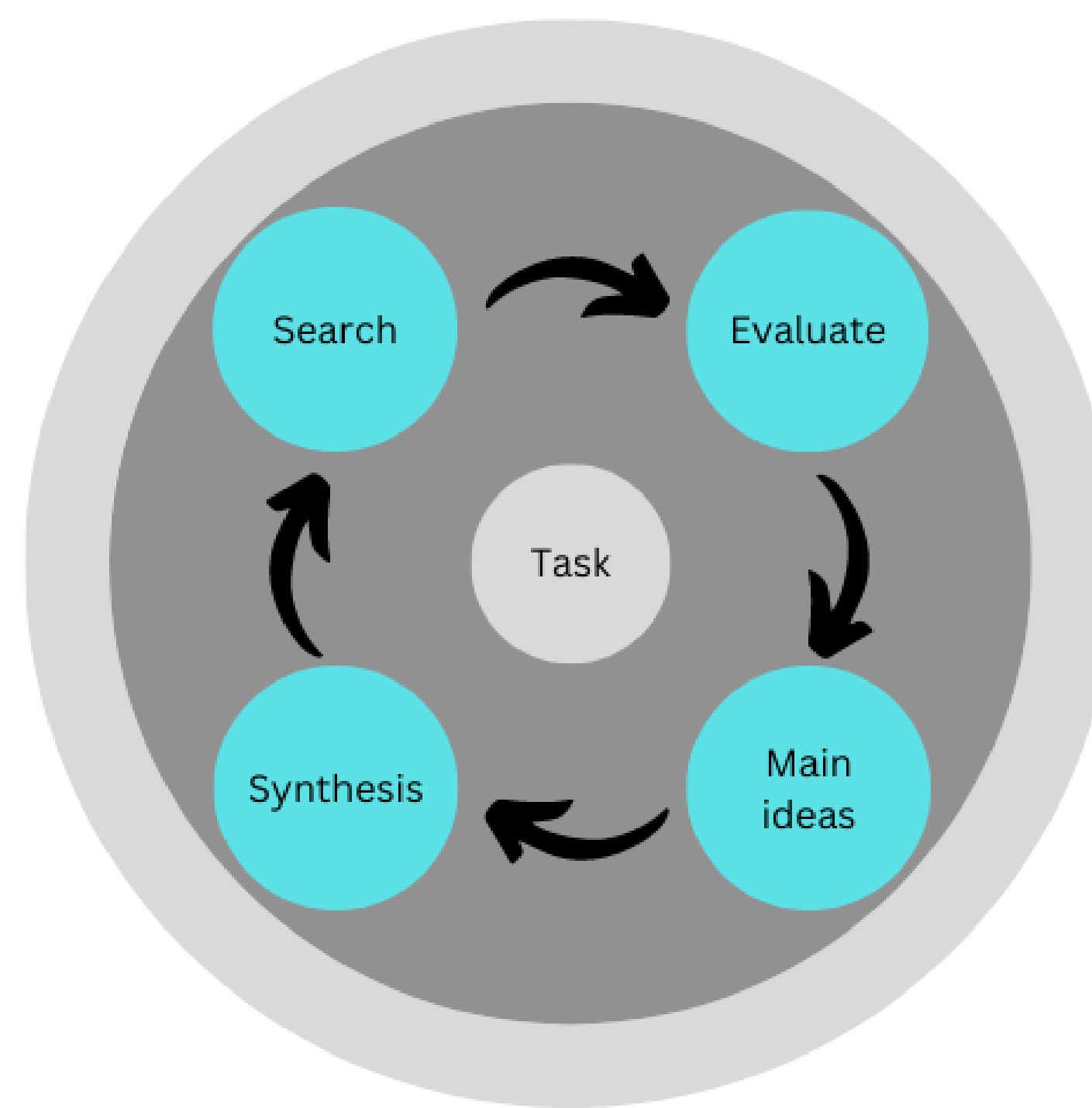

Figure 1: Online inquiry process

Both textual data and log-data are produced and collected in the learning system. The textual data consists of search terms, evaluations, selected main ideas and synthesis texts. Log-data is the process data of students actions and the timing of the actions inside the learning system. For the assessment of how well and progression of the online inquiry process, all the skills and phases of the process have to be evaluated. A more detailed list of what and how was constructed based on the online inquiry process.

Table 2: Evaluation measures

what	how
task	frequency of checking instruction, process strategy
search query	relevance, length, number
search evaluation	ratio of relevant from visited pages, timing of page visits
page evaluation	ratio of relevant to selected bookmarks, ratio of selected to visited relevant, ratio of selected to available relevant
main ideas	number and length, ratio of selected to relevant main ideas
synthesis	ratio and position of directly copied, number of relevant concepts, text coherence

Last spring Kidnet was used during an online inquiry teaching intervention with around forty fifth and sixth grade students. The intervention lasted six double lessons and consisted of several inquiry assignments. During the last two double lessons the students worked on a longer final assignment.

Result example

The data shows that the students have different strengths and weaknesses during the online inquiry process that can't be evaluated from the synthesis. For example there are three students A, B and C, that have completely different needs for guidance. In the final assignment student A has the strongest synthesis with a score of 4,5, student B has a good synthesis with 3,5 and student C has the weakest synthesis with 0,5. During the final assignment from these three students only student A was able to use three relevant sources although student C had also selected more than three relevant sources. Student B had only selected and used two sources. This might give the indication that student C needs help in using the sources and student B searching the sources and student A is strong in every aspect. Looking into more than just the synthesis from the final assignment and using the evaluation measures from table 2, we actually find out the assump-

tion is not accurate. Student A is able to pick out the main ideas and write coherent synthesis using own words, but he seems to have some difficulties in search and page evaluation. Student B starts with the same difficulties in searching and evaluation as student A, but improves towards the end of intervention. Student B needs most guidance in writing the synthesis with his own words and some guidance in selecting main ideas. Student C has difficulties in almost all areas of the online inquiry process. When looking into the students A, B and C data using evaluation measures from table two, the students have the ratio of relevant to selected bookmarks measure in common in 100 percent. That indicates that when reading a source they are all able to know an irrelevant source. However student A is not able to find all relevant sources as the ratio of selected to available relevant varies in his assignments from 0 to 70 percent and ratio of selected to visited relevant is under 100 percent indicating some need for guidance in page evaluation regarding what is relevant. All students also need guidance in search evaluation as the ratio of relevant to visited pages is below 50 percent. Student B is able to sometimes reach 100 percent in ratio of selected to available relevant. When looking into the selection of main ideas and synthesis trough the evaluation measures in Table 2. the students A, B and C seem to be on three different levels of working towards understanding, understanding and working towards synthesising and synthesising with own words. For student C the ratio of selected to relevant main ideas is very low and for student A it is very high close to 100 percent. Student B is in the middle closer to A than C. Because student C is not able to identify main ideas, he is not able to write a coherent synthesis answering the inquiry. Both student A and B are able to write a coherent synthesis but student B has ratio of directly copied in 84 percents when for student A it is 24 percent.

Conclusions and future research

These preliminary results are promising. The analysis of the data has given us understanding of the online inquiry learning process and the individual needs of students for guidance. Our next step is to use Kidnet in larger online inquiry intervention study with about 300 fifth and sixth graders lasting the same six double lessons. Then we will be testing these measures for giving feedback between two lessons to the teacher about the students individual process. With the aim that it will help the teacher in planning of the next lesson and targeting guidance for optimization of learning. The long term goal for the learning analytics implementation for Kidnet is to work towards having few online inquiry assignments available that have real-time intelligent tutoring and automated feedback available for the student.

References

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