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WHICH LEARNING ANALYTICS FOR A SOCIO-CONSTRUCTIVIST TEACHING AND LEARNING BLENDED EXPERIENCE

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The contribution describes and problematizes the use of learning analytics within a blended university course based on a socio-constructivist approach and aimed at constructing artefacts and knowledge. Specifically, the authors focus on the assessment system adopted in the course, deliberately inspired by the principles of formative assessment: an ongoing assessment in the form of feedback shared with the students, and which integrates the teacher's assessment with self-assessment and peer-assessment. This system obviously requires the integration of qualitative procedures - from teachers and tutors - and quantitative - managed through the reporting functions of the LMS and online tools used for the course. The contribution ends with a reflection on the possibilities of technological development of learning analytics within the learning environment, such as to better support constructivist teaching: Learning Analytics that comes closest to social LA techniques providing the teacher with a richer picture of the student's behaviour and learning processes.

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1 Introduction

Introducing technology in learning can take place in different ways depending on different pedagogical approaches, moving along a continuum that goes from more transmissive models to more interactionist and constructivist models. From the model depends, of course, the type of assessment: to a transmissive pattern generally corresponds a summative assessment, based on the attribution of scores / ratings by the teacher at the end of the path; if, on the other hand, the model envisages learning not only as an acquisition of knowledge, but as an active construction, the assessment method will try to take into account the complex underlying dynamics and observe, rather than the mere results, the processes of construction of knowledge and social participation implemented both at individual and at group level. From this point of view, the classical assessment systems - oral test, test, written paper - are not sufficient, as they mainly aim to verify the acquired knowledge and, as such, do not allow to reflect and bring out those processes. To this end, it is necessary to adopt forms of observation and monitoring - rather than just final assessment - and then use them *in itinere*, so that students can grasp the adequacy and efficacy of the learning strategies they put in place while building knowledge. In short, it is a matter of passing from a summative assessment to a formative one, using multiple assessment tools at different times of the learning path (Dochy & McDowell, 1997). This type of assessment allows students to be actively involved, to consider and enhance numerous skills and competences, and to value both the processes and the products of learning (Sambell, McDowell, & Brown, 1997). In fact, if the assessment is introduced within a course, rather than just at the end, it directly calls into question the students, pushing them to reflect on their own path and on how they learn (Gielen, Dochy, & Dierick, 2003): the feedback offered *in itinere* allows both to recognize the validity of what has been done up to that point, and to develop meta-cognitive skills, useful for reorganizing one's own knowledge. Moreover, this type of assessment, in addition to reflecting what really happens in the learning context, supports the individual taking of responsibility (Zimmerman, 2001) and sense of belonging to the group (Ligorio & Sansone, 2016), as well as self-regulation (Brown & Harris, 2013). That is to say that it genuinely reflects the socio-constructivist approach here presented. Taken together, the pedagogical approach and its corresponding assessment generates a huge amount of data within the digital environments used: from MOOC platforms to Learning Management Systems, from collaborative writing tools to shared drawing boards, from discussion forums to repositories of online resources. Each of these tools hosting activities, functions and roles for individual and groups to be performed. Hence the development of a new area of research in the field of educational sciences,

the Learning Analytics (LA) that Siemens (2010) defines as the use of data produced by the student and the analysis models to discover information and social connections, and to predict and give advice on learning. LA applications use data generated by student activities that can be roughly summarized in number of click, participation to discussion forums, formative assessment based on computer – assisted technology. These data can be used to monitor learning outcomes and improve them, if we adopt approaches and analysis tools consistent with the pedagogical model. Unfortunately, this practice is not yet widespread, as it requires the joint work of several stakeholders. That is, it is necessary that researchers, operators and developers work together around factors such as development of new tools, definition of target activities to analyse and care for ethical aspects related to privacy.

Recently, however, a new perspective about LA has emerged. It is called Social Learning Analytics and it includes analysis techniques which are strongly rooted in learning theories and focus its attention on the crucial aspects of active online participation (Ferguson & Buckingham Shum, 2012). The social LA includes: social network analysis and discourse analysis (De Liddo *et al.*, 2011; Ferguson & Buckingham Shum, 2011) with reference to exploratory dialogue (Mercer & Wegerif, 1999; Mercer, 2000), latent semantic analysis (Landauer, Foltz, & Laham, 1998) and computer-supported argumentation (Thomason & Rider, 2008). The development of Social Learning Analytics represents a progressive shifting from a data-driven inquiry to a learning theory-based research that increasingly concerns the complexity of lifelong learning that occurs in a variety of contexts. In this sense, these analytics would seem more capable of achieving objectives such as: guiding training interventions, providing automatic but personalized feedback, encouraging reflection and interaction in students, and identifying the best practices to follow.

2 The experience

The course in Experimental Pedagogy of the graduate course in Psychology and Health Sapienza University of Rome) takes place, since its establishment, in a blended mode, stimulating the students to carry out an experience of collaborative knowledge building (Scardamalia & Bereiter, 2006), through group-work both face-to-face in the classroom as well as online on the Moodle platform. About 80 students participate in the course each year, divided in groups of 8-9 students each. Over the years, the pedagogical design of the course has become more refined, following, as its main theoretical reference, the Trialogical Learning Approach (TLA, Paavola & Kakkarainen, 2014;). This approach aims to integrate the monological vision of learning - which emphasizes the individual activity of knowledge acquisition -, and the dialogical

one - which stresses the importance of the interaction in knowledge construction -, with a third element, represented by the use of mediation tools with the aim of constructing artefacts (tangible objects or knowledge objects) resulting from collaborative work. TLA authors provide a series of guidelines, the so-called design principles (Paavola *et al.*, 2011; Cesareni, Ligorio & Sansone, 2019), supporting the creation of pedagogical scenarios that, in line with the trialogical approach, are aimed at the collaborative construction of artefacts through the mediation of technologies. The design principles focus teachers' attention on some specific aspects of the educational planning: promoting collective agency together with individual agency; stimulate "contaminations" between practices of different disciplines and between professional and academic contexts; support the continuous advancement of knowledge and artefacts; facilitate reflection and metacognitive processes; provide flexible mediation tools to the learning group. In this sense, this approach hardly conceives learning as an acquisition of knowledge, rather as an active construction of it which lead to the development of crucial skills.

In summary, what characterizes a trialogical course is the organization of the activity around the creation of knowledge objects that have a real and concrete utility, that can convey the didactic contents of the discipline and that are realized in a collaborative way, through continuous improvements. The object chosen for the course of Experimental Pedagogy is a "pedagogical scenario", i.e. the conception and writing of an educational project to be carried out in a school or in a university classroom. Since the course of Experimental Pedagogy focuses on collaborative learning and on how technologies can support communities that build knowledge, the pedagogical scenarios need to capitalize on what was presented and discussed during the course, imagining a didactic unit based on an active and collaborative use of technologies to favour the construction of knowledge.

Around and before the final object, the course includes a series of steps to be completed in groups and individually.

First, students are divided into working groups of 8-9 people with a MOODLE course each, in which to discuss, build products, share resources, access to learning contents. Moodle is integrated with the Google Drive suite for collaborative writing and drawing (Google docs and Google drawing). The course is divided into 3 modules lasting three or four weeks, in which two different online activities take place. Each module ends with the creation of an object, reflecting the class contents and preparatory to the construction of the final object. Thus, for example, in the first module the lecture activities concern the different theories of learning ("*how to teach, how to learn")* which are addressed through lectures, movie watching, reading and discussing transcripts of educational activities; at the same time, in their Moodle course, groups

discuss on the figure of the "*Good teacher*" and then discuss the teacher's behaviour that they are asked to observe through a short online video. At the end of this module, the object to be collaboratively built by each group will be a conceptual map on the figure of the "*Good teacher*". A peer-review activity will follow in which each group will provide two other groups with advices on how to improve the map, so that a revised version of the object is produced and then presented to the classmates. The same process of lessons-forum discussions-object building-peer-review and final object improvement is followed for the other two modules.

To support collaboration and active knowledge creation in the group, in each module six scripted roles are assigned (Cesareni, Cacciamani & Fujita, 2016), that students play in turn. The roles can change from one to another module.

3.1 The contribution of Learning Analytics for a formative assessment in a socio-constructivist course

As mentioned before, a crucial aspect of a socio-constructivist course is assessment which cannot be merely of a summative type, instead requires a continuous analysis of students' participation and activities during the course so to provide them with formative feedback. Ongoing monitoring helps reflection and guides the students towards a better participation in the subsequent activities.

The question we asked ourselves is how learning analytics can help the teacher to perform such an assessment, including quantitative and qualitative data and analysis. How the learning analytics can support socio-constructivist teaching and learning approaches? That is why we focus on the recent framework of the Social Learning Analytics (Ferguson & Buckingham Shum, 2012) which seemed to us as a suitable way to take into account the set of processes activated, and the number of objects created from the students, individually and in groups.

Searching for these answers, we now explain how we performed the assessment in the course here described.

The feedback model adopted in this course, at the end of each module, provide students with an overall assessment of their online work. In fact, following the literature suggestions (Gielen, Dochy, & Dierick, 2003), when the assessment is introduced within a course, rather than just at the end, it pushes students to reflect on their own path and to develop meta-cognitive skills, useful for reorganizing their own knowledge.

The feedback model considers 4 different aspects: a) participation in the first module activity, b) participation in the second module activity, c) continuity in commitment to group work, c) role taking in the service of the group activity

(Tab.1).

Table 1
EXAMPLE OF FEEDBACK-ASSESSMENT PROVIDED TO THE STUDENTS OF A SINGLE GROUP-WORK AT THE END OF A MODULE

NAME	First Activity: Discussion about Learning with Technologies	Second Activity: Analysis and discussion on research articles	Continuity in commitment	Roles	Second Module Assessment
M..	very good	excellent	excellent	excellent	excellent
M.	good	very good	satisfactory		good / very good
R.	very good	excellent	excellent	excellent	excellent
A.	excellent	-	good		good / very good
E.	very good	-	satisfactory	good	good
C.	good	-	satisfactory		more than sufficient
R.	very good	excellent	very good	good	very good / excellent
C.	very good	excellent	good / very good	good	very good
A.	excellent	excellent	very good	excellent	excellent

To build this multi-dimensional feedback, the teacher and her collaborators first use the learning analytics provided by Moodle in order to create summary tables of each student's quantitative participation in the activities. These tables are then integrated with a qualitative assessment of the interventions that students write in the forums and of how they performed their assigned role (Tab.2).

Table 2
SUMMARY TABLE OF THE QUANTITATIVE AND QUALITATIVE DATA USED TO BUILD THE FEEDBACK FOR A SINGLE GROUP-WORK

	First Activity			Second Activity					
Name	Notes n°	Quality	Level 0/5	Notes n°	Quality	Level 0/5	Continuity	Role	Role assessment
Cl.	7	excellent	5	1	good	3	excellent	Skeptic	Excellent
Fr.	4	very good	4	0	-	0	good	-	
Re.	4	very good	4	1	good	3	fair	Synthesizer 2	Good
Em.	1	fair/good	2	2	good / very good	4	good	-	
Cl.	7	excellent	5	1	good	3	excellent	Synthesizer 1	Excellent

Th.	4	excellent	5	1	good	3	good	Map presenter	Very good
But.	8	excellent	5	1	good	3	excellent	Observer	excellent
Fl.	4	very good	4	0	-	0	fair	Social tutor	Fair
There.	3	excellent	5	0	-	0	good	-	

Specifically, to perform the qualitative assessment, once again it is necessary to use some sort of LA. In this sense, Moodle provides some functions to keep track of both the overall work of the group as well as of the individual work. By querying the database – using specific masks within the "report" function -, you can get a complete report of all the activities the student has conducted in the online course. Starting from this report, the teacher can evaluate the quality of the interventions based on previously defined criteria: the level of argumentation, the theoretical references to the classroom contents, the originality of the intervention and the connections to others' ideas. This last aspect is the one defining the level of collaborative knowledge building: keeping in mind others' ideas to improve them means actively contributing to the increasing of the group knowledge and to the refining of the collective products. This is the concept of *continuous improvement of ideas* proposed by Scardamalia and Bereiter (2006) when illustrating their theories about the communities that build knowledge, and which is made evident in the Knowledge Forum[1] through the summary notes called "*Build on*".

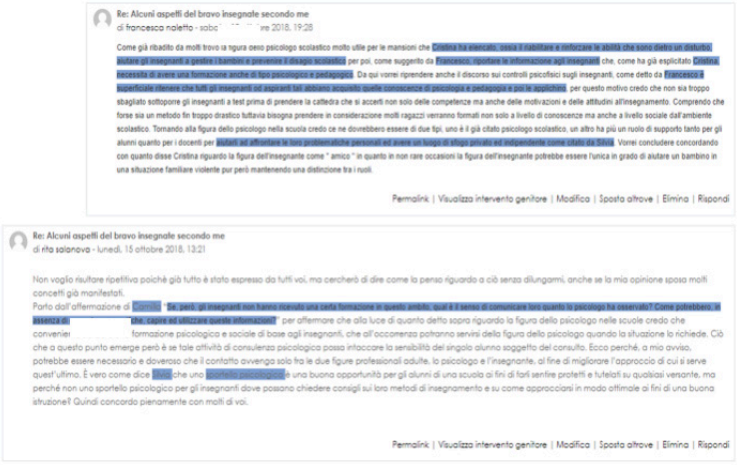

Fig. 1 - the connections to groupmates' ideas highlighted the students in their interventions.

[1] Knowledge Forum is the educational software designed to help and support knowledge building communities (http://www.knowledgeforum.com/).

At the moment, Moodle does not allow us to trace connections between different interventions, so to compensate for this lack, the students of this course are asked they themselves to highlight the concepts taken up by their colleagues which they intend to expand or correct (Fig.1).

It is worth saying that, while on the one hand the request for highlighting was created to compensate for a limitation of the platform, on the other, it promotes students' awareness, as it makes them understand the importance of reading others' interventions taking them into consideration, thus modelling such behaviour. Ultimately, this action helps the teacher in the assessment of the collaborative knowledge building. Starting from the already highlighted connections, the teacher can focus on the assessment of the subsequent parts of the speech, evaluating the level and quality to which they extend others' ideas.

Another important feature in a knowledge building community is how to maintain an adequate continuity and consistency in students' commitment. Writing several interventions at the beginning of the activity and then taking no more interest in what the others say cannot possibly lead to a general advancement of knowledge. A continuous commitment, reading and commenting on the groupmates' interventions is rather a matter to be recognized with a positive assessment. Moodle LA can help in this assessment. Access tracking ("log") allows you to see how the student's engagement is distributed. In the case reported in figure 2, the effort is concentrated only in the first part of the course: this student expressed his ideas only in the beginning of the activities - probably for "absolving the task" - but then he showed no more interest in the progress of the discussion in his group. Thus, the log transcripts represent a further support to evaluate students' interventions and, more generally, their commitment.

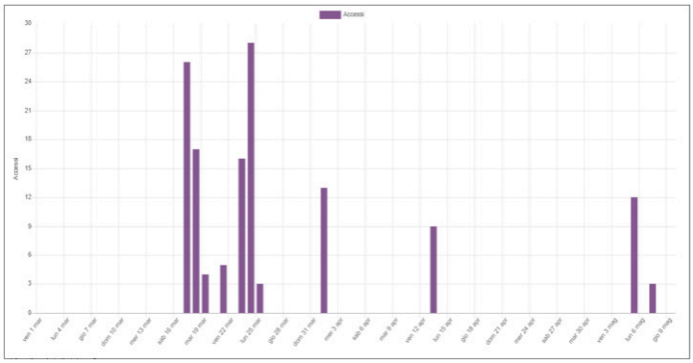

Fig. 2 - Example of log tracking to assess the continuity and consistency in students' commitment.

The role taking in service to the advancement of the group knowledge is the last aspect we consider in formative assessment. In this case too, a good help is provided by the LA, since they show the actions and activities carried out by the students who covered a role, which will be subsequently qualitatively assessed. For example, after having defined the contribution of those who played the role of the skeptic, the teacher can assess whether she/he acted consistently with this role, *avoiding commonplace ideas in the group discussion in order to generate prolific doubts* (Cesareni, Cacciamani & Fujita, 2016).

The online activity of this course does not end within the Moodle platform but, as already mentioned, it also includes the Google Drive Suite for collaborative writing of texts. The final object, the intermediate products, as well as the peer-feedback sheets, they are all created in through Google Documents which are then linked in the Moodle course of each group. Just like Moodle, the Drive documents can track the activities performed on them. Going back to the different versions of the text, the contributions provided by the various participants who have logged into the document itself are highlighted in different colours. The teacher can, in this way, observe the growing of the ideas in the document, as well as the contribution of the different authors. That is how he/she can take into account the complex underlying dynamics and observe, rather than the mere results, the processes of construction of knowledge

3 Reflections and conclusions

In the previous paragraph we described the assessment system adopted and defined in the course of Experimental Pedagogy. It is an assessment model intentionally inspired by the principles of formative assessment: an ongoing assessment in the form of feedback - and not just judgments / scores - shared with the students, and teacher's and peer's assessment. This system requires the integration of qualitative procedures - managed by the teacher and her collaborators - and quantitative data mining - managed through the reporting functions of the LMS and tools used for the course, Moodle and Google Drive. This operation has not been easy, as Moodle has shown some gaps in tracing elements useful for allowing the assessment of a socio-constructivist course. First, when it comes to assessing the quality of the interventions in the forums, the only contribution the platform provides is the possibility of grouping them into a single file (the complete "report") to be evaluated. In the same way, no analysis or even tracking is possible at the level of collaborative knowledge building, where it would be very helpful to automatically highlight those parts of text which are present in several interventions and the subsequent arguments that come to constitute the added knowledge.

A type of LA that comes closest to social LA techniques would reflect

the socio-constructivist learning here proposed in a more coherent way, providing the teacher with a richer picture of the student's behaviour and learning processes. We all know very well that just accessing a resource or being connected for a considerable amount of time does not mean having really acquired knowledge or in-depth concepts. An interpretative mediation of these quantitative data is always necessary, both by the teacher and within the group of students itself, especially if we consider that, in a blended course, not all the work takes place online.

The correct interpretation and placement of the quantitative data, as well as a suitable integration of qualitative and quantitative data is what is required on the one hand by the teachers, on the other by the learning software and the LA techniques, which must necessarily be developed in close connection with the pedagogical assumptions. To this aim, the reflection on the assessment must precede the planning and implementation of the measurement.

Ultimately, we believe that the direction to follow should start from a global understanding of how learning can be facilitated and its socio-relational factors supported, to arrive at personalized reporting and visualization methods that are made available to students and clearly linked to mechanisms for improving their learning.

REFERENCES

Brown G. T. L., & Harris L. R. (2013), *Student self-assessment*, in J. H. McMillan (ed.) *The SAGE handbook of research on classroom assessment*. 367-393, Thousand Oaks, CA, Sage.

Cesareni D., Cacciamani S., Fujita N. (2016), Role taking and knowledge building in a blended university course, *International Journal of Computer Supported Collaborative Learning*. 11 (1), 9-39 DOI 10.1007 / s11412-015-9224-0.

Cesareni D., Ligorio M.B., Sansone N. (2019), *Fare e collaborare. L'approccio trialogico nella didattica*, Milano, Franco Angeli.

De Liddo A., Buckingham Shum S., Quinto I., Bachler M., & Cannavacciuolo L. (2011), Discourse-centric learning analytics. *Proceedings of the 1st International Conference on Learning Analytics and Knowledge*, (pp. 23-33). Banff, Alberta, Canada

Dochy F., & McDowell L. (1997), Assessment as a tool for learning. *Studies in Educational Evaluation*, 23, 279–298.

Ferguson R., & Buckingham Shum S. (2011), Learning analytics to identify exploratory dialogue within synchronous text chat. *Proceedings of the 1st International Conference on Learning Analytics and Knowledge*, (pp. 99- 103). Banff, Alberta, Canada.

Ferguson R., & Buckingham Shum S. (2012), Social learning analytics: five approaches.

Proceedings of the 2nd International Conference on Learning Analytics and Knowledge, (pp. 23- 33). Vancouver, British Columbia, Canada.

Gielen S., Dochy F., & Dierick S. (2003), Evaluating the consequential validity of new modes of assessment: The influence of assessment on learning, including pre-, post-, and true assessment effects, in: M. S. R. Segers, F. Dochy, & E. Cascallar (eds.), *Optimising new modes of assessment: In search of qualities and standards*. 35-54, Dordrecht/Boston, Kluwer Academic Publishers.

Landauer T., Foltz P., & Laham D. (1998), An introduction to latent semantic analysis. *Discourse Process*, 25(2-3), 259-284.

Ligorio M.B., & Sansone N. (2016), *Manuale di didattica blended: il modello della Partecipazione Collaborativa e Costruttiva (PCC),* Milano, Franco Angeli.

Mercer N. (2000), *Words and Minds: How We Use Language To Think Together*, London, Routledge.

Mercer N., & Wegerif R. (1999), *Is "exploratory talk" productive talk?, Learning with computers: analysing productive interaction*, New York, Routledge.

Paavola S., Lakkala M., Muukkonen H., Kosone K. & Karlgren K. (2011), The roles and uses of design principles for developing the trialogical approach on learning, *Research in Learning Technology*, *19* (3), 233-246.

Sambell K., McDowell L., & Brown S. (1997), 'But is it fair?' an exploratory study of student perceptions of the consequential validity of assessment Studies", *Educational Evaluation, 23*, 349-371.

Scardamalia M., & Bereiter C. (2006), Knowledge building: Theory, pedagogy, and technology, in: K. Sawyer (ed.), Cambridge handbook of the learning sciences. 97-118, New York, Cambridge University Press.

Siemens G. (2010, August 25), What Are Learning Analytics?. [web log post] Elearnspace.org., URL: http://www.elearnspace.org/blog/2010/08/25/what-are-learning-analytics.

Siemens, G. (2012). Learning Analytics: Envisioning a Research Discipline and a Domain of Practice. In Proceedings of the 2nd International Conference on Learning Analytics and Knowledge (LAK 2012) (pp. 04-08). New York, USA: ACM.

Thomason N., & Rider Y. (2008), Cognitive and pedagogical benefits of argument mapping: L.A.M.P. guides the way to better thinking, in A. Okada, S. Buckingham Shum, & T. Sherborne (eds), *Knowledge Cartography: Software Tools and Mapping Techniques*. 113-130), London, Springer.

Zimmerman B.J. (2001), Theories of self-regulated learning and academic achievement: an overview and analysis, in: B. J. Zimmerman & D. H. Schunk (eds.), *Self-regulated learning and academic achievement*. 1-37 Mahwah, NJ, Lawrence Erlbaum Associates.