

PROMOTING 21ST CENTURY SKILLS IN HIGHER EDUCATION THROUGH COLLABORATION AND ACTIVITIES

Nadia Sansone (*Sapienza University of Rome*), Donatella Cesareni (*Sapienza University of Rome*), Ilaria Bortolotti (*Sapienza University of Rome*)*

ABSTRACT: The paper presents a model of university teaching where students are involved in concrete activities and collaborate while developing key competences for the academic and working future. 52 students of the Degree Course in Psychology at the Sapienza University of Rome participated to the activity. The method of data collection and analysis combines qualitative and quantitative approach. Results show a general perception of skills enhancement and a good appreciation of the course, especially in comparison with traditional learning modes.

KEYWORDS: skills, collaborative learning, project-based learning, technologies.

1. Theoretical introduction

One of the main goals of secondary and higher education is to ensure that students acquire useful skills to achieve success not only in their studies, but also in their future career and in daily life. A comprehensive list of 21st century skills has been provided by Binkley et al. (2012) who identified ten skills grouped into four clusters: ways of thinking (e.g., creativity and innovation, critical thinking, problem-solving, decision-making, learning to learn, and metacognition); ways of working (e.g., communication and collaboration – teamwork); tools for working (e.g., information literacy, ICT literacy), and living in the world (e.g., citizenship; life and career; personal & social responsibility). By mastering such skills, tomorrow's citizens should be able to solve complex problems, innovate work knowledge practices, create and support professional networks, and cope with multiculturalism and continuous change.

To enhance meaningful and long-lasting learning that can promote knowledge acquisition as well as crucial skills development, more recent literature (Pozzi *et al.* 2012; Schellens *et al.* 2006) asks for educational approaches in which to: fruitfully integrate individual and group activities, structure and guide focused learning discussions, think about specific tasks

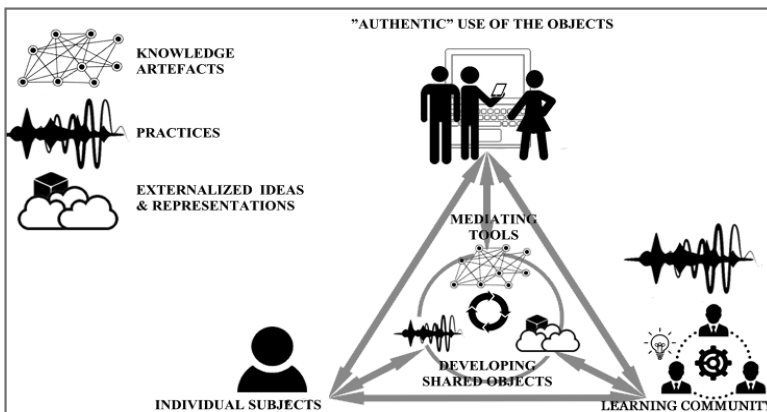
* Nadia Sansone, PhD Student, Department of Social and Developmental Psychology, Sapienza University of Rome, Italy. Email: nadia.sansone@uniroma1.it; Donatella Cesareni, PhD, Associate Professor in Educational Studies, Department of Social and Developmental Psychology, Sapienza University of Rome, Italy. Email: donatella.cesareni@uniroma1.it; Ilaria Bortolotti, PhD Student, Department of Social and Developmental Psychology, Sapienza University of Rome, Italy. Email: ilaria.bortolotti@uniroma1.it.

around concrete activities, and finally, provide theoretically-based technological mediation.

Based on these concepts, the authors are presenting their proposal on how to innovate higher education accordingly, by designing a type of course in which students are involved in concrete activities, and collaborate to create knowledge and build significant artefacts while developing key competences for their academic and working lives.

The course is based on the Trialogical Approach to Learning (TLA, Paavola, Engeström, Hakkarainen 2010), so-called because it integrates ‘monological’ and ‘dialogical’ approaches to learning with a third element: intentional processes involved in the collaborative creation of knowledge artefacts shared by and useful for the community. The acquisition and participation metaphors of learning (Sfard 1998) are, in this approach, embedded in the knowledge creation metaphor, which, by going beyond the many traditional dichotomies (Paavola, Lipponen, Hakkarainen 2004), focuses on the individual and social processes, conceptual knowledge and social practices needed to foster collaborative creativity (Fig. 1). The trialogical approach demonstrates its strong links with the Cultural Historical Activity Theory (CHAT) (Engeström 1987). Starting from Vygotskij’s thinking (1981), according to which our experience of the world is always mediated by a tool, whether tangible or intangible, CHAT perceives knowledge as a collaborative construction mediated by cultural and social artefacts, and grounded in practical activities (Cole 1996).

Figure 1 – The trialogical learning approach. [Sansone, Cesareni, Ligorio 2016]



A trialogical approach is applied through six principles, the so-called ‘design principles’ (Tab. 1: Hakkarainen, Paavola 2009; Paavola, Hakkarainen 2014), which guide the planning of technology-based teaching and learning activities to facilitate shared efforts of working with knowledge artefacts (Paavola, Lakkala, Muukkonen, Kosonen, Karlgren 2011).

Table 1 – The six design principles.

Design Principle	Definition
DP1 Organizing activities around shared 'objects'	Formative action must converge on the realization of shared objects recognized as important and intended for actual use, beyond individual and social dimensions of learning. Shared objects are also represented by shared practices and processes.
DP2 Supporting interaction between personal and social levels	It is necessary to combine individual work with that in a team, considering the diverse needs and "exploiting" inclinations and interests.
DP3 Fostering long-term processes of knowledge advancement	This principle emphasizes the importance of providing enough time for iterative inquiry cycles and of supporting environments to let long-term processes take effect, including the creative re-use of previous practice and knowledge artefacts.
DP4 Emphasizing development through transformation and reflection between various forms of knowledge and practices	Innovative ideas and practices can emerge more easily when learning involves various forms of knowledge and practices: declarative, procedural as well as tacit.
DP5 Cross-fertilization of various knowledge practices across communities and institutions	Creating connections within other contexts intentionally promotes the acquisition of modes of interaction, ways of thinking and languages typical of contexts other than those of training.
DP6 Providing flexible tool mediation	In line with 21 st century society, the last principle affirms the importance of providing adequate and diversified technologies, selecting those most suited to mediate collaborative activities and enhance aspects highlighted in the other design principles.

The six principles synthesize the main pillars of the TLA: designing object-based learning activities in which both individual and collaborative work strategies are mobilized, creative processes are triggered, and educational technologies support each stage of the process. In particular, trialogical activities are favoured by the use of environments and tools that allow participants to create and share, elaborate and transform, organize different artefacts, making the related knowledge practices visible, reflecting on them and evolving them.

2. Methodology

2.1 Aims

The study presented here aimed to observe students' acquisition of knowledge and skills, and to gather useful information for improving learning design. Specifically, our research questions were:

- 1) Do students perceive an evolution in the level of skills they mastered at the beginning and at the end of the course?
- 2) How do students evaluate the course and its activities?

2.2 Participants

Fifty-two 3rd year students (24 M, 28 F – avg age 21.8) from the Three-Year Degree Course in Psychology

2.3 Context

The course described here was on Experimental Pedagogy, and used blended learning by integrating face-to-face and online lessons hosted by the Sapienza Moodle (<<http://elearning2.uniroma1.it>>). The course lasted 10 weeks and was subdivided into three modules lasting approximately three weeks each.

Students were divided into six groups of about nine people each; the groups' membership remained unchanged throughout the entire course.

The following table shows the learning design of the course, describing how the design principles were applied to the activities (Table 2).

Table 2 – TLA principles in the course.

<i>Design principle</i>	<i>Implementation in the case</i>
DP1: Organizing activities around shared objects	The final object to be built by each group was a pedagogical scenario in which technology-mediated collaborative activities were to be designed. Learning topics and intermediate collaborative products were the basis for the construction of the pedagogical scenario. In particular, the last artefact was a significant and useful object, connecting the group with the broader community. In fact, teachers from different Degree courses can all use these projects.
DP2: Supporting integration of personal and collective work	Learning discussions were organized in which students had to bring their personal ideas as well as re-elaborations of scientific and pedagogical issues. Discussions and the following activities of product building were supported by allotting four specific roles: Social Tutor (task: promoting each group member's participation), Synthesizer (task: writing a weekly summary of the group discussion), Sceptic (task: presenting alternative points of view to 'warm' the discussion), Head of the Collaborative Artefact (task: arranging tools and materials for the collaborative classroom activity of building the artefact). Interaction between the groups was ensured by classroom presentations of the works and peer-review activities aimed at improving the group work. Reflection on students' own participation and responsibility (agency) was solicited by compiling personal Learning Diaries, consisting of different stimuli to allow students to analyse their path more systematically and improve their own participation.

DP3: Emphasizing development and creativity	<p>During the course, the students dealt with various kinds of knowledge, ranging from the theories studied and taught by the teacher to concrete examples of didactic activities illustrated through films, charts, stories, and analyses of scientific articles, till the final phase of constructing their artefacts, which all of these different formats had to become part of.</p> <p>Personal and group reflection was repeatedly stressed in the group discussions around the teachers' evaluations at the end of each module, also by compiling observation forms and reading these in groups, and finally, through the Learning Diaries.</p>
DP4: Fostering long-term processes of knowledge advancement	<p>The learning activities lasted ten weeks and were organized in 3 different modules, thus including many moments of transition in which to reflect upon the previous phase.</p> <p>The course was designed so that theoretical knowledge on the teaching and learning themes was repeatedly taken up and reflected on, in view of its practical application within the planned pedagogical scenario.</p> <p>Moreover, the artefacts were reviewed and improved through advice given: a) by the teacher in the plenary presentation, b) by the pairs through the peer feedback review – based on a specific template, c) by experts (primary, secondary and university teachers) during the final stage of constructing the pedagogical scenario.</p>
DP5: Promoting cross-fertilization of knowledge practices	<p>Students were able to experience the practices and methodologies of learning design in schools and higher education. Each group was supported and advised by an expert in the level of education chosen as the specific topic of their project. Thus, primary or secondary school teachers reviewed and provided feedback on their school-level projects, while a university physics professor provided feedback on a project to do with collaborative work between physics students, designing artefacts in that field.</p>
DP6: Providing flexible tools for developing artefacts and practices	<p>During the activities, several tools were used. Students interacted in small groups within Moodle courses. To perform the various activities, tools such as Padlet (brainstorming in the classroom), Google Drive Design Tool (to create shared conceptual maps), and Shared Google Documents (to collaboratively write the project) were used.</p>

To effectively apply the TLA prescriptions, each module had a specific focus which the corresponding activities and products to be built came from, as shown below (Tab. 3).

Table 3 – Discussions, activities, and artefacts in each module.

	Theoretical Contents	Discussions/Activities	Artefacts
First Module	Teaching/learning theories	'The good teacher': Discussion	Conceptual map on 'The good teacher'
Second Module	School history, learning technologies	Analysis of scientific articles	Draft of the pedagogical scenario stressing the theoretical principles

Third Module	Technologies and collaborative learning	Searching for best practices on technology at school; school; collaborative writing of the project	Final pedagogical scenario
--------------	---	--	----------------------------

2.4 Tools and procedure

The study presented here is based on the Design-Based Approach (DBA) (Brown, 1992; Collins, 1992; Design-Based Research Collective, 2003) which seeks to plan and implement innovative interventions, to then observe and analyse working elements as well as areas for improvement, and ultimately, re-design further interventions. The method of data collection and analysis combines qualitative and quantitative approaches. Specifically, the following data were collected:

1) First research question

Forty-three anonymous pre-post questionnaires, namely, the Contextual Knowledge Practices Questionnaire (Muukkonen *et al.* 2016). This was self-administered using Google Drive modules (<<https://drive.google.com>>) and consisted of: a) a pre-post section containing 21 items on perceptions relating to studies and abilities; b) a post-section consisting of 27 items examining the perception of any knowledge and skills acquired during the course and its activities. These items were organized in seven scales built around the TLA design principles.

Answers to the questionnaires were analysed using SPSS.

2) Second research question

Three Focus Groups (FGs) were held at the end of the course. Stimuli aimed to detect students' views on: their preferred activity (usefulness in terms of learning and skills); the role taken; pros and cons of group work; the assessment methods (ongoing, self-assessment, peer-observation); and the differences between the course just completed and traditional ones. To favour a critical and diversified discussion, the FGs consisted of students from each group.

The transcripts were analysed using qualitative content analysis, aimed at defining categories to group the key concepts.

2.5 Results

1) Do students perceive an evolution in the level of skills they mastered at the beginning and end of the course?

The results show a general perception of skills enhancement (Table 4), with statistically significant differences, both for the Work Compe-

tence scale (Wc), ($t = -4.48 (42) p < .01$), and for the Self-efficacy scale (Se) ($t = -2.955 (42) p < .01$). At the end of the activity, the students felt that they had more collaborative work skills and felt greater confidence in their skills.

Table 4 – Differences in perception of incoming and outgoing skills.

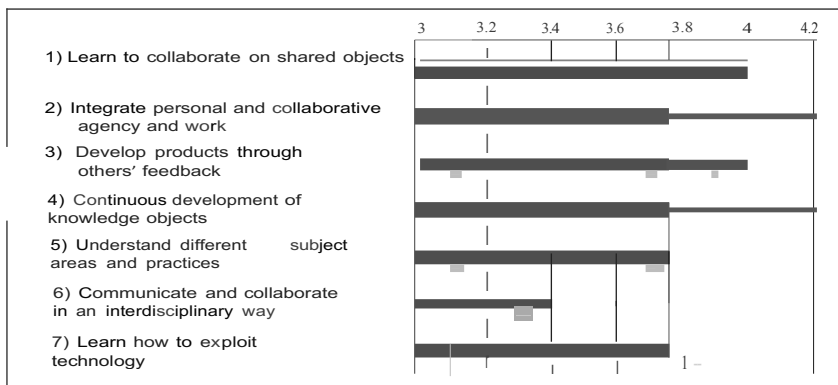
N = 43 (24F.; 19 M.)	Entry	Exit
Work competence	3.60	3.95
Work engagement	3.53	3.53
Self efficacy	3.86	4.03
Total	3.63	3.79

No significant differences were found for the gender variable either in entry or in exit for Wc and Se. Instead, the Work Engagement scale, presented statistically significant differences in exit (One-Way ANOVA $f = 6.343 (42) p = .016$). It seems that the course led the girls to feel more involved ($M = 3.69$) than the boys did ($M = 3.23$).

Specifically, students believed that the course had allowed them to improve their skills in each of the areas investigated, the average score being above 3 in all seven scales (Fig. 2). In particular, they believed they had learnt to collaboratively build knowledge objects (scales 1 and 2, Average 4 and 3.91) and make these artefacts iteratively better (scale 4, 3.90), also thanks to the feedback received from their peers and the experts (scale 3, Average 4).

Furthermore, they perceived that they had learnt new ways to use technologies (Average 3.88). However, they believed that they had only partially learned to collaborate and communicate in an interdisciplinary way (scale 6, Average 3.34).

Figure 2 – Perception of skills development after the course (Likert scale 1-5)



As for possible gender differences, female students generally expressed a higher perception, but no significant differences were found in any items or scale.

2) How do students evaluate the course and its activities?

Generally, students showed appreciation for the course, especially when comparing it to traditional ones. Compared to the latter, the course was recognized as exciting and engaging, capable of generating «interest in a pedagogical subject and a desire to go deeper into the topic» and made attractive by the idea of «working together towards a common goal», even if this was considered as requiring a greater commitment and effort «than having to just study from a book» because, on this course, «you have to attend the class and engage all through the course».

In the following table (Tab. 5), we have highlighted the pros and cons the students saw in the different aspects of the course which they themselves pointed out as most relevant.

Table 5 – Pros and cons of individual aspects of the course from a student perspective.

	Pro	Cons
Group-work	<ul style="list-style-type: none"> – a real innovation, not existing in other courses – a stimulus for individual participation, as well as supporting real interdependence 	<ul style="list-style-type: none"> – issues relating to a non-homogeneous participation by some group members
Online discussions	<ul style="list-style-type: none"> – the possibility to really get to know many points of view – engaging material and content (e.g. articles and project) 	<ul style="list-style-type: none"> – the tendency of some peers to write lengthy notes on web forums, without having read others' – limited time dedicated to both the second discussion and the project
Role Taking	<ul style="list-style-type: none"> – the Synthesizer role promoting a higher focus on the discussion – the Tutor role connecting online and offline activities 	<ul style="list-style-type: none"> – the up-down role distribution not considering personal inclinations and availability – tutor's stimuli seen as critical and therefore not implemented
Evaluation and self-evaluation	<ul style="list-style-type: none"> – ongoing evaluation seen as useful for self-monitoring – self-assessment considered as triggering good reflection 	<ul style="list-style-type: none"> – structure of the Learning Diary perceived as too binding or repetitive – also, its lack of anonymity as impacting authenticity
Peer review	<ul style="list-style-type: none"> – a possibility to improve, both by receiving and providing feedback 	<ul style="list-style-type: none"> – feedback given not always constructive
Online environment	<ul style="list-style-type: none"> – the chance to be connected at any time, even via smartphones 	<ul style="list-style-type: none"> – web forum not supporting proper discussions because of its structure

In detail, we can see how group work was the real added value of the course, as claimed in the following excerpt: «This course was the most

pleasant of all my three years, because it was based on exchanging ideas, thinking all together; the opposite of the usual boring frontal lessons». Probably, the group work had this impact on the students' perception since it worked well (as already mentioned, the designers paid great attention to integrating individual and collaborative agencies as stated in DP2): «For me it was reassuring that it was not a thing like, “as a group we decide what to do and then a single person does the job”, but that everyone had to and could participate».

Among the activities of the course, however, some were considered more able to promote useful skills for future profession, such as the Learning Diaries, considered «useful also for the profession we will choose. Putting into writing and finding out what's going on, what I feel, somehow helped me to recognize it right when it was happening and to adjust my behaviour».

Weaknesses and limits were also pointed out by the students, starting from the online discussions of the first module (see Tab. 4): «At a certain point I said to my group-mates, “listen, please, could you stop doing thirty-line monologues? Could we start and have a discussion? Because in my opinion that's what you have to do [...] do you really think I'm going to go read ten posts of thirty lines that have nothing to do with each other? [...]”. This complaint, however, ended with a possible solution: “maybe you should present it a bit more like a debate”».

In other cases, suggestions referred to more practical aspects, such as the timeframes: «In my opinion, the problem was that in the second module we discussed the added value technologies for too long (...) and then, suddenly, on the day, we were told to design a project ... so [...] I would redefine the timeframe, giving a whole third module to the drafting of the project [...] or I would have put in a fourth module».

3. Final remarks

In this contribution we have described a university course based on the Dialogical Learning Approach and the study we performed to detect its impact on students' appreciation of the learning activities and perceptions relating to their skills development.

Collaborative activities, continuous development of knowledge objects, active use of technology, and the possibility to learn different disciplines and practices, were recognized and appreciated by the students as key factors of the course, after which they perceived that they had reinforced some skills crucial for their future career.

According to the DBA method that inspired our work, and to further enhance the overall student experience, in future courses we will be paying attention to the critical areas reported by the students: participation in work groups, certain tools and materials, and the timeframes.

Finally, we will focus on improving interdisciplinary collaboration and communication, perceived as the most underdeveloped skill.

References

- Binkley M., Erstad O., Herman J., Raizen S., Ripley M., Miller-Ricci M. and Rumble M. 2012, *Defining twenty-first century skills. Assessment and teaching of 21st century skills*, Springer, Berlin, 17-66.
- Brown A.L. 1992, *Design experiments: Theoretical and methodological challenges in creating complex interventions in classroom settings*, «The Journal of The Learning Sciences», II (2), 141-178.
- Cole M. 1996, *Cultural psychology. A once and future discipline*, Harvard University Press, Harvard.
- Collins A. 1992, *Toward a Design Science of Education*, «New Directions in Educational Technology», 15-22.
- Design-Based Research Collective 2003, *Design-based research: An emerging paradigm for educational inquiry*, «Educational Researcher», XXXII (1), 5-8.
- Engeström Y. 1987, *Learning by Expanding: An Activity-Theoretical Approach to Developmental Research*, Orienta-Konsultit Oy, Helsinki.
- Hakkarainen K.P., Palonen T., Paavola S. and Lehtinen E. 2004, *Communities of networked expertise: Professional and educational perspectives*, Emerald, London.
- Hakkarainen K.P. and Paavola S. 2009, *Toward a triological approach to learning*, «Transformation of knowledge through classroom interaction», 65-80.
- Muukkonen H., Lakkala M., Toom A. and Ilomäki L. 2016, *Assessment of competences in knowledge work and object-bound collaboration during higher education courses*, Higher Education Transitions: Theory and Research. EARLI book series New Perspectives on Learning and Instruction.
- Paavola S., Engeström R. and Hakkarainen K. 2010, *Triological approach as a new form of mediation*, in Morsh A., Moen A. and Paavola S. (eds.) *Collaborative knowledge creation: Practices, tools, and concepts*, Sense Publishers, Rotterdam, 9-23.
- Paavola S. and Hakkarainen K. 2014, *Triological approach for knowledge creation*, «Knowledge creation in education», 53-73.
- Paavola S., Lakkala M., Muukkonen H., Kosonen K. and Karlgren K. 2011, *The roles and uses of design principles for developing the triological approach on learning*, «Research in Learning Technology», XIX (3), 233-246.
- Paavola S., Lipponen L. and Hakkarainen K. 2004, *Models of innovative knowledge communities and three metaphors of learning*, «Review of Educational Research», LXXIV (4), 557-576.
- Pozzi F., Persico D. and Dimitriadis Y. 2012, *15. Tecniche e strategie per strutturare la collaborazione in una KBC in rete*, «Qwerty-Open and Interdisciplinary Journal of Technology, Culture and Education», VI (2), 179-200.
- Sansone N., Cesareni D. and Ligorio M.B. 2016, *Il Triological Learning Approach per rinnovare la didattica*, «TD Tecnologie Didattiche», XXIV (2), 82-91, DOI: <http://dx.doi.org/10.17471/2499-4324/892>.

- Schellens T. and Valcke M. 2006, *Fostering knowledge construction in university students through asynchronous discussion groups*, «Computers & Education», XLVI (4), 349-370.
- Sfard A. 1998, *On Two Metaphors for Learning and the Dangers of Choosing Just One*, «Educational Researcher», XXVII (2), 4-13.
- Vygotsky L.S. 1981, *The genesis of higher mental functions*, in Wertsch J.V. (ed.) *The concept of activity in Soviet psychology*, Sharpe, Armonk.