A Study on Teachers' Design Choices Regarding Online Collaborative Learning

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Abstract: This study aims to contribute to our understanding of whether and to what extent collaboration is a consolidated teaching practice in Italian schools. The paper reports the results of a survey of Italian teachers (N=268) that investigated (self-reported) behaviours regarding the design of collaborative learning activities (prior to and during the pandemic). Results show that even if collaborative learning approaches are implemented to some extent by Italian teachers and were also proposed online as part of Emergency Remote Teaching during the lockdown - their design choices are not always in line with recommendations widely agreed by the Computer Supported Collaborative Learning (CSCL) research community.

1 INTRODUCTION

For a couple of decades, research in the Technology Enhanced Learning (TEL) field has been advocating a shift in pedagogical perspectives in school, from transmissive approaches, to learner centred and collaborative approaches, based on socio-constructivist learning theories. This shift has happened to some extent, even if it seems collaborative teaching and learning are not yet commonplace in schools across Europe and "teaching about or through collaboration remains uncommon in schools." (Cassells, 2018).

Moreover, it is not completely clear whether and to what extent technologies are fully exploited to support collaborative learning in school (Beldarrain, 2007) and this is usually blamed on the fact that, on average, less than 40% of teachers across the EU feel ready to use digital technologies in teaching (OECD, 2018).

Such limited capacity has been put under the lens especially during the recent lockdown imposed by many governments due to the covid-19 pandemic, which forced about 1.5 million learners to move to emergency remote teaching (UNESCO, 2020). On that occasion, the TEL research community leapt into action to analyse such a huge, unprecedented set of experiments-in-the-wild taking place in schools, which afforded researchers a unique opportunity to examine how institutions, students and teachers were coping with that situation. The preliminary results seem to indicate in most cases online teaching took the form of a simple 'replication' in online environments of traditional teaching approaches, often transmissive in nature and most of the times synchronous (Collazos et al., 2021). This is in contrast with many years of research in the field of Computer Supported Collaborative Learning (CSCL) that proved the need to design online collaborative learning bearing in mind not only the different affordances of the technological tools, but also the importance of artefacts as catalysts of knowledge building (Stahl et al., 2021; Paavola & Hakkarainen, 2009) and the essential role of collaborative techniques in scaffolding collaboration (Pozzi & Persico, 2011). The effects of "collaborative techniques", such as Jigsaw, Case study, Brain storming, Peer review, Role play, Pyramid, on learners' collaboration have been investigated by researchers in learning design and the outcomes of such research should inform the decision making process involved in designing for learning (Laurillard, 2012; Persico, Pozzi, Goodyear, 2018; Pozzi, 2010; Pozzi, 2011; Pozzi et al., 2016). In an attempt to

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understand what the current attitudes and behaviours of school teachers are in respect to the design and application of collaborative learning and the related research evidence, and to understand how the use of technology intertwines with it, we have conducted a study targeting Italian school teachers. Particularly, we have analysed the self-reported behaviours of Italian teachers as far as the adoption of collaborative learning approaches prior to and during the pandemic. The research questions were:

RQ1. What are the approaches used by Italian teachers to design collaborative activities? Is there any difference between their design approaches before and during the emergency (i.e., in face-to-face and online settings)?

RQ2. What is the nature of the proposed collaborative patterns/ activities? Is there any difference between the nature of collaborative activities before and during the emergency?

RQ3. What technologies are used in the proposed collaborative activities? Is there any difference between the technologies used before and during the emergency?

2 METHODOLOGY

The study was based on a bespoke survey that was devised by the authors to investigate relevant aspects of the design of collaborative learning activities. Participants were recruited by using a convenience sampling method. The survey, implemented with the Google Form functionality, was addressed to school teachers and comprised a total of 27 questions, aimed at collecting data concerning respondents' self-reported design behaviours for face-to-face and online teaching. The questionnaire also contained a consent form regarding the management of personal data, according to the GDPR.

In terms of data analysis, we conducted a descriptive and inferential statistical analysis using SPSS (version 22.0, SPSS Inc., Chicago, IL, USA). Means and standard deviations were calculated to describe continuous variables. The categorical variables were presented as absolute (n) and relative (%) frequencies. To test the associations among categorical variables, we used the Chi-Square test of independence.

2.1 Context of the Study and Participants

The questionnaire was advertised in the context of a

number of online training activities organized by ITD-CNR in Spring 2020, as a response to the urgent need expressed by the Italian schools to receive specific training for teachers on how to tackle the shift from face-to-face to online teaching. It was presented at the end of the training and trainees were invited to voluntarily fill it in soon after the training.

Overall, we collected 268 responses. Participants were 196 females (73,13%) and 66 males (24,63%) (with 6 undisclosed). The unbalance reflects a similar unbalance in the target teacher population in Italy (OECD, 2021).

Regarding the school level of respondents, our sample was composed as follows: Kindergarten = 12 (4,48%), Primary school = 60 (22,39%), Lower Secondary school = 48 (17,91%), Upper secondary school = 145 (54,1%), Other (not specified) = 3 (1,12%).

In terms of teaching experience, our respondents had on average 19,56 years of teaching experience (SD = 9,40; Min = 1, Max = 40), which is in line with the trend at national level (OECD, 2021).

3 RESULTS

3.1 Approaches Used to Design Collaborative Activities (RQ1)

Regarding the design of collaborative activities, first of all, we asked teachers how long they usually dedicate to this task. This was used also to detect how many of them did not dedicate any time to this task.

Most of the participants reported that they usually dedicate a few hours (52.6%) or some days (25%) to this task. Table 1 shows the complete picture of their responses.

Table 1: Time dedicated to the design of collaborative activities (frequency and percentage).

	Frequency	Percentage
Some minutes	19	7.1
Some hours	141	52.6
Some days	67	25.0
Some weeks	15	5.6
Usually not designing collaborative activities	26	9.7
Total	268	100.0

It is worth noting that a small percentage (26 participants, 9.7%) reported that they do not usually design collaborative activities at all. More precisely, 17 teachers declared they do not design, nor deliver any collaborative activity, while 9 teachers do deliver,

without any design phase. So, from now on, the data will include only responses from teachers who usually design (n.=242).

Then, we asked what element they regard as most relevant during the design, and we posed the question by differentiating their behaviour between before (i.e., usually) and during the pandemic. Table 2 shows the results regarding the element considered most relevant in the design of collaborative activities in teachers' usual design practice, before and during the COVID-19 emergency. The choice of the elements is based on the 4Ts model (Pozzi, Ceregini, Persico, 2016) that posits the importance and reciprocal influence of task (i.e., tasks to be performed), time (i.e., time schedule of the activity), team (i.e., teams of students to be involved), and technology (i.e., technology to be used) in the design of online collaborative learning.

Table 2: Element usually considered most relevant (before and during the COVID-19 emergency) (frequency and percentage).

	Before the COVID-19 emergency		During the COVID-19 emergency	
	Frequency	Percentage	Frequency	Percentage
Task	130	53.7	83	34.3
Time	36	14.9	32	13.2
Team	47	19.4	28	11.6
Technology	22	9.1	65	26.9
Not responding	7	2.9	34	14.0

The data show that, with the pandemic, the leading role of the Task in the pre-pandemic design of collaborative learning activities has given way to that of technology in pandemic practice.

A marginal homogeneity test determined that there is a statistically significant difference in the frequencies of responses before and during the COVID-19 emergency, $p < .001$ (2 sided).

3.2 Nature of Collaborative Activities (RQ2)

Table 3 shows the results regarding the use of seven quite well known (Pozzi, Ceregini & Persico, 2016) collaborative techniques (Discussion, Case Study, Jigsaw, Brainstorming, Peer Review, Pyramid, Role Play) in three different conditions:
A. Before the COVID-19 emergency (face to face only).
B. Before the COVID-19 emergency (face to face + online).
C. During the COVID-19 emergency (online only).

Table 3: Nature of the proposed collaborative activities (frequency and percentage).

		Frequency	Percentage
Discussion	A. Before (f2f only)	199	74.3
	B. Before (f2f + online)	74	27.6
	C. During (online only)	134	50.0
Case Study	A. Before (f2f only)	82	30.6
	B. Before (f2f + online)	48	17.9
	C. During (online only)	62	23.1
Jigsaw	A. Before (f2f only)	32	11.9
	B. Before (f2f + online)	18	6.7
	C. During (online only)	24	9.0
Brain-storming	A. Before (f2f only)	150	56.0
	B. Before (f2f + online)	57	21.3
	C. During (online only)	95	35.4
Peer review	A. Before (f2f only)	71	26.5
	B. Before (f2f + online)	34	12.7
	C. During (online only)	48	17.9
Pyramid	A. Before (f2f only)	11	4.1
	B. Before (f2f + online)	10	3.7
	C. During (online only)	14	5.2
Role Play	A. Before (f2f only)	80	29.9
	B. Before (f2f + online)	27	10.1.
	C. During (online only)	37	13.8

Discussion. Cochran's Q test indicated that there were differences between the three conditions, $x2(2, N = 268) = 130.28$, $p < .001$. A pairwise post-hoc Dunn test with Bonferroni adjustments was significant for AB ($p < .001$), BC ($p < .001$), and AC ($p < .001$).

Case Study. Cochran's Q test indicated that there were differences between the three conditions, $x2(2, N = 268) = 20.14$, $p < .001$. A pairwise post-hoc Dunn test with Bonferroni adjustments was significant for AB ($p < .001$) and AC ($p = .026$).

Jigsaw. Cochran's Q test indicated that there were differences between the three conditions, $x2(2, N = 268) = 6.30$, $p = .043$. A pairwise post-hoc Dunn test with Bonferroni adjustments was significant for AB ($p = .037$).

Brainstorming. Cochran's Q test indicated that there were differences between the three conditions, $x2(2, N = 268) = 97.17$, $p < .001$. A pairwise post-hoc Dunn test with Bonferroni adjustments was significant for AB ($p < .001$), BC ($p < .001$), and AC ($p < .001$).

Peer Review. Cochran's Q test indicated that there were differences between the three conditions, $x2(2, N = 268) = 24.07$, $p < .001$. A pairwise post-hoc Dunn test with Bonferroni adjustments was significant for AB ($p < .001$) and AC ($p = .008$).

Role Play. Cochran's Q test indicated that there were differences between the three conditions, $x2(2, N = 268) = 19.86$, $p < .001$. A pairwise post-hoc Dunn test with Bonferroni adjustments was significant for AB ($p < .001$) and AC ($p < .001$).

3.3 Technologies (RQ3)

Table 4 shows the results regarding the Technologies typically used in the proposed collaborative activities, in face-to-face or blended education contexts (before the pandemic). Again, in this case, only 242 of the total 268 participants are considered, excluding the 26 who previously stated that they do not usually design collaborative activities. Each participant could indicate more than one option.

Table 4: Technologies used in collaborative activities before the COVID-19 Emergency (frequency and percentage).

	Frequency	Percentage
Forum	30	12.4
Web conferencing (e.g., Meet, Zoom, Skype)	13	5.4
Social network (e.g., WhatsApp, Facebook, Instagram)	45	18.6
Interactive Whiteboard	151	62.4
Text editor (e.g., MS Word, Google docs, Wiki)	121	50.0
Presentation (e.g., MS PowerPoint, Google Presentation, Prezi)	151	62.4
Instructional software, digital games, simulations	75	31.0

Table 5 shows the results regarding the technologies used to support the proposed collaborative activities, during the COVID-19 emergency.

Table 5: Technologies used during the COVID-19 emergency (frequency and percentage).

	Frequency	Percentage
Forum	28	11.6
Web conferencing (e.g., Meet, Zoom, Skype)	189	78.1
Social network (e.g., WhatsApp, Facebook, Instagram)	74	30.6
Interactive Whiteboard	11	4.5
Text editor (e.g., MS Word, Google docs, Wiki)	110	45.5
Presentation (e.g., MS PowerPoint, Google Presentation, Prezi)	144	59.5
Instructional software, digital games, simulations	66	27.3

A McNemar's test determined that there was a statistically significant difference in the frequency before and during the COVID-19 emergency for Web conferencing tools ($p < .001$), social network tools ($p < .001$), and for interactive whiteboard ($p < .001$).

4 DISCUSSION

In the following we discuss the results, basing on the 3 research questions.

4.1 Approaches Used to Design Collaborative Activities (RQ1)

Regarding the design of collaborative activities, a preliminary question intended to check to what extent respondents dedicate time to the design of collaborative activities. Only a minority of them (9,7%) do not dedicate any time to their design, while the majority (52,6%) state they usually take some hours or even days (25,0%) to this task.

Interestingly, among those who do not design, 9 teachers (3,3%) deliver collaborative activities without designing them, which is definitely in contrast with the recommendations provided by the CSCL research community stating that collaboration does not happen automatically, and teachers need to design and create the conditions to foster effective group interactions (Law et al, 2021).

Regarding the element of design that is considered most relevant, it seems in face-to-face settings the design process was primarily Task-oriented, while during the emergency, it became more Technology-driven.

This is not surprising, as during the lockdown teachers were forced to use technological tools (to mediate communication with students, to assign tasks, to collect assignments, etc.) which in the previous, non-pandemic scenario were available, but not mandatory. It is worthwhile mentioning that, although in the past the Italian government invested quite a lot in terms of ICT equipment for all the schools through a number of national programmes, the use of technologies by teachers is still limited. This is clearly stated by a recent OECD report: "…in Italy teachers use technology well below other high-skilled workers. Additionally, 3 out of 4 teachers report needing further training in ICT for teaching." (OECD, 2019).

It will be interesting to re-check the data about use of (and familiarity with) technologies by Italian teachers in the future, to see if any change has occurred in their use of technology as a consequence of this long period.

4.2 Nature of Collaborative Activities (RQ2)

As far as the nature of the collaborative activities proposed, we have investigated the use of a number of collaborative techniques/patterns (face-to-face or blended) and online (during the pandemic). In general, it appears that the number of respondents who uses these techniques in face-to-face mode is significantly higher than those who used it online (for all techniques except the Jigsaw). This is true especially for the Role Play, where the gap between frequencies is the highest. In turn, the number of teachers that use them in online mode, is higher than those who use them in blended mode. Among the techniques, Discussion and Brainstorming are the most commonly used patterns/techniques. Pyramid and Jigsaw are far less used. Case Study, Peer Review and Role Play are moderately common techniques, especially in face-to-face conditions.

This seems to confirm what we have already pointed out under RQ1, i.e., it seems some teachers tend to perceive the online environment as a barrier, rather than an advantage, to the implementation of collaborative learning approaches, in contrast to what is claimed by the CSCL research community (Garrison et al., 1999; Stahl et al., 2021).

Moreover, the added value of more structured techniques, such as for example the Pyramid or the Jigsaw, where the social structure (i.e., the team composition) evolves during the activity, seems to be still overlooked, in favour of 'flatter' techniques. Although the debate about the effects of different degrees of structuredness of collaborative techniques is still ongoing in the CSCL community (Dillenbourg, 2002; Law et al., 2021; Persico & Pozzi, 2011; Radkowitsch et al., 2020), there are evidences of benefits brought about by structured techniques and scripts (Weinberger et al., 2005; Pozzi, 2010; Pozzi et al., 2016), so – again in this case - it seems teachers' design choices do not fully resonate with research results.

4.3 Technologies (RQ3)

Regarding the technological tools used during collaborative learning activities, obviously we observe a drastic increase in the use of synchronous online communication tools during the lockdown (especially video-conferencing systems, that moved from 5.4% to 78.1%, but also social networking tools, from 18.6% to 30.6%), along with a decrease of the use of the interactive whiteboards. These results are easy to explain: while video-conferencing systems

were hardly used before the lockdown, as classes worked mainly (if not exclusively) face-to-face, the emergency teaching was almost exclusively based on these tools. At the same time, interactive whiteboards were mainly used in face-to-face classes, but became inaccessible during the lockdown. Social networking tools, already used to some extent by teachers before the pandemic, became more important as a communication channel between teachers and students.

What is more interesting to note, is that the use of forums is not significantly affected by the emergency teaching. This suggests the advantages of asynchronous communication to mediate online collaborative activities, that are so often claimed in the scientific literature (Garrison et al., 1999; Means et al., 2009; Greenhow et al., 2020; Persico & Manca, 2000), is disregarded by teachers. The permanent nature of asynchronous interactions allows for more reflection and critical thinking, permits students to proceed at their own pace and - last but not least – can mitigate digital inequalities (Williamson et al., 2020, Giovannella, Passarelli & Persico, 2020), in that it limits connection issues and other socio-cultural barriers that frequently hinder synchronous events. But it seems these useful features tend to be overlooked by teachers.

Last but not least, consideration should be given to lower use, during the remote teaching, of software to produce artefacts, such as for example text editors or presentation software. Even if not statistically significant, the difference is somehow surprising, because it might imply online group-work – when proposed – was not always oriented to the production of an artefact, an aspect that is highly recommended by the CSCL community (Paavola & Hakkarainen, 2009; Stahl et al., 2014).

5 CONCLUSIONS

This paper reports the results of a study based on the collection of self-reported data concerning Italian teachers' behaviours towards collaborative learning approaches. Since our study was based on a convenience sampling method as well as on self-reported data, our findings are not generalizable; nonetheless, they can provide insights and trigger the discussion about teachers' competences on learning design.

Overall, the results indicate collaborative learning approaches are to some extent adopted and applied, but it seems some of the design choices made by the

teachers are not in line with what is recommended by the CSCL research community.

These results seem to highlight there is a need for teacher training in the field of online collaborative learning approaches. This is quite in line with Tallent-Runnels et al. (2006) who state teacher training and support are crucial to the design and implementation of quality online environments. Our study has highlighted there seem to be aspects related to how to effectively design online collaborative activities that – although well acknowledged by the research community - cannot be taken for granted for practitioners. These aspects include, but are not limited to, the importance of using structured techniques, asynchronous communication and the essential role of artefacts as catalysers of collaboration.

Further research directions should include data collection with a larger, international sample, to compare the results with data concerning other countries.

Another aspect that deserves further investigation, is the extent to which the different approaches adopted in face-to-face or online settings will remain once the teachers will be free again to choose between the two delivery modes and to carefully design their teaching, by choosing technology mediated teaching when it has a pedagogical added value, and face-to-face or blended settings, when their advantages overcome the disadvantages.

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