Quality Teaching in Large University Classes:

Designing Online Collaboration among Learners for Deep Understanding

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Abstract

This study aimed to explore the impact of eLearning on quality teaching in higher education and to implement Computer-Supported Collaborative Learning (CSCL) that targeted the quality challenges in practice. It was a mixed method research composing of three stages. It initially focused on university teachers' perception of quality teaching, problems, and strategies in practice to understand the actual usage of eLearning by practitioners. Seventeen university teachers participated in the inquiry of stage 1. It found the common perception of quality teaching was students' deep understanding of the learning subject. Besides, large class teaching was the most common problem faced by teachers who already achieved quality teaching in small classes, which became the research focus in the inquiry of stage 2. CSCL was selected as a potential eLearning strategy that targeted quality challenges in large class teaching due to its theoretical benefits. the inquiry of stage 2 aimed to explore the impact of CSCL on quality teaching in large classes. Considering the institutional influence on teaching approaches, it defined the case in the university level. Two universities composed of ten teachers were investigated. It found the majority of participants perceived a limited quality in large class teaching, and this limitation was due to two issues: insufficient teacher-student interaction, and the difficulty in checking students' understanding in the learning process. Besides, CSCL was not widely adopted in practice, and adopted strategies did not target those two issues mentioned above. The inquiry of stage 3 designed and implemented CSCL activities in an authentic large university class with the aim to explore its impact. It indicated CSCL helped to improve teaching quality in large classes – students' deep understanding - by enhancing interaction and feedback in the learning process. In sum, this three-stage study revealed the practical challenges of quality teaching in higher education, then designed and implemented eLearning activities to tackle them.

Keywords

Quality teaching in higher education, large class teaching, computer-supported collaborative learning, learning for understanding

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1. Introduction

1.1 Quality: a complex issue in higher education

Quality is a complex issue in higher education. Firstly, diverse quality cultures exist in the system. In *Defining Quality*, Harvey & Green (1993) systematically reviewed five cultures. The first notion is quality *as exception*, where quality is associated with the notion of distinctiveness, of something special or "high class" that implies exclusivity and inaccessibility such as Oxbridge education. The second notion is quality *as perfection*, where quality is seen in terms of consistency that focuses on process and sets specifications that it aims to meet. This view conforms to a particular predefined and measureable specification to meet benchmarks. The third notion is quality *as fitness for purpose*, where quality is judged in terms of the extent to which the product or service fits its purpose. The fourth notion is quality *as value for money*, where quality is associated with accountability that implies you get what you pay for. The last notion is quality *as transformative, a concept* well established in western philosophy that being discussed in the works of Aristotle, Kant, Hegel and Marx. It implies that education is a dialectical process. Secondly, there are various stakeholders for quality in higher education including policy makers, employers, instructors, learners, administrators, and researchers, assessors, etc. Their notions of quality vary due to their different values and perspectives (Ehlers, 2004). Thirdly, there are several ways for analysing quality. Quality can be analysed in terms of evaluation method standards, best practices, guidelines, benchmarks, checklists, and rubrics (Ghislandi & Pedroni, 2009). Quality can be analysed in terms of time, i.e. ex ante, in itinere, and ex post (Ghislandi, 2012). Quality can be analysed in terms of focus i.e. input, process, and output (Chua, 2004). Quality can be analysed in terms of levels i.e. macro level quality for the whole higher education system, mezzo level quality for institutions level, and micro level quality for activities within institutions (Zhang, 2009).

1.2 eLearning, quality and university teaching

eLearning usually refers to the use of electronic technologies for teaching and learning, and it plays a crucial role for quality education as technology has an impact on the way how education is designed, implemented and delivered (Ehlers & Schneckenberg, 2010). Since the social impact of technology depends on how it is designed and used (Feenberg, 2001), eLearning might also lead to two possibilities for quality educational process: impetus and inhibition. For eLearning as the impetus, firstly, it might provide personalised and adaptive learning experience via intelligence tutoring systems to enhance students' motivation for active learning (Walkington, 2013). Secondly, it might increase the opportunities of teacher-student interaction and student-student interaction via online learning environments with a high engagement in learning (Dixson, 2010). Thirdly, since eLearning overcomes the time and space constrains in traditional contexts with a more flexible learning experience and an opportunity of more interaction and feedback, it might lead to a better cognitive development and learning outcome (Garrison et al., 2001). For eLearning as the inhibition, firstly, eLearning is often taken for a panacea of quality and innovation in education, so based on this illusion it tends to induce explorations on chasing new technology rather than understanding better the nature of learning that will guide a reasonable adoption and an effective use of technology in teaching practice (Laurillard, 2002). Secondly, compared to the potential better learning experience mentioned above, it might also cause practical issues in educational process such as instructors' pressures on work overload and time (Hara et al., 2000; Thomas, 2002) and students' distraction from learning in online environments (Davis & Wong, 2007).

Although eLearning has the potential to revolutionise university teaching, in fact university teachers adopt technologies in a limited way during educational practices (Selwyn, 2007). One of the major barriers is teachers' disbelief of technologies' benefits (Butler & Sellbom, 2002; Chizmar & Williams, 2001; Al-Senaidi et al., 2009). Beside the scepticism from the academics, there are also results of studies, which indicated the no-significant difference between eLearning and traditional teaching (Philpps & Merisotis, 1999; Rivera & Rice, 2002; Lim et al., 2008; Keller et al., 2009;

Ehlman et al, 2011; Bain, 2012) and even a better academic performance for students in traditional teaching setting (Emerson & MacKay, 2011; Jaggars, 2014). This disparity between the potential learning benefits expected from eLearning and the actual learning activities and experiences in practice required further inquiries on the impact of eLearning in university teaching. Perhaps eLearning *per se* does not guarantee an improved educational outcome (Kirkwood, 2009), but the efforts on exploring how to effectively use eLearning in practice might lead to an innovative and quality education (Laurillard, 2002).

2. Literature review

2.1 Quality teaching in higher education

2.1.1 Characteristics and approaches

Teaching in higher education is distinctive from teaching in primary and secondary education due to at least two characteristics. Firstly, professors are typically trained not as teachers but as disciplinary specialists; secondly, students are diverse in terms of their age, experience, and development (Menges & Austin, 2001). Thus, it faces more challenges to achieve quality teaching in higher education. There are two approaches to quality teaching in higher education: quality assurance and scholarship of teaching. The quality assurance approach is an external managerial strategy, where quality teaching is assessed by predefined standards just as quality is practised in manufacturing and service industry (Ellis, 1993); the scholarship of teaching approach is an internal practical strategy, where quality teaching achieves through continuous reflections on empirical teaching experience by professors themselves (Boyer, 1990). Since the concept of quality is a complex issue in higher education, it is essential to review the concepts of quality teaching in the existing literatures.

2.1.2 Quality teaching as the mediation for learning

Quality teaching targets learning rather than teaching itself. In higher education, particularly, teaching is to mediate learning rather than to impart knowledge (Laurillard, 2002). The mediation nature of quality teaching is presented in three aspects: the content of learning, the learning process, and the learning outcome.

Quality teaching for the learning content

University students are not only expected to acquire knowledge but also to gain competences such as critical thinking and intellectual flexibility, thus, quality teaching means to facilitate competence development rather than mere knowledge acquisition (Kuh & Bridge, 2010). Besides, since students will learn more effectively when they find a framework to fit new facts rather than receiving separate materials or information (McKeachie, 1963), quality teaching also requires teachers to organise learning contents in a meaningful way in order to support learners in constructing the new knowledge in relation to their prior knowledge (McKeachie, 2007).

Quality teaching for the learning process

Quality teaching also facilitate a learning process composed of motivation, engagement, and feedback. There are two types of motivation: intrinsic and extrinsic. Students are intrinsically motivated if they are interested in the contents of their learning or in the process of learning itself. Students are extrinsically motivated if they get rewards from academic study (Ryan & Deci, 2000). Therefore, quality teaching should enhance both the intrinsic motivation, e.g. display teachers' own enthusiasm to share the learning subject with students (Ramsden, 2003) and the extrinsic motivation, e.g. provide guidance and feedback through formative assessment in the learning process (Nicol & Macfarlane-Dick, 2006).

Engagement is the action of being involved in the learning activities (Fosnot, 2013). Quality teaching facilitates engagement by supporting student-student interaction, teacher-student interaction, and student-content interaction (Garrison, 1999). Beside these three types of

interaction, engagement can be also described in terms of learning approach (Marton & Saljo, 1976): surface and deep. When students adopt surface approach, learnt concepts stored arbitrarily and non-substantively in cognitive structure, which cannot be recalled and confer interference with new and related learning (Novak, 2010). When students adopt deep approach, students integrate new concepts within the overarching knowledge structure and linked to prior knowledge (Hay, 2007). Therefore, quality teaching should facilitate students to adopt deep approach.

Feedback is a crucial element for learning in any educational level. In higher education, students learn to become professional specialists. The teaching and learning process can be seen as the conception matching between experts (instructors) and learners through a dialogue or conversation (Pask, 1976a; Laurillard, 1999; Entwistle & Smith, 2013). Feedback helps revealing the gap between the experts' conception and students' conception. Therefore, quality teaching requires teachers to provide feedback to students in the teaching and learning process (Laurillard, 2012).

Quality teaching for the learning outcome

On the one hand, quality teaching requires the teaching and learning activities and assessments align with the intended learning outcome (Biggs & Tang, 2011); on the other hand, it also means to achieve the intended learning outcome, i.e. learning effectiveness (Ghislandi, 2005). Learning effectiveness can be evaluated concretely based on students' understanding of the learning subject (Entwistle, 2009), which will be explained in the section 2.2.

2.1.3 Quality teaching as a reflective practice

As mentioned above, university teachers usually lack a systematic training for the profession of teaching, quality teaching in higher education is even more necessary to be seen as a reflective practice than other educational contexts. Therefore, beside the mediation of learning, quality teaching itself should be considered as a constantly improved process, where university teachers enhance the teaching quality through reflection and practice. Just as Ramsden (2003) stated:

"effective teaching refuses to take its effect on students for granted. It sees the relation between teaching and learning as problematic, uncertain and relative. Good teaching is open to change: it involves constantly trying to find out what the effects of instruction are on learning, and modifying that instruction in the light of the evidence collected (p98)". Besides, as eLearning brings new possibilities to teaching and learning, quality teaching also requires teachers to understand how to use technologies that lead to a better learning experience and learning outcome. Then teachers who are capable of designing pedagogical patterns based on their own reflection and practice will not only improve their own teaching quality but also have a wide impact on quality teaching generally through sharing these patters to teachers from other fields and educational contexts (Laurillard, 2012).

2.2 Learning for understanding

2.2.1 Understanding as a learning process

Understanding can be considered as a learning process, and it requires continuous assimilation of new information to what is already known and the weaving of bits of knowledge into an integrated and cohesive whole (Nickerson, 1985). In the process notion of understanding, learners can be divided into two types according to the learning approach: holists and serialists. Holists have many goals and working topics under the aim topic in their learning, and they assimilate information from many topics to learn the aim topic. Serialists have one goal and working topic that is the aim topic in their learning, and they moves to a new topic only when they finish learning the current topic (Pask, 1976b).

Support understanding in a domain independent context

Pask developed the conversation theory to explain how interactions between two cognitive systems (such as a teacher and a student) lead to the construction of knowledge (Pask, 1975; Pask 1976a; Pask, 1976c). During the interactions, there are two types of knowledge constructed: conceptual and performative. The conceptual knowledge enables cognitive systems "*to explain or justify what a topic means in terms of other topics* (Scott, 2001: p352)", and the performative knowledge

enable cognitive systems "*to apply a particular topic in a situation or context such as how to recognise it, construct it, and maintain it* (ibid. p253)". Conversation theory was furtherly developed by Laurillard (1993) into a conversational framework in the context of university teaching (Hawkridge, 2002). In conversational framework, the original two types of knowledge in conversation theory were interpreted as conception and action, and the two cognitive systems were explicitly defined as the teacher and the student. The conversational framework was composed of four elements: teachers' conception, teachers' action, students' conception, and students' action. Furthermore, it not only described the interaction about the conception and action between teachers and students but also it revealed the interaction between the conception and the action from one cognitive system. All these interactions were explicitly described as twelve procedures, which provided a theoretical model to understand how teachers support students to construct their own understanding in a domain independent context.

Support understanding in a domain dependent context

The threshold concept is a pedagogic strategy to support students' understanding in a specific disciplinary context, which has the following characteristics (Meyer & Land, 2003; Mayer & Land, 2005; Meyer & Land, 2012; Perkins, 2006; Cousin, 2006):

1. Transformative: it brings a significant shift in the perception of a subject that opening up a new way of thinking about something.
2. Troublesome: it is troublesome in terms of knowledge acquisition. Besides, it might be ritual[1], inert[2], conceptually difficult[3], alien[4], and tacit[5].
3. Irreversible: it is unlikely to be forgotten for its transformative potential in learners' understanding.

[1] Routine and rather meaningless
[2] Retrievable for quizzes and examinations but not connected to other ideas or transferable to real world experience
[3] Barriers from the misimpression from every day experience, reasonable but mistaken expectations, and the strangeness and complexity of scientists' views of the matter
[4] A perspective that conflicts with our own one.
[5] Personal and implicit

4. Integrative: it exposes the previously hidden interrelatedness of something.
5. Bounded: it pertains to a limited disciplinary.
6. Discursive: it is a shift in perspective that simultaneously accompanied by an extension of the use of language through expression, reflection and communication.
7. Reconstitutive: there is a shift in the learner's subjectivity, a repositioning of the self or identity transformation after they acquire threshold concepts.

2.2.2 Understanding as a learning outcome

Understanding can be seen as a learning outcome from two perspectives: representation and performance. In the former perspective, understanding is an appropriate representation of a schema or a mental model with various issues or topics connect to each other such as concept maps (Minchin et al., 2000), explanation patterns (Schank, 1986), and abstract schemas (Ohlsson, 1993). In the latter one, it is a flexible performance capability, which allows learners to explain, justify, extrapolate, relate and apply in ways that go beyond knowledge and routine skills (Perkins, 1998; Wiske, 1998).

Understanding as presentation

The Structure of the Observed Learning Outcome (SOLO Taxonomy) described the structural complexity of a particular response (that presents the mental state of learners on a particular topic) to a learning situation with five levels: pre-structural, uni-structural, multi-structural, relational, and extended abstract (Biggs, 1980). Recent studies (Dudley & Baxter, 2009; Smith & Colby, 2007) indicate that the last two levels (i.e. relational and extended abstract) of SOLO Taxonomy represent students' deep understanding.

Understanding as performance

Inspired by the studies on the relationship between learning approach and learning outcome[6] (Marton & Säljö, 1976) and four types of students' responses[7] (Fransson, 1977) in academic reading, Entwistle (2000) proposed a framework to describe understanding from a performative perspective, which included mentioning, describing, relating, explaining and conceiving. In addition, Fransson (1977) indicated that students who adopt deep approach is capable of choosing different response strategies according to their perception of the demands of the test situation while those who adopt surface approach to learning use only one response strategy – list the content of the text, which is the first level of understanding in the Entwistle's framework. The capability of choosing different response strategy shows students' flexibility of presenting their understanding, as Perkins (1998) indicated: "*understanding is more than a routine well-automatized skill…an understanding of a topic is a flexible performance capability (p40)*".

2.3 Large class teaching

2.3.1 Challenges in large class teaching

Defining "large classes"

It is not easy to define "large classes" in a quantitative approach for instructors' perception of large classes varies in terms of teaching experience, disciplines, course level (such as undergraduate and postgraduate) and the nature of classes (such as lectures, tutorials or laboratory) (Hayes, 1997; Kerr, 2011; Coleman, 1989). In general, a class composed of more than 50 students is usually considered as a large class (Chimombo, 1986; Holliday, 1996; Hayes, 1997; Li, 1998; Harris et al.,

[6] Students who adopt deep approach to learning achieve a deeper understanding than those adopt surface approach to learning

[7] The first type is description with mentioning, in which students write a complete list of content of the text. The second type is description with content, in which students give a neutral and complete summary of the content of the text. The third type is conclusion-oriented with mentioning, in which students report they have found certain parts of the information interesting, but they did not summarise the contents of these parts. The last type is conclusion-oriented with contents, in which students summarise their main conclusions from reading the text and they explain their thoughts and reflections and summarise the parts of information they have found most interesting. (Fransson, 1977:p250)

2004; Wang & Zhang, 2011). Gedalof (2007) furtherly explained this threshold number based on his own teaching experience: it was impractical for instructors to make individual, protracted eye contact with each student in the room in order to gauge their involvement and comprehension of material.

Challenges for the learning process

Quality teaching in large classes is challenged by motivation, engagement, and feedback. In a large class setting, students are often anonymous to both the instructor and to each other. The anonymity in the classroom results in a less personal responsibility for learning, which reduces students' learning motivation (Cooper & Robinson, 2000). Furthermore, it also reduces students' active involvement in the learning process. The anxiety of participating verbally in class increases for students fear saying something foolish in front of so many people (Gleanson, 1986; Geski, 1992). Besides, the student-student interaction and teacher-student interaction are limited in large classes when traditional lecturing is the dominant teaching method (Feldman, 1984; Carbone & Greenberg, 1998; Deslauriers et al., 2011). Last but not least, it reduces the frequency of feedback provision to students due to the limited interaction between the instructor and students (Wulff et al., 1987).

Challenges for the learning outcome

Large class teaching might reduce students' cognitive development (Carbone & Greenberg, 1998) and even academic performance in terms of course grades (Bandiera et al., 2010). Feedback contributes directly to students' learning outcome (Chickering & Gamson, 1987; Gibbs & Simpson, 2004). When teachers have less interaction with students, which results in a limited feedback provision to students. Based on the conversation theory and conversational framework, students received limited feedback to adjust their own conceptions and actions in the large class setting, which negatively influences their construction of knowledge with a less cognitive development and academic performance compared to students in the small classes.

2.3.2 Potential benefits in large class teaching

More interaction

A large class setting provides enough students for interaction (Hess, 2001). There are three types of interaction in learning: teacher-student interaction, student-student interaction, and student-content interaction (Garrison et al., 1999). Anderson (2003) indicated that deep and meaningful learning is supported as long as one of the three types of interaction is at a high level. The other two may be offered at minimal levels, or even eliminated, without degrading the educational experience. Therefore, though teachers in the large class setting might not maintain the same level of interaction with students as they do in small classes, they could encourage the student-student interaction, in which the number of students becomes an advantage.

More resources

Large classes might bring more creativity and innovation than small ones (Hess, 2001; Wang & Zhang, 2011; Qi & Wang, 2009). Learning is a journey of constantly constructing our understanding in a specific field or of the world in general based on the available resources to us. A large class, in terms of the number of students, is potentially composed of a high diversity of learners. These learners will co-construct a learning environment with multicultural, backgrounds, temperaments, world-views, and values, which provides more resources to each other and tends to make students confront conflict ideas that facilitates critical thinking in the learning process.

More tutors

The instructor is not the only pedagogue in the large class setting (Hess, 2001). Vygotsky (1978) indicated, in the definition of zone of proximal development, more capable peers are able to facilitate learners to achieve the potential development. Therefore, students in the large class setting also means potentially there are more peers who are available to instruct others in the learning process compared to the small class setting.

More reflections

Large class teaching impels teachers' professional development (Hess, 2001). The large class setting brings more challenges to achieve quality teaching compared to small classes, which truly forces instructors to innovate teaching strategies. Particularly for university teachers who are trained with pedagogic knowledge, the large class setting drives them to conduct reflective practice for continuously improving the teaching quality.

2.3.3 Strategies for large class teaching

Large class setting brings both challenges and benefits for quality teaching and learning, which implies that the effect of class size in educational outcome depends upon the teaching method used rather than the class size *per se* (McKeachie, 1980). There are two main approaches for quality teaching in large classes: one is making the large class to seem small, and another one is taking full advantage of the large class.

Making the large class to seem small

The rationale behind this approach is that usually the small class is more effective to achieve the learning effectiveness due to a higher level of student engagement, timely feedback, and personal tailored instruction in the learning process (Schanzenbach, 2014). Strategies such as vicarious learning, snowball groups/pyramids, and personal response systems belong to this approach.

Vicarious learning emphasizes a process of social learning, in which students' learning behaviour is shaped by the observation of others attempting to learn it. Firstly, it reveals learners' misconceptions or highlighting questions at a particular level of conceptual understanding. Secondly, it provides an example of how to engage in learning dialogs and how to ask appropriate questions, which might provide a model of good learning behaviour (Mayes et al., 2001). In the large class setting, the instructor could select students who represent different levels of understanding in the subject matter and records the questions and guidance as several episodes to share with the whole class as an additional learning material (Laurillard, 2013).

Snowball groups/pyramids are group works that involve progressive doubling: students first study alone, then in pairs, then in fours, and so on (Jaques, 2000). The times of doubling depends on both the available time and class size. During the snowball groups/pyramids, students gradually construct a complex and deep understanding through constantly confronting their own ideas with others. Besides, progressive doubling also allows the instructor to provide feedback in an affordable way (Gibbs & Jenkins, 1992; Laurillard, 2013).

Personal response systems as tools that enable students to press a button on a hand-held remote control devices corresponding to their answer to multiple choice questions projected on a screen, and students will see the distribution of answers in the class and discuss the correct answer (Mayer, 2009). In the large class setting, it will not only facilitate active engagement in the learning process for students but also provide a timely feedback for the instructor on students' learning outcome. Furtherly, Laurillard (2002) proposed a strategy called conceal multiple-choice questions, which can be a powerful supplement when using the personal response system. First, the instructor conceals the available choices of a question to let students work out their own answer. Second, after revealing all the choices, students select the nearest fit based on their own answer (Laurillard, 2002). This strategy facilitates students to think independently without the influence of the available choices, and it may deepen students' understanding of the learning subject.

Taking full advantage of the large class

The rationale behind this approach is that a large group of students means more interaction, more resources and even more tutors. Strategies such as the Keller plan and the learning community belong to this approach.

The Keller plan is a systematic method for personalised instruction (Keller, 1968), and it has the following salient features (Keller, 1974):

1. The unitising of course content: it provides the basic condition for effective personalised learning as it sets a step-by-step learning path for students.

2. The self-pacing study: it allows students to proceed in their learning at their own speed that might facilitate the adoption of deep approach to learning with a deeper understanding of the subject.
3. The mastery demanded for each unit before going to the next unit: it assures the pre-requisite knowledge and skills for the efficient learning in the next step.
4. The repeated tests provided by the student proctors: it supports students to assess their mastery of the learning content through repeated tests and tutoring from their advanced peers.

Personalised instruction is one of the obvious challenges in large class teaching due to the number of students, the Keller plan is an applicable solution to facilitate personalised learning in the large class setting. Especially, the last feature of the Keller plan can be used independently to take advantage of students as a good resource for peer tutoring.

The learning community is based on the theory of Community of Practice that a group of people develop themselves personally and professionally through the process of sharing information and experiences (Lave & Wenger, 1991). In the large class setting, the learning community emphasises the creation of a sense of belonging and the ability to connect with the instructor and other peers for students (Kerr, 2011). It might alleviate the isolation and anonymity issues for promoting an active engagement, and it might also result in both a learning environment with richer learning materials contributed by the members of the community and a productive individual learning experience through the interaction with other members.

In the next section, we introduce collaborative learning, which is also a strategy in large class teaching. It can belong to both approaches (making the large class to seem small and making full advantage of the large class) depends on the design of collaborative activities among peers.

2.4 Collaborative learning

2.4.1 Potential benefits for teaching and learning

Collaborative learning generally means two or more people learn or attempt to learn something together (Dillenbourg, 1999). The aim of collaborative learning is students working together to maximise their own and other's learning (Johnson & Johnson, 2008), and it has the following positive impacts on quality teaching and learning.

Motivation

In the constructionism learning theory, learning can only happen through the learner's effort on meaning making (Suthers, 2006). Collaborative learning facilitates the process of meaning sharing for building a shared understanding progressively, and the desire to understand something or to be understood is a strong motivator of human behaviour (Schwartz, 1999), therefore, the motivation to learn might be enhanced through collaboration.

Engagement

Student engagement can be presented from student-student interaction, teacher-student interaction, and student-content interaction (Cleveland-Innes & Garrison, 2012). Collaborative learning emphasises the importance of social interaction (Hiltz, 1994), which is designed for enhancing the value of interaction among learners themselves (Jacobs & Ward, 2000), therefore, it might encourage students to participate actively in the learning process.

Feedback

Laurillard (2012) indicated collaborative learning produced two types of feedback, which came from two types of learning cycles. One is the peer-modelling cycle, where students learn from how others approach to the learning subject. The feedback in the peer-modelling cycle targets the learning behaviour that gets students to be aware of different approaches to learning. The other one is the peer-communication cycle, where students exchange their understanding of the learning

subject with the peers. The feedback in the peer-communication cycle targets the learning content that might result in a conceptual change on the learning subject for students.

Learning outcome

Collaborative learning might facilitate students' cognitive development and also a better academic performance due to its supportive effects on various aspects of learning such as motivation (Tella, 2007; Goodman et al., 2011), engagement (Rowe, 2011; Aboho, 2014), and feedback (Swan, 2003; Irons, 2007), which have positive impact on academic performance. Besides, there are studies that indicated directly collaborative learning enhanced learning outcome from questionnaires (Hommes et al., 2014), focus group (Leger et al., 2013) or students' self-reported materials on the accomplishment of course objectives (Dougherty & Andercheck, 2014).

2.4.2 Challenges for effective collaboration

Social loafing

Social loafing is a phenomenon that people reduce their exertions when they work in groups than working alone (Latane et al., 1979), and it usually results in two effects: free rider and sucker. The former effect describes some group members do not devote effort to the group task (Kerr & Bruun, 1983; Morris & Hayes, 1997; Joyce, 1999). The latter effect describes active or capable members of a group reduce the level of their own effort after they discover the free riders in the group (Kerr, 1983). In sum, social loafing has negative impacts on learning motivation and student engagement in collaborative learning.

Status sensitivity

Status sensitivity is a phenomenon that active or capable members take charge and have an increasing impact on the team's activity and products while inactive or incapable members have both less access to social interaction and less cognitive development in the collaborative learning (Dembo & McAuliffe, 1987). Learners are more likely to develop cognitively in contexts that peers have equal power and all have opportunities to influence one another (O'Donnell & Hmelo-Silver,

2013), unequal power relations among group members might result in some members simply accept the opinions of the more powerful and authoritative members without experiencing cognitive conflicts or examining existing thoughts. Therefore, status sensitivity might hinder students to construct their own understanding by experiencing conflict ideas and theoretical debates in the learning process.

Ganging up on the task

Ganging up on the task is a phenomenon that team members collaborate with each other to get the whole task over as easily and as quickly as possible (Salomon & Globerson, 1989). It is likely to happen when there is only one or few members in the group are interested in the group task, therefore, they resolve their conflicts by accepting the least effort solution, which directs group members to adopt surface learning approach with limited engagement.

Process losses

Generally, in collaborative learning, there is a transaction cost that some resources (time and thinking) of group members must be invested and expropriated in the group coordination and interaction (Steiner, 1972; Hertel, 2011). Learners might be less motivated to participate in the collaborative learning due to an assumption on less efficiency compared to learning alone.

2.4.3 Design principles for effective collaboration

Just assigning students in groups does not guarantee collaboration (Brush, 1998), a sound design of collaboration will maximise the positive impacts and minimise the negative impacts of collaborative learning on quality teaching. The original idea of collaborative/cooperative learning[8] was much influenced by Deutch (1949)'s cooperation theory, especially about positive social independence - the accomplishment of each individual's goals is positively affected by the actions

[8] The concept of cooperative learning and collaborative learning is interchangeable as collaborative learning become more structured, which blurs the difference between cooperative and collaborative learning (Johnson & Johnson, 2008, p404).

of others (Johnson & Johnson, 2008). Therefore, a sound design depends on the construction of positive interdependence in the collaboration.

Positive goal interdependence

Positive goal interdependence means members of a group have a mutual set of goals that they are striving to achieve. It potentially reduces the possibility of ganging up on the task, in which the group goal is not interested for all the members and students decide to finish the group work as easy as quickly as possible.

Positive reward interdependence

Positive reward interdependence means a mutual reward is given for successful group work, which enhances group productivity. There are specific strategies designed bases on positive reward interdependence such as team-games-tournaments (De Vries & Edwards, 1973), team-accelerated instruction (Salvin, 1984), cooperative integrated reading and composition (Madden et al., 1986) and student teams-achievement division (Salvin, 1986).

Positive resource interdependence

Positive resource interdependence requires each member of the group only have a portion of the information, resources, or materials necessary for his or her own task and they have to combine their resources in order to complete the group task. Jigsaw[9] is a well-known pedagogic pattern on collaborative learning based on positive resource interdependence (Dillenbourg, 2002).

Positive role interdependence

Positive role interdependence requires each member of the group is assigned complementary and interconnected roles that specify responsibilities for completing the group task e.g. reader, recorder, time-keeper, dictionary manager, editor, calculator, publisher etc. Recent studies (Ghislandi, 2012; Johnson & Johnson, 2014) used this scripted role collaborative learning.

[9] Students are organised into groups with one member assigned to each topic. Then students gather into groups divided by topic. In the same-topic groups, students synthesise information from each other and create a final report on that topic. Then students go back to their own groups and report the findings from topic-specific group discussion.

Besides, there are also other types of positive interdependence such as identity, fantasy, environmental, task interdependence, and outside enemy, which are likely to be developed based on these four positive interdependence mentioned above. All of these positive interdependence provide a theoretical foundation on how to design effective collaboration among learners. Last but not least, a sound design is only a prerequisite for true collaboration, it also requires the instructor to monitor the process and check learning outcome to understand the effectiveness of collaborative activities (Urhahane et al., 2010).

3. Stage 1: Exploration on university teachers' perception of quality teaching and quality teaching practice

3.1 Research questions

eLearning is considered as a catalyst for pedagogic innovation and quality improvement (Beetham & Sharpe, 2013), it actually achieves less in higher education than we expected. First, teachers make only limited formal academic use of information and communication technologies (Selwyn, 2007). Second, existing studies provide inconsistent evidences on eLearning for students' academic performance, which is one of the most important element for quality teaching (Ghislandi, 2005). Some studies indicated students achieved better performance in blended/online learning environment (Hughes et al., 2007; Rauh, 2011). Some studies indicated there was not a significant difference on academic performance between eLearning and traditional teaching (Philpps & Merisotis, 1999; Rivera & Rice, 2002; Lim et al., 2008; Keller et al., 2009; Ehlman et al, 2011; Bain, 2012; Tatli & Ayas, 2013), and even a better performance in traditional teaching (Emerson & MacKay, 2011; Jaggars, 2014). Therefore, it is crucial to ask the question: what is the impact of eLearning on quality teaching in higher education? Especially it is crucial to ask this question to university teachers. On the one hand, university teachers are one of the key stakeholders in the teaching and learning process - the centre of gravity of higher education (Higher Level Group on the Modernisation of Higher Education, 2013); on the other hand, university teachers have the

transformational leadership in the teaching and learning process who decide the involvement of eLearning in practice.

To investigate the impact of eLearning on quality teaching from university teachers' perspective, it is necessary to understand how university teachers perceive quality teaching. Quality is a complex value-laden concept in higher education (Harvey & Green, 1993; Ghislandi & Raffaghelli, 2012; Ghislandi et al., 2013), university teachers' perception of quality teaching will influence their adoption of eLearning in practice. Furthermore, we should explore the problems of quality teaching that university teachers confront in practice and their strategies to tackle these problems, which develop our understanding of specific aspects that eLearning actually contributes to quality teaching rather than theoretical benefits. To sum up, the research questions in the Stage 1 are:

Main question:

What is the impact of eLearning on quality teaching in higher education?

Sub questions:

1. What is university teachers' perception of quality teaching?

2. What problems of quality teaching do university teachers confront?

3. What eLearning or non-eLearning strategies do they use for quality teaching in practice and how do they use them?

3.2 Related studies

Laurillard (2002) presented eLearning's theoretical benefits for quality teaching by describing different types of media and their supports in learning experience through specific technologies. However, eLearning's theoretical benefits for quality university teaching does not equal to its impact in higher education because the impact largely depends on how the university teachers actually use eLearning in practice rather than its potentials in theory. Existing literatures indicated one of the reasons to explain teachers' limited adoption of eLearning in practice was that they did not believe in its benefits for teaching and learning (Butler & Sellbom, 2002; Chizmar & Williams,

2001; Al-Senaidi et al., 2009). Therefore, it is crucial to understand studies on the conception of teaching and the conception of eLearning from university teachers' perspective, which are the fundamentals to develop their perception of quality teaching and their potential use of eLearning in practice.

For studies on teachers' conception of teaching, Samuelowicz and Bain (1992) proposed a five-level classification by using constant comparative analysis in the interviews of thirteen university teachers in science and social science. The classification included "teaching as supporting student learning, teaching as changing students' conception of understanding of the world, teaching as facilitating understanding, teaching as transmission of knowledge and attitudes to knowledge within the framework of an academic discipline, and teaching as imparting information". Later, Kember and Kwan (2000) followed the methodology of Samuelowicz and Bain (1992)'s study and furtherly summarised the conceptions of teaching in two orientations: teaching as transmission of knowledge and teaching as learning facilitation. Besides, they also indicated "*the teaching approach is strongly affected by the conception of teaching* (Kember & Kwan, 2000:489)." Then Eley (2006) found a contrary result that "*conceptions of teaching are seen as entities that can exist independently of detailed planning and teaching activities* (p. 209-210)". Twenty-nine teachers participated in Eley (2006)'s study. During the interview, Eley asked teachers to recall and describe their thinking that went into the planning of teaching episodes within a recent class rather than directly asked their conceptions of teaching to collect indications of functional decision steps rather than post hoc reflections on teachers' past experience. This inconsistency on the research results of teachers' conception and practice in higher education was supported by a critical review (Kane et al., 2002), in which indicated there was still not a definitive conclusion about the relationship between university teachers' conceptions of quality teaching and their teaching practices.

For studies on teachers' conception of eLearning, McConnell and Zhao (2006) studied the Chinese higher education setting with twenty-four participants. This study revealed several practical issues in eLearning adoption such as teachers spent too much time to follow online groups, and online

collaborative learning led to poor learning outcomes compared with other means. However, the sample of participants was mixed of different types of stakeholders including teachers, staff developers, researchers, and eLearning specialists who involved in promoting or developing eLearning in their own institutions, thus the result presented conceptions of eLearning and practical issues in adopting eLearning from not only university teachers' point of view but also other stakeholders. Khan (2014) interviewed twenty-three teachers from vocational educational institutions in Australia for their conceptions of eLearning and teaching approaches. There were five categories about teachers' conception of eLearning: to meet external expectations[10], to gain access to information and resources, to use as a delivery tool, to use as a medium for active learning, and to prepare students for future profession. The five teaching approaches were: teacher-focused, information-oriented strategy to deliver subject content; teacher-focused, feedback-oriented strategy to achieve intended outcomes; teacher-focused, practice-oriented strategy to link theoretical and practical knowledge; student-focused, facilitation-oriented strategy to provide active learning for developing students' understanding; student-focused, industry-oriented strategy to develop students' knowledge for meeting industry's needs. Beside the studies exploring both the conception of eLearning and teaching practice, some studies focused only on the conception of eLearning.

Gonzalez (2009) interviewed seven teachers from health sciences and found there were four functions of eLearning: to provide information to students, for occasional online communication, for engaging students in online discussions, and to support knowledge-building tasks. Recently, Stein et al. (2011) proposed a framework (Figure 1) about the conception of eLearning by conducting a survey with one hundred and fourteen teachers and teaching-support staffs in New Zealand and twenty interviews with participants from universities (twelve), polytechnic sectors (seven), and the adult training provider (one). Different to other studies on the conception of

[10] External expectations were composed of three aspects: student expectation, faculty or organisational requirements, and subject nature (Khan, 2014: p.160).

eLearning, Stein et al. constructed the conception of eLearning framework from what eLearning is rather than the functions of eLearning, which already limited the conception of eLearning as a tool (McConnell & Zhao, 2006; Gonzalez, 2010; Robert, 2003; Ellis et al., 2006; Lameras et al., 2011). The ultimate purpose of eLearning is to enhance learning, thus "eLearning as learning" is at the core. To achieve the ultimate purpose, eLearning is also seen as methods for "facilitating learning interaction" and "reducing distance between and among teachers, students and the course material (p.153)". Besides, eLearning also refers to tools that support the two methods mentioned above. At last, eLearning is conceived as collaboration at all levels supports the whole system presented in the figure. This framework presents a logical relationship among various conceptions, which also implies the complexity on the conceptions of eLearning issue itself.

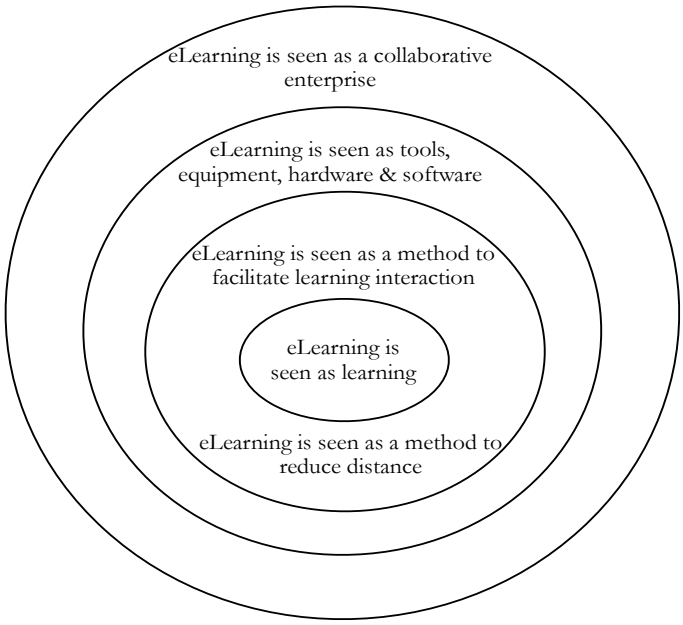


Figure 1 Conceptions of eLearning (Stein et al., 2011)

Teachers' conception of eLearning describes the theoretical impact of eLearning in practice, and issues that contribute to the inconsistency between the conception of eLearning/teaching and the practice implies the impact in reality. Kember & Kwan indicated team teaching, large classes, and heavy teaching loads were factors that influenced the actual teaching practice being away from teachers' own conception of teaching. Olafsdottir (2014) investigated the institutional and external influences affecting quality teaching, in which she found there were five issues: class size, teaching

room allocation, time distribution of academic duties and the impact of the promotion criteria, institutional policy on teaching and teaching-learning cultures, and the impact of financial factors. To sum up, there are three main issues in the existing literatures. Firstly, how university teachers define quality teaching remains unclear though there were studies on teachers' conception of teaching and practice (Olafsdottir, 2014). Secondly, specific strategies adopted currently by university teachers for quality teaching in practice do not fully explored. Existing studies mainly explore general teaching approaches (Kember & Kwan, 2002; McConnell & Zhao, 2006; Gonzalez, 2010; Stein et al., 2011) with a limited number of inquiries on specific strategies (Ellis et al., 2006; Lameras et al., 2011). Thirdly, inquiries on the inconsistency between teachers' conception of teaching and their practice are still limited (Kember & Kwan, 2002; Olafsdottir, 2014). Therefore, we conducted this research to furtherly investigate on teachers' conception of quality teaching with problems and strategies in practice, with the aim to reveal the impact of eLearning for quality teaching in higher education.

3.3 Methodology

3.3.1 Rationale for adopting case study

The case study is a qualitative research methodology that focuses on investigating a contemporary phenomenon within its natural setting (Yin, 2014). The inquiry of Stage 1 was to explore the impact of eLearning on quality teaching in higher education, specifically, to understand university teachers' perception of quality teaching with the problems and strategies they have in practice. The case study was adopted for two reasons. Firstly, it suited the research situation. This inquiry was to explore how university teachers try to achieve quality teaching in their specific contexts with the aim to discover the real impact of eLearning in practice. Since the primary advantage of case study research is its deeper understanding of specific instances of a phenomenon (Creswell, 2013), it enables us to comprehend profoundly the contextual factors that influence university teachers' decision about using eLearning or not. Secondly, it suited the research purpose. This inquiry aimed

to explore how university teachers think of quality teaching from their point of view rather than to use a pre-selected theory to explain their perception. In the case study, theory is allowed to be absent from studies that focus on describing the case and its issues (Stake, 1995), which allows an inquiry without a predefined framework.

3.3.2 Unit of analysis and a multiple-case study

In the case study, unit of analysis defines what the "case" is (Yin, 2008). In this inquiry, individual university teacher was considered as a case for collecting rich information about their perception of quality teaching and practice. This inquiry aimed to understand the impact of eLearning for quality teaching in practice. We selected the multiple-case design for making comparison among cases to figure out both shared issues and potentially special issues from individual cases under a specific context, which hopefully balanced the provision of a general picture about teachers' perception and practice of quality teaching with the detection of contextual issues to implement quality teaching.

3.3.3 Sampling and recruitment

There was not a specific sampling criteria for case selection as the sampling strategy is maximum variation sampling that refers to select a wide range of variation, which serves the purpose of discovering common issues that cut across a diverse sample while at the same time offers the opportunity to discover unique or diverse issues within specific contexts.

Recruitment of participants was mainly via email. We started recruiting teachers in traditional universities in Italy and then more teachers were recruited from other educational contexts in terms of both countries and teaching approaches to achieve a diverse sample.

3.3.4 Instrument

An interview is a directed conversation, which is a useful data-gathering method in various types of qualitative research (Lofland & Lofland, 2006). This inquiry mainly adopted in-depth interview to collect data for it fosters eliciting participants' interpretation of their opinions and experience

according to the research topic (Charmaz, 2006). All the interviews were recorded, and F5[11] was used to transcribe all the interviews verbatim. Besides, we also collected data from classroom observation and access to online course. Due to the limitation of time and resource, these two methods were only used in a few cases.

3.4 Data collection

Seventeen university teachers participated in the inquiry of Stage 1, and they were from a variety of disciplines in Italy, UK, and China. Interviews were mainly conducted face-to-face in the interviewees' offices, and some interviews were conducted via Skype or telephone when it was not practical to meet interviewees. Table 1 presents a summary of participants' characteristics. We interviewed teachers from Italy and UK in English while teachers from China in Chinese, in which they expressed their opinions in a more comfortable and richer way. Interviews lasted for about 60 minutes averagely, which were the main data source in this stage. Supplemental data were field notes – written records of the fieldwork including personal interview journals, classroom observation, reflections on accessing to online courses taught by the participants and participation in the events organized by the participants.

Table 1 Stage 1: characteristics of participants

Identifier	Gender	Year of teaching in higher education	Disciplines	Teaching approach	Country
T1	F	12	Psychology	Face-to-face	Italy
T2	F	11	Philosophy	Face-to-face	Italy
T3	M	10	Cognitive Science	Face-to-face	Italy
T4	M	15	Cognitive Science	Face-to-face	Italy
T5	M	18	Computer Science	Face-to-face	China
T6	M	8	Education	Blended teaching, Distance teaching	UK
T7	F	14	Media and Communication	Blended teaching	UK
T8	F	18	Economics	Blended teaching	Italy
T9	F	4	English Education	Distance teaching	UK
T10	M	4	Media and Communication	Blended teaching	UK
T11	M	4	Medicine	Blended teaching	UK
T12	M	35	Marketing	Blended teaching, Distance teaching	UK
T13	M	3	Statistics	Distance teaching	China

[11] F5 is a professional software on transcribing interviews.

T14	M	28	Agroforestry	Distance teaching	China
T15	M	N/A	Structure Engineering	Distance teaching	China
T16	F	27	Accounting	Distance teaching	China
T17	M	23	Economics	Distance teaching	UK

3.5 Data analysis

Grounded theory, a methodology to build theories[12], provides a systematic way to analyse qualitative data, and there are three stages of coding in grounded theory: open coding, focused coding, and theoretical coding[13] (Charmaz, 2006; Tarozzi, 2012). This inquiry aimed to explore quality teaching in higher education from teachers' point of view rather than to construct a theory about university teaching, therefore, we used grounded theory as an analysis method rather than a methodology.

3.5.1 Within-case analysis

Within-case analysis is the in-depth exploration of a single case in case study research (Peterson, 2010). Each case was initially analysed according to the three sub questions of Stage 1, therefore, there were three focuses: perception of quality teaching, problems in practice, and strategies in practice. We used the technique of open coding in grounded theory as we did not have a predefined coding framework for data analysis. The procedure was: firstly, read the transcription[14] line-by-line; secondly, selected a segment of text in the transcription that relevant to the three main focuses; thirdly, created a code or several codes for that segment of text. An example of codes creation is showed in Table 2

Table 2 Stage 1: within-case analysis: creating codes

Codes	Segment of text in the transcription of T3
critical discussion [perception] students' real understanding [perception]	quality academic course should give time for critical discussion what is being said, for real understanding with that being said

[12] Grounded theory is a qualitative research methodology of analysis that linked with data collection that uses a systematically applied set of methods to generate an inductive theory about a substantive area (Glaser, 1992).
[13] In open-coding phase, data are coded with no preconceived framework; in focused-coding phase, codes are grouped into several categories; in theoretical-coding phase, links among all the categories and a core category were identified to generate a theory.
[14] For a few cases, there were also filed notes on class observation or online course for analysis.

assessment [perception]	It's very important the way you structure, the exam is important for the way of learning.
reduction in topics [strategy] too much content [problem]	One thing that is surely changing in my teaching was that I reduced the amount of topics I addressed but I tried to make the topics I addressed where they understood. It wasn't just a survey of the topic because I sort of change my idea from giving an overall survey of the topics to let the people intuitive, from this, actually get the students to fully understand how I would approach one specific topic and maybe leave them on their own to address all the topics in the similar way

After the open coding for the entire case, we used the technique of focused coding in grounded theory to identify links among codes in a case. Some links were among codes with the same focus in a case such as perception, which presented the structure of that participant's perception of quality teaching. Some links were among codes with different focuses in a case such as a link between a code about strategy and a code about problem, which presented that participant's effort to improve the teaching quality. In some cases, there were also not obvious links among codes that can be identified in the data. Figure 2 is an example of links among codes, which were presented in Table 2. There were five codes in Figure 2: three codes (critical discussion, assessment, and students' real understanding) about perception, one code about problem, and the last code about strategy. The three codes about perception were connected as the first two codes i.e. critical discussion and assessment contributed to the third code i.e. students' real understanding. The third code about perception were linked to the code about problem i.e. too much content and the code about strategy i.e. reduction in topics because the strategy targeted the problem, which indirectly contributed to achieve that participant's perception of quality teaching.

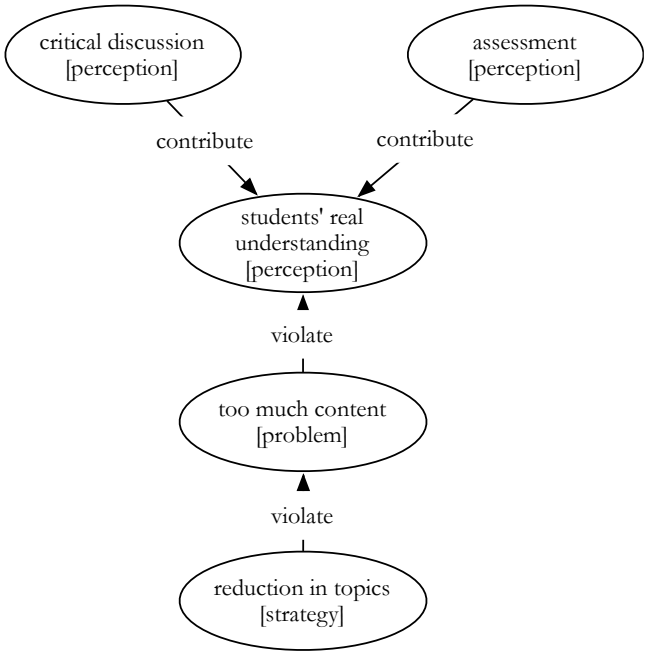


Figure 2 Stage 1: within-case analysis: identifying links among codes

3.5.2 Across-case analysis

Across-case analysis is used to gain an in-depth understanding of a multiple-case study by extracting the common issues across cases and constructing themes (Ayres et al., 2003). We used the technique of focused coding to compare codes from all the cases. There were four types of comparison. The first type was to recognise the common issues across cases. Table 3 presents an example of a common issue i.e. large class teaching emerged from several cases.

Table 3 Stage 1: across-case analysis: identifying common issues

A common issue: large class teaching
T1: They [master students] are obliged to read every time and I cannot check every person read everything but some way they should have some have ideas because I ask them to build a little bit conversation. So in these participation moment, with understanding and we can exchange. It [the teaching method] is interesting, but you can't adopt it in a class with 140 students. T2: I cannot use this method [Socratic teaching] because I have a bachelor class of 250 students. T3: It's not ideal [in teaching a large class separated into several rooms] I think especially for me it's very difficult to, e.g. I would like to interact much more with students to ask questions, but it's very difficult to do it because every time a student made a question I have to say it aloud and then I answer. Even we repeat every single word, if they are not in the class; it's difficult to follow the conversation if you are never part of it. So if you are away, I intend to make it much more a straight line, just lecture. Stop if they have questions for clarification but not really make interaction because I failed that this wouldn't really involve the students in the classes. T4: I think if you have a big class, maybe with 200 students, then what you can do is very limited...I prefer classes maybe more like 20 students, then you should have quality teaching as that point means interacting students, making them think, giving them things to challenge them, but you can't really do that with 200, 300 students

T7: That was used to be a very small group of seminars based way that we used to teach. The idea of workshop, it would be interactive, students could ask the questions, but because of the numbers, we have to change slightly the way that we teach them now. So we can't make students do presentation because it's just too big, it just won't work. T10: I think you can't do a flipped lecture for campus-based students. It doesn't work if you just put the whole lecture and just use face-to-face time for small group discussions with cohort of 400. T12: Once you get above a certain level, sort of above seminar group number, which should be about 12, when you can expect everyone to contribute and you can go around and ask everybody, there is nowhere to hiding and students learn from each other and learn from the group, and learn from the tutor at the same time. Once you get a big class, it's a different sort of learning. So the guarantee of quality isn't so agreed through students....We could guarantee the minimum quality, but I don't think you could not achieve the quality where you get from a small group.

The second type was to establish the potential links among codes across cases. Table 4 presents an example of the link between a code from the case T1 and a code from the case T12. T1 shared a problem in her practice i.e. students did not study during her classes and asked her questions when her classes were over. T12 used formative assessment in practice, which might be a solution for T1's problem because formative assessment allows teachers to examine students' learning in the process rather than in the end.

Table 4 Stage 1: across-case analysis: establishing links among codes

Code: miss the right moment to teach	Code: formative assessment
T1: First, they go to classes, but they don't study, and in the end, they study. So when they read and have doubts, but your class is over. So they came: exercise me, but now I have…OK, but it's not the right moment because the right moment was several months ago. This can be really a problem	T12: I mean if you have a question and answer session, you can tell most of their understanding; you can give them opportunities to ask if they are not. I will try to find out their understanding. You can give them exercises as resources, you could have sort of essay or assignment before the exam to check if they understand the basic concepts.

The third type of comparison was to identify if there was any difference among cases including external factors such as teaching context (traditional universities vs. open universities) and internal factors such as teaching experience and disciplines. Table 5 presents an example of a radical difference on the role of eLearning in practice between traditional universities and open universities. In the former context, teachers who teach students face-to-face have the possibility to introduce more interactive activities within the classroom. Thus, eLearning is not so necessary, especially for small classes. In the latter context, students were taught in distance; therefore, eLearning becomes a mandatory element in practice.

Table 5 Stage 1: across-case analysis: identifying differences

eLearning in traditional universities	eLearning in open universities
T4: It [online teaching] is efficient for big classes. That is not right for small classes. You can't do scientific writing and speech online[15], which would be hard.	T7: It [new technology] just enables new ways of communicating and interacting and distance learning so much more dynamic today. I suppose I would say now that there is not really an excuse for someone, for department or individual teachers in distance learning program that not using technologies effectively.

The last type of comparison was to group codes into categories for reporting an aggregated finding of this multiple-case study. Table 6 presents an example of a category created based on three different codes. The codes *coherent knowledge*, *frontier knowledge*, and *engaging knowledge* presents teachers' perception of quality teaching in terms of content, so *content design* is created as the category to summarise these codes.

Table 6 Stage 1: across-case analysis: creating categories for codes

Category: content design
Code: coherent knowledge T6: You need to have a useful amount of knowledge and content, and that content need to be coherent. You need to have that sort of knowledge based to it. But then to help students access that knowledge, you need to have time for them to play with that knowledge, understand that knowledge, develop that knowledge to discuss with other people, to think about it, to understand in relation to the knowledge they already have.
Code: cutting-edge knowledge T4: It should be about research what we know now, not what we knew in 20 or 30 years ago.
Code: engaging knowledge T4: I think for me good teaching means it should be exciting and related to people's real life experience

3.6 Research results

3.6.1 Perception of quality teaching

Content design

In this multiple-case study, many teachers indicated that content was important for the teaching quality, and there were various dimensions to be considered in the content design. The first dimension was about the structure of content. It referred to the code *coherent knowledge* shared by

[15] In the course scientific writing and speech, one session was that the teacher asked every student in the class to prepare a talk and present in front of all the peers and the teacher. Besides, there was a technician who recorded students' performance on their own talk. In the end, every student received a summary with all the positive and negative comments from peers and a video recording of their own performance in order to improve the skills of scientific speech.

cases, which required content to be designed in a logical and well organised way that was clear and easy for students to understand.

> T6: You need to have a useful amount of knowledge and content, and that content need to be coherent. You need to have that sort of knowledge based to it. But then to help students access that knowledge, you need to have time for them to play with that knowledge, understand that knowledge, develop that knowledge to discuss with other people, to think about it, to understand in relation to the knowledge they already have.

> T7: In terms of thinking through the rationale, obviously designing and putting it together, think about which areas of content you want to cover and why. And how do they in terms of sequences, how to put them together, how different concepts may build.

> T9: The courses themselves need to give students a very clear overview of what the content area is in that subject and some support in making sense of all the different things that they going to be asked to read and look at and understand. So they need to be clear logical progression through content.

The second dimension was content itself. It referred to two codes: one code is *cutting-edge knowledge*, which required content to be the state-of-the-art in that subject rather than knowledge out-of-date.

> T4: It should be about research what we know now, not what we knew in 20 or 30 years ago.

> T12: It's also a mix of received knowledge in that area and plus especially for business subjects, enough topical new and practical knowledge.

The other one is *teaching different levels of students*, which required teachers to engage students with different levels of knowledge in the subject.

> T4: To organize things if you give a talk or a lecture that works in the different levels. So you have something which everybody can understand, you don't want everything to be too difficult. I also think it's important to include some aspects when you teach which challenge people and so the really smart people won't be bored, when the people who already know the topics, they were not bored.

> T16: It is important to meet students' learning need in different levels, so it should include both the basic level and extended level of knowledge in the design.

The third dimension was the delivery of content. It referred to two codes: one was *engaging knowledge*, which required content to be attractive to students.

> T5: The content should be attractive, so students are willing to participate in the lessons otherwise students might not paying attention to it even they attend the lessons… The content should be relevant to students.

The other one was *multimedia*, which indicated content to be delivered in various forms to satisfy students' need.

> T5: It also requires good design, especially our university, we talk about multimedia - the diversity of teaching approaches. To apply "Excellent Course" in our university, one criterion is to use multimedia.

> T15: Such as virtual simulation experiments. With the development of technologies, we are able to have many things in the classroom that influences the teaching quality. When I studied in university, it is only the teacher who lecture on the stage and we have the textbooks. Now if there is an image, you don't need to spend a lot of words to describe it, for example, to know calcare, you can only show a picture of calcare to students, so they understand the features of calcare.
>
> T16: It [quality teaching] should meet students' learning need, provide different forms of learning materials such as text, audio, video, and online resources.

Teaching and learning process

There were two issues about the teaching and learning process in terms of quality teaching. The primary issue was learner-centred teaching approach. It referred to the code *teaching based on students' perspective* shared by cases, which indicated teachers' focus on facilitating students' learning either when they make decisions about specific learning activities, strategies or teaching in general.

> T4: You learn to put yourself in other person's lives, so as a teacher you're trying to think what it likes to be a student.
>
> T6: Rehearse in your own mind, whether it's face to face, whether it's blended, whether it's distance learning. Rehearsing, well, when they do this, how might help them, what would they be doing, how will they understand and what they gaining from it.
>
> T7: It is also resources and time, which is an issue really in the sense of students' access, so I don't know how it is on campus [for using Second Life]. If they need to do it, they have to do it through their own devices. With some of the students in the experiment, their graphic cards of computer were not so good and the speed of that computer [was slow]. So it's kind of all kinds of issues we have to look at before we do it [in practice].
>
> T13: You need to change. Though the course is the same, you are the same, students gradually change, you teach for students, so you need to adapt yourself since they are changing
>
> T14: To adjust teaching according to students' feedback. For distance learning, many feedbacks are not coming from the classroom, you receive them from their assignments and other aspects.

The second issue was interactive teaching. It referred to the code *maintaining interaction with students* shared by cases, which indicated the importance of interaction between teacher and student for quality teaching.

> T3: You need to make sure that the class is with you during your teaching, at least a significant number of people in the class is with you. When you start receiving questions that really challenge you and challenge the knowledge that you have presented...they really start to see the application of each single topic and more than single concept they are required, a logic of discussing or a logic behind the subject
>
> T5: it is necessary to have an online forum or a learning management system, which enables teachers to maintain constant interaction with students in a long run.

Assessment

Learning assessment was considered as an essential element for quality teaching, and teachers indicated its importance from two aspects. The first aspect was the form of assessment. It referred to two codes. One was *formative assessment*, which required teachers to assess students' learning in the process.

> T12: Ideally, you will have check points, so students know how well their understanding as they go through the course and there is still time to change the reading and change the methods or ask questions so you know better if they have troubles.
>
> T14: Formative assessments influence the final exam a lot. The monitoring activities for learning is achieved through teaching, whether they have good grades depends on both the way of teaching and the way of learning, so it should be discussed in two aspects.
>
> T16: We do constant tests in the learning process in order to let students acquire the knowledge, we do the assessments to facilitate learning, not studying for exams.

The other one was *multiple assessment*, which indicated teachers should assess students with various methods of assessment.

> T5: In my teaching, I adopt multiple assessments, which includes both the activities inside the classroom and outside the classroom, such as the attendance rate, the frequency of raising questions and performance, the quality of assignments and experiments. In case there is an online forum, I also consider the engagement such as the number and quality of questions posted in the forum, replies from other peers. So students won't get a good grade if they only get a good score of the final exam, all the other learning activities are also counted. It is important to design the weights of each element I mentioned, so that students are willing to participate.
>
> T6: You need some different types of assessments that you are assessing people in different ways, so they have to access to their learning in different ways that you developing that skill sets.
>
> T11: Assessment on the quality of their blogs was a good reflection, assessment on their professionalism, they assess students' presentation during the blocks, self-assess, tutor-assess, peer-assess in the group. So there are quite a lot of ways that we assess them in the course, which hopefully address some of the quality issues.

The second aspect was the effectiveness of assessment. It referred to the code *assessment for discriminating student*, which indicated the assessment should be able to check if students' real academic performance achieved the expected level.

> T3: In the bachelor of my class, the evaluation is a number of multiple choices question with the main purpose of excluding a number of students will not make sufficient mark because it's like a initial screening. Those who complete this, then get two small open questions and a bigger open question. I think it is much better evaluation than the multiple choice; although I see quite strong relation between those who can't respond to multiple choices and those who can. This works quite well because I can easily see whether the students has preparation or not, and then focus on those who are really prepared, to evaluate them well on the open questions.

T4: I want my exam to be able to allow me to discriminate between people who deserve 30 and other people who deserve to fail and everything in between. But this is very difficult. So some people try to do that very quantitative and quantify everything, my approach is instead to give the short essay questions where each essay question has at least two parts, one is did you learn what you are supposed to learn and the other is think and reason about what I said for the question.

T5: Everyone wants a good grade. So it is important that the assessment is rational, fair and objective. A good assessment method enable students engaged more in the learning activities while a bad one might demotivate students in their learning as they understand no matter how much time and efforts they spent in the study, they won't get a good grade.

Learning outcome

Though quality teaching was perceived by teachers in terms of various issues such as content design, teaching and learning process, and assessment. The most common perception of quality teaching across cases was students' learning outcome. It referred to the code *understanding and competence*.

T1: I think, the most important thing [quality teaching] would be that we should ask ourselves what kind of competence we are giving to students in our classes.

T4: To help the students build their own structure of knowledge, otherwise just facts, things like that you won't remember.

T5: Students acquire an idea, a way of learning rather than a specific technique. In case VB and FoxBASE are not popular anymore, they can use Oracle as they already acquire the fundamentals of databases when enable them quickly adapt to the new technique. The same situation for Java, if they already study Turbo C and VB, they are able to adapt to Java soon

T6: I think what you need is sort of multilayer approach, that is about knowledge and understanding, it's about skills development, it's about practical application, but also working in lots of different ways.

T8: When you teach students, most of them have high understanding where you teach during the course, and of course, they have high final evaluation because they really understood what you were teaching.

T10: I think with this university a problem that every other institution may have or academics probably have an issue: are they being understood? You know, bearing fruits in terms of students' learning outcomes, I think it's a genetic problem across the sectors.

T13: For this course (experiments design and biometrics), on the one hand, it has a large amount of content in theoretical aspects; on the other hand, it also has practical aspects. So it is better to combine theory and practice [for quality teaching].

T14: Such as animal reproduction, the core is to understand the basic theories and methods for animal reproduction and the capability of applying these methods in practice, such as breed mating and frozen semen.

T16: It is important to put the learning and assessment together, how to accomplish the assessment during the learning process rather than having only one exam in the end of study. If you only have one final exam, students might only focus on learning by the end of the course, in that case students usually learn fast but also forget fast, there is no time to consolidate what they learnt.

Reflective practice

Beside the above sections focus on learning, university teachers also perceive quality teaching in terms of teaching practice itself. It referred to the code *teaching reflectively*, which indicated teachers need improve practice constantly according to their reflections on experience.

> T4: Those things which I think are quality and that takes a lot of practices to try to make what you say more and more interesting and it means that every year you sort of change a little bit even if you teach the same course over and over again, you change it over the time.
>
> T6: You never teach a perfect lesson, it's impossible. What is good from trying, so the way what I see course development, curriculum development, teaching and learning is that you just have to keep, it goes back to what I initially said is the idea of cycle of development and wherever you are, you are trying to make it better than it was before. If something doesn't quite work, as long as I realize it is not working. I will try to do it better or different next time.
>
> T8: The quality is something just according to what you have in front. So it's something I like to improve each year but it also depends on the students you have in front, not only from the tools you have been using.
>
> T10: If there are some very important points come up, we would say how would we address them and I have done this here and in Glasgow before. I think it's good for our reflective teaching practice because practically academics, it's probably important that they see that, good idea, how they are doing and how they're coming across.
>
> T12: That could be new material, new theory, might be great case study, and might be new books. You are always watching for good textbooks, good articles. That might change the basic course, but you may do a session depends on the available material, even in YouTube, if you can find some topical good like ads, you can use that to change how you handle a particular session, so there are always things you try to do to stay updates.

3.6.2 Problems for quality teaching in practice

Plagiarism

Plagiarism is an issue that mentioned in several cases, which hindered teachers to select essay or other similar methods that not only demonstrate students' understanding of the learning subject but also improve general skills such as information retrieval and academic writing for students.

> T1: I think they are just afraid that these [questions of the exam] are not in the book. When you ask me something not in the book, I need to think about because it's true that these kinds of questions will be much better to say, OK, I give you the questions and you can get it done at home very carefully and come back. But then they come with these kinds of Internet… I think it's a pity because I mean it's [essay writing] a good skill to practice.
>
> T2: In Italy, I started using the same method [that used in Germany], but I immediately understood that it was a completely different situation. Students copy all the time and some in a very bad manner like cut and copy and other do better work trying to rephrase what they see in Internet. It was a tough work because I spent a lot of time in Internet looking. You notice if they copy when you have a small group. You have the possibility to know them directly to speak with them shortly, you know when they copy because they have a certain language level, certain capacity, certain background, you know what they can do and what they cannot do, so I stopped doing this, because it's really bad…

> T5: There is a problem about copying. I assign a task in the lessons with a class of 40 students. Then they ask a very good student in the class to do this task, and everyone copy his or her work. So the quality of assignment for homework is very difficult to evaluate.

> T12: An essay is enable students to look, to use different sources, ensure they know how to use the sources, you can expect them to search and search beyond the reading list and answer questions. So it does show a certain of knowledge, the only real problem is on the plagiarism, even authorship. You can Google, you can buy essay, and you can buy PhD online.

Large class teaching

Large class teaching is the most common issue shared by cases, and it hinders quality teaching in three aspects. The first aspect was content design. Large classes are usually introductory lessons for undergraduates, where teachers need to deliver a large amount of learning contents to students. Compared to postgraduate lessons, it is more difficult for teachers to reduce topics. There was a tension between quantity of learning content and teaching quality.

> T3: I think I am closer to my idea of teaching in the master students and further away from my idea of teaching in the bachelor. But I am not really sure how to address the difficulties in the bachelor, because yes I could sort of impose structure of the course where I want to focus on certain topics at the same time you will leave them a large amount of independent study, self-study.

The second aspect was interaction with students, which was an element for quality teaching in the process considered by teachers.

> T2: In the bachelor class, I have 250. So I cannot use this method [Socratic teaching[16]].

> T3: it's not ideal I think especially for me it's very difficult to, e.g. I would like to interact much more with students to ask questions, but it's very difficult to do it because every time a student made a question I have to say it aloud and then I answer. Even we repeat every single word, if they are not in the class; it's difficult to follow the conversation if you are never part of it. So if you are away, I intend to make it much more a straight line, just lecture. Stop if they have questions for clarification but not really make interaction because I failed that this wouldn't really involve the students in the classes.

> T4: I think if you have a big class, maybe with 200 students, then what you can do is very limited...I prefer classes maybe more like 20 students, then you should have quality teaching as that point means interacting students, making them think, giving them things to challenge them, but you can't really do that with 200, 300 students.

> T7: That was used to be a very small group of seminars based way that we used to teach. The idea of workshop, it would be interactive, students could ask the questions, but because of the numbers, we have to change slightly the way that we teach them now. So we can't make students do presentation because it's just too big, it just won't work.

> T8: When the classroom is quite large, it means over thirty students, you don't know much about their way of learning or understanding, and the only way, in general, you understood something only when they do their final exam.

> T10: I think there is an element that you want to have enough size of words it doesn't apparently just talking without nothing behind, but not too many squeeze the spaces and what you can get

[16] Socratic teaching is an interactive teaching method. Teachers focus on giving students questions to stimulate critical thinking and to illuminate ideas. (Chorzempa & Lapidus, 2009)

> them to do something to check their understanding. But a lecture isn't a perfect way of delivering that sort of content, if you teach a small group of ten in one hour, you probably can stop and ask questions and know their names and have the contact which most of students want. If you teach in 60, that's not really going to happen.

The third aspect was understanding and competence, which was an element for quality teaching in terms of students' learning outcome considered by teachers.

> T1: I try to have some goals in my mind but especially for the big class, my goal could be that they can use these knowledge to analyse outside world in their perspective. But I mean it is very hard to achieve.

Promotion pressure

University teachers have responsibility for both teaching and research. Since research was more directly connected to the promotion of professoriate than teaching, it was not easy for university teachers to balance both. Thus, the pressure on research and promotion might be an implicit problem for quality teaching in practice shared by cases.

> T2: It's not easy because the university standards require you to be active with your research all year long. I heard a lot of colleagues that would be incredibly happy if someone would tell them: you don't need to make research during the time of teaching which in Italy is not long, because you can concentrate all your teaching activities in one semester. So you could teach four months only and then for personal research. This would be perfect. But we are not allowed to do this, because they ask to publish, publish, publish and I cannot do everything during my class because I have the class.

> T3: In the time of teaching, you really have to divide your attention a lot between two things and it's difficult to keep doing it qualitatively well.

> T4: One of the things which I think it's a problem of teaching is that we were busy, so if your choices: do I finish my research project or send off my grant or spend a little bit of extra time preparing for class. You can't do everything. So sometimes teaching suffers because people have other priorities.

> T5: In China, the evaluation for university teachers is research. If you do research well, you get a good evaluation. Since teaching is an element weights less for the evaluation, so teachers pay less attention to it.

> T7: There is a tension expectation through research, especially this time of year where we are evaluated on our research, output, you know, stuff that we published and teaching, is an ongoing issue. The pressure on both sides to both be working on the research but also delivering on the teaching.

> T10: I think the pressure of this [research], it's not just this university, every university, it is that you are supposed to be doing your research all year around with a certain quality, bring research money and grants. Teaching is never formally recognized their values as research activities, which personally I find problematic.

3.6.3 Strategies for quality teaching in practice

eLearning strategies

Some teachers[17] used Twitter, online forum, and online group work for interaction and the dissemination of learning material.

> T6: One of the things I do is have twitter club. I give them a hashtag, and say watch some videos that I am tweeting to you. if you have any questions, you want to ask, any comment or observation about what we were doing, tweet it with that hashtag, and I will pick it up on Twitter and during the session, I will see what we got and have a bit of discussion.
>
> T7: We introduce Etivities, which are small little tasks that they can do online in small groups to try and give them opportunities to do some small interactive work.
>
> T8: I may be available online every day to answer to their questions. At the beginning, they are a little bit suspicious but they learnt that I reply promptly, they use more this instrument [online forum].
>
> T10: I use Twitter and hashtag as a back channel to give my students more things to read plus homework.

Besides, teachers also used Second Life to help students learn through experience.

> T7: One of the area in media and communication is virtual environment. Second Life is a virtual environment. We were interested about being in that immersive space of Second Life. Also part of we would do is if you are going to talk about Second Life, you have to be in it to understand it…So we were kind of looking all those theoretical debates by identities, virtual spaces and explore that in a very practical way to get students to reflect on building an avatar.

non-eLearning strategies

In this multiple-case study, non-eLearning strategies could be summarised into three types. The first type was to facilitate students' engagement with the strategy of introducing topics that relevant to real life experience.

> T2: At the first glance, if I say moral responsibility is a very important problem; you will think it is not my problem, actually, I survive pretty well without knowing anything about it. So first of all, I want to convince you that it's a problem and it is worth considering. All the preliminary discussion, it's to introduce what you want to explain because after that [preliminary discussions] you are interested.
>
> T5: In the course of Computer network, I design learning activities that ask students to design a LAN (local area network) to connect several dorms, to make straight-through cables, cross-over cables, students are willing to participate as they could share resources and games among the dorms.
>
> T8: Most of the stimuli are taken from the reality, because marketing is something really connected the actual moment. So they change because the moment is different, the way of marketing are outside from the lectures is different.

[17] Here the research did not include teachers from open universities because it was mandatory for them to have at least an online course for disseminating materials and organise learning activities.

The second type was to facilitate students' understanding with strategies such as Socratic teaching, reduction in topics, use few slides, and illustrative cases.

> T2: Not to teach directly but to ask questions, then the other person has to find the answer… So you can try to have active ways of proceedings where the students try to formulate some kinds of answers on the basis of what they have read before, then you put these answers into questions, you forced them more and more developed and complicated answers on the basis of your arguments against their previous ones.

> T3: one thing that is surely changing in my teaching was that I reduce the amount of topics I addressed but I tried to make the topics I addressed where they understood. It wasn't just a survey of the topic because I sort of change my idea from giving an overall survey of the topic to let the people intuitive, from this, actually get the students to fully understand how I would approach one specific topic and maybe leave them on their own to address all the topics in the similar way.

> T3: I think it was quite good is that I use very few slides. I think it helps me a lot to follow what was the reasoning of the students. When I use PowerPoint, you force your lecture through PowerPoint or sort of always return to PowerPoint. This doesn't really allow you to know where the difficulties in reasoning are, where the links that students are making, going instead of if you are free, you just have a whiteboard to write on, and maybe couple of PowerPoint to assist just difficult images or parts.

> T7: Students are struggling with content. I think it was because they are numbers of why, but one of the issues is just too much content that being pushed into that module. So it's a case of when we look back, can we strip out some of the contents, can we stream line it, can we make it less complicated?

> T16: We start from the cases and students learn the topics in the cases, so these cases will facilitate students' understanding of the topics.

The third type was to bring new perspectives in the teaching and learning process with strategies such as guest speakers and students' contribution.

> T3: I used experts coming in, guest speakers, this is very helpful. This is also something that I use this year in the master class. One guest speaker in the bachelor class, I don't use them too much but I think it's very helpful. The students understand different perspectives, what I did in the master class is I discuss with what the experts said. So it's also useful.

> T7: We have a number of students from different parts of world, because it is globalisation. It's quite useful in our interaction although I am very much familiar with British and western contexts, as many our students are westerners. I am interested in how they feel about predominant western paradigm, debates and issues and from their particular experience and country region, many students come from practice background. Some of students are journalists, some of them worked in the media, not all, some from financial backgrounds, so they worked in the financial industry, some in business, some of them can be used in the context of we were teaching. So I am interested in getting their perspectives

> T9: When you have a group of students together, you can use that group, you can use the knowledge and human resources within the group to generate more knowledge and you can get students to challenge each other.

> T10: You try to encourage students rather than passively receiving what you say, you do get them to do things, to work in groups perhaps answering questions, not necessary to you but to talk about things with their neighbours.

> T13: We need to study as well, it is mutually promotive process as they (students) have more rich practical experiences than us.

> T17: What we are doing in our course now is using students' working experience as a learning resources as well not for themselves but each other.

3.6.4 eLearning for quality teaching

Educational contexts

The impact of eLearning for quality teaching in higher education is different, which depends on the educational contexts. In this multiple-case study, teachers from open universities and teachers who offered distance education programs from traditional universities considered eLearning as a mandatory element in teaching practice. eLearning impacts on many aspects of teaching such as content design, delivery of learning material, and interaction in the learning process. Differently, teachers from traditional university had the possibility to teach students face-to-face. Therefore, eLearning was a supplemental option in teaching practice.

> T9: It [new technologies] just enable new ways of communicating and interacting and distance learning so much more dynamic today. I suppose I would say now that there is not really an excuse for someone, for department or individual teachers in distance learning program that not using technologies effectively.

> T13: To implement new technologies for the diversity of teaching approaches such as iPad… You need to change. Though the course is the same, you are the same, students gradually change, you teach for students, so you need to adapt yourself since they are changing.

> T15: Such as virtual simulation experiments. With the development of technologies, we are able to have many things in the classroom that influences the teaching quality. When I studied in university, it is only the teacher who lecture on the stage and we have the textbooks. Now if there is an image, you don't need to spend a lot of words to describe it, for example, to know calcare, you can only show a picture of calcare to students, so they understand the features of calcare.

> T16: It should meet students' learning need, provide different forms of learning materials such as text, audio, video, online resources, which is the diversity of learning resources. Learning support on solving students' problems in the process is very important because we teach in distance.

> T17: Text, video, learning activities are included in the design, such as podcasts in which I give lectures, like 10 minutes each. Students are engaged in active learning for a lot of time.

eLearning's impact in traditional universities

In this inquiry, participants from traditional universities mainly considered eLearning as a communication strategy[18], which used to disseminate learning materials and to interact with

[18] There was one case that the instructor who teach in communication and mass media used eLearning i.e. Second Life not only as a way to interact with students but also as a study topic. We exclude it because this depended on the learning subject, which did not present an impact of eLearning on quality teaching in general.

students online. We discussed the impact of eLearning in two aspects: positive and negative. For the positive impact of eLearning, we compared its capacity of problem-solving to the capacity of non-eLearning strategies in practice. Table 7 presents four problems indicated by participants in this inquiry. Three of them can be solved by non-eLearning strategies while only one problem can be solved by eLearning strategies.

Table 7 Stage 1: strategies for solving problems in practice

Problem	Strategies
Code: Miss the right moment to teach T1: First, they go to classes, but they don't study, and in the end, they study. So when they read and have doubts, but your class is over. So they came: exercise me, but now I have…OK, but it's not the right moment because the right moment was several months ago. This can be really a problem.	Code: formative assessment [non-eLearning] T12: Ideally, you will have check points, so students know how well their understanding as they go through the course and there is still time to change the reading and change the methods or ask questions so you know better if they have troubles. T14: Formative assessments influence the final exam a lot. The monitoring activities for learning is achieved through teaching, whether they have good grades depends on both the way of teaching and the way of learning, so it should be discussed in two aspects. T16: We do constant tests in the learning process in order to let students acquire the knowledge, we do the assessments to facilitate learning, not studying for exams.
Code: empty knowledge T1: Just give me an example. It is a way to see they have studied the definition in general. Sometimes it's really weird because I am trying…they can write down the completely definition, it's correct; but when they give an example in general, you know it's completely incorrect. ...Then you can see that they actually have knowledge but it's completely empty, they are just words	Code: four-step learning [non-eLearning] T6: You start something about connect. You connect it back to things done before, so they can see how it fits in. Then, you have something to activate their interests, activate their learning, get them into and hook them wanting to learn more. Then, you have an element, normally a large element to demonstrate, so you give them the knowledge, you got them to engage with the ideas that you want them to demonstrate that they really start to engage with and understand it, and you have a part at the end was asking them to consolidate that new learning.
Code: bias in oral exam T2: However my problem with oral exam, this term is really subjective because you are in front of a student, and s/he looks usually nice and you try, and it becomes more a dialogue. It's not an evaluation. It's a very nice dialogue sometimes, but then, at the end, you don't know how much you said and how much the student said because you try to be Socratic on this, you try to collaborate, to guide, to give suggestions. You don't know what you said, what you suggested, and what the original and authentic contributions of the students were.	Code: multiple assessment [non-eLearning] T3: So I think a good evaluation has to go through a good question that is not asking for small concept; it's open question, not something like oral exam because oral exam influences by so many things. In the bachelor of my class, the evaluation is a number of multiple choices question with the main purpose of excluding a number of students will not make sufficient mark because it's like an initial screening. Those who complete this, then get two small open questions and a bigger open question. I think it is much better evaluation than the multiple choice; although I see quite strong relation between those who can't respond to multiple choices and those who can. This works quite well because I can easily see whether the students has

	preparation or not, and then focus on those who are really prepared, to evaluate them well on the open questions.
Code: limited interaction with students T3: it's not ideal I think especially for me it's very difficult to, e.g. I would like to interact much more with students to ask questions, but it's very difficult to do it because every time a student made a question I have to say it aloud and then I answer. Even we repeat every single word, if they are not in the class; it's difficult to follow the conversation if you are never part of it. So if you are away, I intend to make it much more a straight line, just lecture. Stop if they have questions for clarification but not really make interaction because I failed that this wouldn't really involve the students in the classes.	Code: interaction enhancement [eLearning] T6: One of the things I do is have twitter club. I give them a hashtag, and say watch some videos that I am tweeting to you. if you have any questions, you want to ask, any comment or observation about what we were doing, tweet it with that hashtag, and I will pick it up on Twitter and during the session, I will see what we got and have a bit of discussion. T7: We introduce Etivities, which are small little tasks that they can do online in small groups to try and give them opportunities to do some small interactive work. T8: I may be available online every day to answer to their questions. At the beginning, they are a little bit suspicious but they learnt that I reply promptly, they use more this instrument [online forum].

For the negative impact of eLearning, some teachers adopted online forums, which both increased the workload and time-investment and resulted in a reduced teaching quality.

> T2: To make questions, the forum can be actually nice, it's extremely time consuming for the teacher. So I try to do this once, and without an assistant, I will never do it again… The students are really interested…they make a lot of questions then you have some students that want to be remembered, those your notice they don't care [your answer], but they want you to remember their names when you correct their exams… They make stupid questions, they try to look in the lecture use the words that are not quite uncommon, and they look in the dictionary to rephrase the question and so on. But the questions are empty and uninteresting. Then they start to speak that they don't understand anything… they try to ask very completely basic questions like "could you repeat from the start what you said today?" Maybe not in this formulation, but the idea is I haven't understood a word, could you repeat everything? Obviously, you cannot.
>
> T3: I don't like to be online. It's very time-consuming and also I thought I was much less than I could deliver in the class. So if I pay tutors for being online, I would prefer to pay tutors for being in the class for even less hours. The quality of teaching that I can give online, in my view, is less than I can give in the class.

Besides, some teachers adopted eLearning, which did not result in any practical help for quality teaching.

> T7: I got a Twitter identity and I often said to students if you want to ask me questions or there are links you see are interesting then put that on Twitter but that' not really… I am not found that really taken-off in any way.
>
> T11: We did set up an online discussion for one of our courses, they could discuss what they have seen in the resources in a security environment. But students never do it.

eLearning's impact: reality versus ideality

We expected eLearning to impact positively on quality teaching in three aspects including personalised and adaptive learning experience (Walkington, 2013), interaction enhancement in the learning process (Dixson, 2010), and students' cognitive development and academic performance (Garrison et al., 2001; Anderson, 2003). This inquiry found that eLearning's impact on quality teaching in higher education actually was limited compared to its potentials. Though the issue about effective adoption of eLearning in practice was beyond the research agenda in this inquiry, participants did contribute their opinions on this topic by arguing it is necessary for teachers to understand the potential pedagogic value brought by technologies in order to embed eLearning effectively in practice. Therefore, it was important to focus on practical problems that did not solved by non-eLearning strategies, which might make teachers to aware the pedagogical values of technologies and to facilitate effective adoption of eLearning for quality teaching.

> T6: If you are a teacher, you have to try to bring together the idea that teaching you should get a subject of knowledge, but you also need to understand pedagogy, you need to understand how to put that subject knowledge across, where they two meet, it's what called pedagogical content knowledge or PCK.… In the modern classroom, teachers also need to understand how to use technology, it's called TPACK, it should actually be TPCK but you put the A, just to make it work. Just sounds for technological pedagogic content knowledge.
>
> T7: The aim is to use technology to enhance the delivery or assessment or general pedagogical quality. I think technology should only be used if it can really add something important or useful for the course, we can't just throw it in.
>
> T17: I tell you the most important barrier, which is identity, somebody senses who they are. What you do is you go along to people and you say: "You are specialist in your area or scholarship, maybe a specialist in psychology". But what we really need you do is to design learning experiences, and many of them would say: I can see why that is important but I am not a learning designer, I am a psychology specialist. You are asking me to be someone I am not and you are asking me to change who I am. That's a difficult transition for people to make… all that [keeping their identities] does is they enforce the tendency to try to reproduce face-to-face learning techniques in the online environment and that leads to the bad quality. Actually, we have to challenge people in higher education to think very hard and to learn about learning design and to treat learning design as an important part of their work.

3.7 Discussion and summary

3.7.1 Perception of quality teaching: practitioners versus researchers

There is a consistency between the finding of this study on university teachers' perception of quality teaching and existing literatures on the concepts of quality teaching reviewed in section 2.1 (Table 8). Besides, this inquiry also discovered some specific perceptions of quality teaching such as delivering learning content using multimedia, teaching cutting-edge knowledge, preparing content for different levels of students, and assessment for discriminating students based on their grasp of knowledge. In sum, this inquiry indicates that university teachers' perceptions of quality teaching are consistent with the concepts of quality teaching held by educational researchers.

Table 8 Stage 1: comparison on the concept of quality teaching between practitioners and educational researchers

Quality teaching	Research result of Stage 1	Existing literatures
learning content	coherent knowledge (structure): to be designed in a logical and well organised way for students to understand	McKeachie (2007): organise content in a meaningful way for learners' construction connected with prior knowledge
	engaging knowledge (delivery)	Ryan & Deci (2000): students' learning motivation
teaching and learning process	teaching based on students' perspective	Ramsden (2003): quality teaching is to make student learning possible
	maintaining interaction with students	Garrison (1999): teaching presence in the community of inquiry framework
Learning outcome	understanding and competence	Ghislandi (2005), Entwistle (2009): learning effectiveness, understanding,

3.7.2 Quality teaching: perception versus practice

This inquiry indicates the gap on quality teaching between perception and practice is because teachers faced problems such as large class teaching, and promotion pressure, and these findings are consistent with the findings of previous studies (Kember & Kwan, 2002; Olafsdottir, 2014, Gregory & Lodge, 2015). Besides, there are also some inconsistencies between the research result of this study and existing literatures. E.g. many participants did not divide their perception of quality teaching based on students' educational level while in the finding of Samuelowicz & Bain (1992), conception of teaching was context-dependent: for undergraduate students, it was

transmission of knowledge and changing students' conceptions; for postgraduate students, it was supporting student learning. Furthermore, different to the finding of Stain (2011) that the conception of eLearning was systematically presented as a framework with the core idea – eLearning as learning (Figure 1), participants perceive eLearning as specific technologies or tools that potentially support learning such as online forums, twitter, and SecondLife.

3.7.3 eLearning for quality teaching in large university classes

This inquiry found a limited adoption of eLearning on quality teaching in traditional universities, which is consistent with previous studies (Butler & Selborn, 2002; Chizmar & Williams, 2001; Alsenaidi et al., 2009). Besides, the positive impact of eLearning was also limited. Participants' experience mainly supports eLearning's positive impact on enhancing teacher-student interaction and student-student interaction, and there is still a distance to arrive its theoretical impact such as personalised and adaptive learning experience, and better academic performance (Garrison et al., 2001; Dixson, 2010; Walkington, 2013). To take full advantage of eLearning in university teaching practice, it requires exploring how to use eLearning effectively in authentic learning environments rather than in controlled laboratories. To explore the effective way of using eLearning in practice, it requires teachers to adopt it in their teaching. One of the barriers for teachers to adopt eLearning in practice is they do not see the pedagogical value added by eLearning (Butler & Sellbom, 2002; Chizmar & Williams, 2001; Al-Senaidi et al., 2009), therefore, it is crucial to start exploring the impact of eLearning from problems faced by university teachers in practice.

In this inquiry, participants shared three problems, which have not been solved by the strategies they used: plagiarism, large class teaching, and promotion pressure. Among these three issues, large class teaching is the most common issue[19]. Therefore, it is crucial to focus on the impact of eLearning on quality teaching in large university classes. It might be an opportunity for teachers

[19] For barriers in quality teaching, four participants (T1, T2, T5, and T12) mentioned plagiarism; six participants (T2, T3, T4, T5, T7, and T10) mentioned promotion pressure; seven participants (T1, T2, T3, T4, T7, T8, and T10) mentioned large class teaching.

to aware the positive impact of eLearning for quality teaching, and this impact cannot be made by non-eLearning strategies. The evidence in this inquiry was one participant used online groups for interactive learning activities, which solved the issue of insufficient interaction in large classes mentioned by another participant.

3.7.4 Summary

This inquiry first explored university teachers' perception of quality teaching by interviewing seventeen teachers from Italy, China, and UK. Their perceptions of quality teaching can be summarised in five aspects including content design, teaching and learning process, assessment, learning outcome, and reflective practice. Among various perceptions of quality teaching, the most common perception was students' deep understanding of the learning subject in terms of learning outcome. Secondly, it found three unsolved problems for quality teaching in practice: plagiarism, large class teaching, and promotion pressure. This result was consistent with previous studies, which indicated large classes and promotion pressure were factors that led to the inconsistency between teachers' perception of teaching and practice (Kember & Kwan, 2002; Olafsdottir, 2014, Gregory & Lodge, 2015). Besides, plagiarism was emergent as a new factor in some participants' experience. Thirdly, it explored strategies adopted by university teachers for quality teaching. Both specific eLearning and non-eLearning strategies were found in this study, and it turned out that non-eLearning strategies tackled more problems compared to eLearning strategies. In sum, eLearning had a limited impact on quality teaching in traditional universities compared to its potentials. To use eLearning effectively and to reach its full potential for quality teaching, the inquiry in the next stage will focus on using eLearning for quality teaching in large university classes, which was the most common problem mentioned by participants in this inquiry.

4. Stage 2: Exploration on computer-supported collaborative learning in large class teaching

4.1 Research questions

The inquiry of Stage 1 found large class teaching was the most common issue shared by many teachers, therefore, quality teaching in large classes became a research focus in Stage 2. Although teachers have already achieved quality teaching in small classes with both eLearning and non-eLearning strategies, they still faced problems in large class teaching. As such, we decided to explore large class teaching with a specific eLearning strategy, which has the potential to solve the problem of quality teaching in large classes. Computer-Supported Collaborative Learning (CSCL) was selected for two reasons. Firstly, one participant in the inquiry of Stage 1 adopted online groups for adding interactive learning activities, which was helpful to solve the insufficient interaction in large classes mentioned by another participant. This inspired us to explore quality teaching in large classes by using CSCL. Secondly, existing literatures indicated CSCL enhanced both the interaction in the learning process and students' academic performance (Jacobs & Ward, 2000; Laurillard, 2012; Swan, 2003; Hommes et al., 2014; Leger et al., 2013; Dougherty & Andercheck, 2014). It targets directly the problems in large class teaching such as less interaction and reduced learning outcome found in the inquiry of Stage 1 and previous studies on large class teaching (Feldman, 1984; Carbone & Greenberg, 1998; Deslauriers et al., 2011; Carbone & Greenberg, 1998; Bandiera et al., 2010). Besides, participants in the inquiry of Stage 1 considered the large class itself as a hinder to quality teaching, thus, this inquiry also aimed to explore university teachers' perception of class size effect for quality teaching. To sum up, the research questions in the Stage 2 were:

Main question:

Do university teachers use CSCL for quality teaching in large classes?

Sub questions:

1. From the university teachers' perspective, does the class size affect quality teaching?

2. If university teachers use CSCL in large class teaching, how do they use it?

3. If university teachers did not use CSCL in large class teaching, what strategies do they use for quality teaching in large classes?

4.2 Related studies

Existing studies indicated the relationship between class size and teaching quality in higher education was complex and still inconclusive. On the one hand, some studies argued students' grades decreased as class size increased (Kokkelenberg et al., 2006; Westerlund, 2008; Bradley et al., 2008; De Paola et al., 2013; Diette & Raghav, 2015); on the other hand, some studies indicated there was no significant relationship between those two issues (Hancock, 1996; Kennedy & Siegfried, 1997). Furthermore, for those "significant-relationship" studies, they held different views on the impact of class size in terms of student ability. Bandiera et al. (2010) indicated students at the top of the test score distribution were more affected by class size. De Paola et al. (2013) discovered low ability students were affected largely by the negative effect of large classes and this negative effect was negligible for high ability students. Besides, studies found different results in terms of the class size itself. Kokkelenberg et al. (2008) indicated students' grade declined dramatically with class size up to 20 students. Bandiera et al. (2010) discovered a significant impact on students' learning only at the very top and bottom of the class size distribution. For those "non-significant-relationship" studies, an important argument was class size does not influence student achievement directly, and it was what teachers do in large class teaching that mattered (Bascia & Fredu-Kwarteng, 2008). Therefore, it is crucial to understand class size effect from teachers' point of view.

Although there are voluminous literatures on class size effect in the primary and secondary educational contexts (Hattie, 2009), studies on teachers' perception of class size are still limited (Bennett, 1996; Handal et al., 2015; Harfitt & Tsui, 2015). Studies on university teachers'

perception of class size are even more limited. Gobena (2014) investigated teachers' perception in teaching large classes in the context of Eastern Ethiopia. Two hundred and twenty one teachers from private and public universities participated in this study. It showed more than 60% of teachers did not want to teach classes with more than 100 students and teaching large classes led to drastic fall in the quality of education.

There are also few studies that indicated how teachers deal with large classes in practice (Snowball, 2014; Dougherty & Andercheck, 2014). Many studies, conducted by educational researchers to explore the potential benefit of specific strategies, failed to present the situation of large class teaching in practice. Blended learning is widely considered as a strategy for active learning in large classes (Svinicki & McKeachie, 2014). George-Walker & Keeffe (2010) designed a self-determined blended learning course, which allowed students to select both online and campus-based learning activities according to their preferences. Besides, peer assessment is also used for student engagement in large classes. Some studies (Robinson, 2001; Likkel, 2012; Pittard & Rayens, 2014) explored an updated strategy of peer assessment – calibrated peer assessment[20], which considered the differences of students' ability influenced the assessment quality. Junco et al. (2011) used twitter for enhancing discussions, and the result showed both students and instructors were highly engaged in the learning process. Isbell & Cote (2009) used personalised and supportive emails for students with lower score in the exam to improve their academic performance through expressing concern and decreasing the sense of anonymity that increased students' self-efficacy and motivation to learn.

To sum up, there are two main issues in the existing literatures. Firstly, the relationship between class size and teaching quality in higher education is indefinite due to both the contrasting views on a significant negative impact of large classes to students' achievement and narrow measures

[20] Calibrated peer assessment is an online application developed by Dr. Orville Chapman at University of California, Los Angeles. Students are calibrated by this application on their ability to critically evaluate a set of standardised reviews. Each student's calibrated ability to review is weighted into a formula when they assess their peers' work. (Robinson, 2001)

such as students' grade that present academic achievement (Toth & Montagna, 2002). It requires to explore university teachers' perception of class size effect on quality teaching, which might reveal practical issues for understanding the class size effect better. Secondly, the majority of existing literatures on strategies in large class teaching are reported as an exploration of using eLearning in large class teaching rather than a daily strategy adopted in practice, which fail to present the situation of large class teaching in higher education currently. Therefore, it requires exploring the daily practice of large class teaching in higher education, which might help to understand the contextual factors that influence teachers' decision on how to teach large classes.

4.3 Methodology

4.3.1 Rationale for adopting case study

Case study is a qualitative research methodology in which the investigator explores a bounded system (a case) or multiple bounded systems over time (Creswell, 2013). The inquiry of Stage 2 was to explore the situation on university teachers' adoption of CSCL for quality teaching in large classes. Since the behaviours of people are always consistent with their environments (Carley & Kaufer, 1993), thus, it is crucial to investigate the adoption of CSCL by taking account of their teaching contexts. Case study allows in-depth exploration of complex issues within important circumstances (Stake, 1995), so it was chosen as the methodology to guide this inquiry.

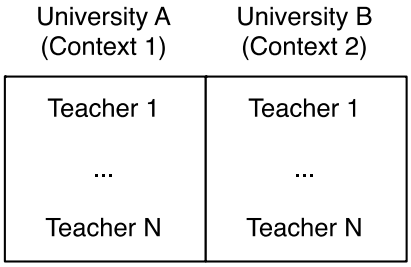
4.3.2 Unit of analysis and multiple-case (embedded) study

Teaching approaches in large classes might be influenced by the way organised by institutions[21], therefore, we defined a case of this case study research in the institutional level, and individual university teachers from one institution were considered as sub-units in one case. These sub-units are usually called embedded units in the case study research (Yin, 2008). Furthermore, we selected

[21] "It's not me (that divide students into several rooms)! It's the organization of university since we have officially 250 students; the main room in our university has 100 seats or we should decide they sit on the floor as we did in my time... But our university doesn't want them to sit on the floor, so they offer them the possibility to sit on chairs but in another room because we don't have a room big enough for everyone. So it's their decision. (a quotation from T2 in Stage 1)"

a multiple-case design, which was regarded as more robust for evidences collected from multiple cases were more persuasive compared to a single case (Yin, 2008). Figure 3 presents this multiple-case design.

Figure 3 Stage 2: the multiple-case design



4.3.3 Sampling and recruitment

Large class teaching was an issue emerged in the inquiry of Stage 1, and most of participants who indicated this issue came from two universities. Therefore, these two institutions were selected as cases in this inquiry. One case is a public university in Italy, and it was acknowledged as one of the leading universities in Italy for the quality of its research and didactics (refers to Case A)[22]. The other one is a public university in UK, which is also held in high regard for the quality of its teaching (refers to Case B)[23]. The sampling criteria were teachers with more than five years of university teaching experience and teach classes with at least fifty-five students. Participant recruitment was mainly via email.

4.3.4 Instrument

Data were mainly collected from in-depth interview, which fosters eliciting participants' interpretation of their opinions and experience according to the research topic (Charmaz, 2006).

[22] Reference from 2010 Censis Guide from La Repubblica newspaper (http://www.universita.it/classifica-universita-censis-repubblica-2010/) and Italian public universities ranking by Il Sole 24 Ore (http://www.ilsole24ore.com/speciali/atenei_classifica/universita_dati2-tipo_statale.shtml)

[23] Reference from Quality Assurance Agency for Higher Education (QAA), the independent body entrusted with monitoring and advising on, standards and quality in UK higher education. http://www.qaa.ac.uk/

Besides, supplemental data were collected from official websites of the two institutions[24]. All the interviews were recorded and transcribed verbatim.

4.4 Data collection

Ten university teachers participated in this inquiry[25]. Interviews were mainly conducted face-to-face in the interviewees' offices, and some interviews were conducted via telephone when it was not practical to meet interviewees. Table 9 presents a summary of participants' information. All the interviews were conducted in English, and lasted for around fifty minutes averagely. Supplemental data were collected from official university websites such as participants' teaching profile and information about institutional policies that might influence teachers' decisions in teaching practice, and materials in the online learning environment where we accessed by the permission of the participant.

Table 9 Stage 2: characteristics of participants

Identifier	Gender	Country	Discipline	Year of teaching	Case
T1	F	Italy	Psychology	12	Case A
T2	F	Italy	Philosophy	11	Case A
T3	M	Italy	Psychology	10	Case A
T4	M	Italy	Linguistics	15	Case A
T5	F	Italy	Education	23	Case A
T6	F	UK	Media and Communication	10	Case B
T7	F	UK	Education	6	Case B
T8	F	UK	Education	12	Case B
T9	F	UK	Geography	20	Case B
T10	M	UK	Psychology	45	Case B

4.5 Data analysis

We used grounded theory as an analysis method in this inquiry for the reason explained in the section 3.5.

[24] The official websites provide two types of data for analysis: one is extra information about the participants (such as their profiles on teaching); another one is about the institutional policy and support that influence teachers' adoption of eLearning.

[25] Some of them also participated in this inquiry (T1, T2, T3, and T6), and they were recruited because they met the sampling criteria. We failed to conduct the second interview with T1 after several contacts. T1's interview in the inquiry of stage 1 was reused in this inquiry as she shared her experience in large class teaching. Due to the limitation of time and resources, we dropped the plan of recruiting another teacher.

4.5.1 Embedded unit analysis

When a case study containing more than one sub-unit, the sub-unit analysis is called embedded unit analysis (Yin, 2008). Each case was composed of five participants, and the analysis started with individual teachers – the embedded units. According to the three sub questions of Stage 2, there were three main focuses: perception of class size effect, the way of using CSCL in practice, and other strategies in large class teaching (if they did not adopt CSCL). We conducted open coding on all the interview transcriptions because we did not have a predefined coding framework but only three focuses. Each transcription i.e. individual teacher's opinion and experience about large class teaching represented an embedded unit to be analysed. The procedure was: firstly, read the transcription line-by-line; secondly, select a segment of text in the transcription that relevant to the three main focuses; thirdly, create a code or several codes for that segment of text. Table 10 presents an example of coding.

Table 10 Stage 2: embedded unit analysis

Codes	Segment of text in the transcription of T2
interaction with students [perception]	I think it would be better if I had a smaller class because obviously you have more direct relationships with students...So you have the possibility to follow them more closely to help them
check students' understanding [perception]	Some of them, usually the good ones have a question or two, so you get the feedback, but if the feedback comes from the good ones, they usually don't understand something very specific and very particular, they have very smart questions. The others don't say anything, so I don't have feedback. If I should check all the students that I have in a year, for what they really understand and they don't, I would spend all my time paying attention to them because if I check every topic, let's say I do 15 topics.
Recorded lesson [strategy]	Since we don't have lot of materials for blind persons, you should read and record an entire book, but you don't find people like reading and recording the books and make them available for blind persons. So they don't have the possibility to read the book practically. So for these students, we recorded the classes, almost every lecturer in this university record the class…maybe the blind students are present in the class but they need to repeat the lessons. I give this opportunity to all students to pick up the recordings if they like because it exists. So for some people, they have particular difficulties in passing the class and doing the exams, I give the possibility to take the recordings to listen at home because many students work [part-time during their study], they don't have the possibility to follow the

	course. So many people, I know, they ask in the office for the recording of the class.

4.5.2 Within-case analysis

Within-case analysis is the in-depth exploration of a single case in case study research (Peterson, 2010). In this phase, all the codes created in the embedded unit analysis were collected together. We used focused coding to compare these codes. There were two types of comparison. The first type was to recognise the common issues within the case. Table 11 presents an example of a common issue from several embedded units within Case A.

Table 11 Stage 2: within-case analysis: identifying common issues

Less interaction with students
T2: I think it would be better if I had a smaller class because obviously you have more direct relationships with students [compared to large classes]...So you have the possibility to follow them more closely to help them. T4: Quality really depends on the size of the class. I had the situation, maybe 200 students. What you can infer is to be as clear as possible, obviously there is no interaction or very few people raise their hands in such a large number. T5: If you have 20 students, you can do this for a long time because your teaching time for one academic course is limited, and you can divide 100% of your time for 20 students; if you have 50 students, the percentage of your time for every student is very small.

The second type was to discover differences among the embedded units[26]. Table 12 presents an example of a difference on the adoption of CSCL in large class teaching between T2 and T5. T2 rejected CSCL while T5 adopted it. The explanation for T2's rejection of CSCL could be his time-consuming and unsuccessful experience on using online forum in the past. Promotion pressure, the tension between teaching and research, was one of the three problems for quality teaching found in the inquiry of Stage 1. Promotion pressure provided a reasonable explanation on the difference between T2 and T5. T2 was a teacher in cognitive science, and his research interest was related to cognition and psychology generally. T5 was a teacher in education, and her research interest was related to teaching and learning[27]. Due to the promotion pressure, T2 might not

[26] T1, T2, T3, and T6 in the inquiry of Stage 2 were respectively T1, T2, T3, and T7 in the inquiry of Stage 1. Data collected from these participants in the previous inquiry were used in the analysis and explanation in this inquiry.

[27] "I am a pedagogist, and I am concern in all these topics [quality teaching], because it is my research. (Quoted from T5)"

motivated to adopt CSCL since he already had unsuccessful experience on trying an eLearning strategy in the past. T5 was an educational researcher, and her adoption of CSCL was not only her own effort to improve the teaching quality but also one part of her research topic, which did not cause the tension between teaching and research.

Table 12 Stage 2: within-case analysis: identifying differences

Rejection of CSCL	Adoption of CSCL
T2: [Using technology in teaching] it is it is very time-consuming. You have to be there in presence, and it is too much akin to surf the web for students. If they are in class, they are not able to access to Google immediately and get the content they are searching for. In the forums, students are copying and pasting contents from other places as they are on Internet. They just take things and put them there, which just create the whole mess. I spent more time to clarify the mess that was put there speaking comments from black sources and I really know the points. I very much prefer they read relevant literatures, which is rich instead of just copy and paste. So my overall impression with this tool arrived what happened 8 years ago, totally negative.	T5: In the group collaboration, there are always some explicit roles, the very well defined role is the leader role, but the leader itself has many different roles inside. So I thought it was probably a good idea to combine the collaboration with the role playing, try to predefine the roles for students, imagine what kinds of roles in a collaborative group will probably help students perform their roles… So one role is the moderator. One role is the president, who has the last word in every discussion especially in the difficult ones. One role is the researcher, who go around in the Web to find the papers and sites that related to the topics for the group study. One role is the editor, if you want to have an essay in the end of week, one of the person have to produce the essay… The role-playing combined with the collaboration was very powerful.

4.5.3 Across-case analysis

Across-case analysis is used to gain an in-depth understanding of a multiple-case study by extracting the common issues across cases and constructing themes (Ayres et al., 2003). We used focus coding to analyse further the result from both embedded unit analysis and within-case analysis. Firstly, it was to identify common issues across cases. Table 13 presents an example of a common issue in both Case A and Case B, where teachers find it difficult to check students' understanding in the large class setting.

Table 13 Stage 2: across-case analysis: identifying common issues

The difficulty in checking students' understanding
T1 (Case A): For master students, the thing I do is they are in charge. One chapter each person then we will discuss when we have questions, so I see some problematic things. They are obliged to read every time and I cannot check every person read everything but some way they should have some have ideas because I ask them to build a little bit conversation. So in these participation moments, and we can exchange our understanding. It's interesting, but you can't adopt in [the class with] 140 students. T9 (Case B): I think it's different. If you have a very small class, I am talking about 10 or less, it's much more personal experience and you could really dig whether students understand and you can engage students and make the course more student-led rather than tutor-led.

Secondly, it was to identify differences between Case A and Case B, and also to explain the differences. Table 14 presents an example of a difference on how teaching activities were organised in the large class setting between Case A and Case B. Teachers from Case A generally worked alone without any support from the institution, thus, T2 were not motivated to use online forum as a supplemental activity for student learning. The phenomenon of working alone was also presented by T3, who had a heavy workload on assessing a big cohort of students in the class. Teachers from Case B generally worked in team, therefore, T8 got help to monitor the learning activities in the online forum, and T9 shared the workload in assessing students with her colleagues. The cause of this difference came from the institutional decision on how to organise teaching in large classes.

Table 14 Stage 2: across-case analysis: identifying differences

Large class teaching
Case A: working alone T2: They have only limited amount of money that gives you the possibility to do the forum but nothing else. Indeed, every year I have the possibility to open the forum because we have the online resources to do that, but they would never give me an assistant to do this if I offer this opportunity. So I am free to offer this possibility or not offer, but if I offer this completely for free, it's me that completely for free. T3: In fact, one of the most annoying part of teaching is the evaluation…marking and being in the classroom for evaluation. All these, if they can be helped [by other colleagues] on this part, that would be already very good.
Case B: team work T8: We have associated tutors and also supports & answers there, there is a whole structure of collaboration (in the online activities) …we are lucky here as we got international team, we have colleagues come from different nations. We all bring different perspectives to the table, if there is only one person, there is no one really critic or share. I could imagine that could be quite hard. T9: For me the workload is fine. I mean if we have very big classes in our departments, then we divide the marking, so no one person is left with having lots and lots of marking.

4.6 Research Result

4.6.1 University teachers' perception of class size effect

All the teachers in this inquiry confirmed the negative impact of large classes on teaching quality. Two main challenges in large class teaching were summarised based on their experiences. The first one was about interaction and engagement. Due to the large number of students in the class, it was difficult for teachers to interact with students.

> T2: I think it would be better if I had a smaller class because obviously you have more direct relationship with students [compared to large classes]... So you have the possibility to follow them more closely to help them.
>
> T4: Quality really depends on the size of the class. I had the situation, which I teach in seminars … maybe 200 students. In this situation, what you can infer is to be as clear as possible, obviously there is no interaction or very few people raise their hands in such a large number.
>
> T5: If you have 20 students, you can do this for a long time because your teaching time for one academic course is limited, and you can divide 100% of your time for 20 students; if you have 50 students, the percentage of your time for every student is very small. At the end, the consequence is very logical, so if you have a large class, it is very difficult to give a lot of time to each student; in principle, it reduces the quality of the course.
>
> T6: For large group teaching, obviously you always have less one to one opportunities… you don't have much time to have much feedback from students really in large classes, which is so big. With small classes, one of the things you can do is to get to know individuals within the class everybody can make an input as much as they can.
>
> T7: For the primary [postgraduate certificate for education course], on the biggest day is 160 [students]. That's really difficult because you wanted to be interacted as possible.
>
> T8: I had 130 students. It was harder in a big lecture hall to get interaction.
>
> T10: It is certainly much harder in a large class, I much prefer teaching small classes, but maybe it is possible to maintain quality in large class but it is more challenging. I mean it is more difficult for a lecturer to be interactive in a large class, what happened at least in UK is that you can't get any timely interaction within students larger than about 30 because they just don't want to speak out.

The second one was the difficulty in checking students' understanding. In small classes, teachers usually have direct interaction with individual students, which helps teachers to get feedback on students' understanding of the subject in order to adjust their teaching. However, in large classes, it is quite impossible for teachers to do the same thing.

> T1: For master students, the thing I do is they are in charge. One chapter each person then we will discuss when we have questions, so I see some problematic things. They are obliged to read every time and I cannot check every person read everything but some way they should have some have ideas because I ask them to build a little bit conversation. So in these participation moments, and we can exchange our understanding. It's interesting, but you can't adopt in [the class with] 140 students.
>
> T2: Some of them, usually the good ones have a question or two, so you get the feedback, but if the feedback comes from the good ones, they usually don't understand something very specific and very particular, they have very smart questions. The others don't say anything, so I don't have feedback. If I should check all the students that I have in a year, for what they really understand and they don't, I would spend all my time paying attention to them because if I check every topic, let's say I do 15 topics.
>
> T3: I think it (less slides) helps me a lot to follow what was the reasoning of the students… I think it works so much better and indeed this is something I would like to do in the bachelor course probably (the reason that I did not do) it was the number of students was too large.
>
> T6: For large classes, you might have less time for discussion, might be more kind of you giving information… So I suppose we prefer small group teaching because you get more opportunity not to deliver but to have discussion.

> T9: I think it's different [in terms of the teaching quality]. If you have a very small class, I am talking about 10 or less, it's much more personal experience and you could really dig whether students understand and you can engage students and make the course more student-led rather than tutor-led.

> T10: It is very difficult, you cannot make sure if the content of the lectures is not too simple when you include both the basics and more advanced materials, you are not sure if the exams are going to be demanding if students learn the materials and they read the literatures. You can take steps to maintain quality, but it is much difficult as some steps you can't take, you can't give feedback in the lectures, you can't really judge how well they understand what you were saying.

Besides, one participant from Case A indicated an advantage of large class teaching. When she taught in the large class setting, there was usually a small group of active students who brought new topics that not planned by the teacher, which made inputs to the teaching and learning process.

> T2: There is an advantage that I see in having a very large class. You always have a small group of very good students. They help a lot because they contribute by making the class more interactive, they make interesting questions, not only stupid questions about: I didn't understand what you said before. They make really interesting questions and because they are in your classroom, so you have the possibility to speak about something else, to bring new topics on the table, to discuss other things besides the things that you planned to discuss in the first place.

4.6.2 CSCL for large class teaching

Adoption of CSCL

There were only two teachers who actually adopted CSCL in large class teaching. One was T5 from Case A, who designed online activities with predefined roles for students to play in the group work, and it worked well due to a continuous effort in design and practice over several years. Table 15 presents the roles defined by T5 to guarantee an efficient collaboration in the group work. All the roles were rotating, since some roles were more demanding than other roles in terms of workload, members in the group decided together how to assign the roles according to their availability of time.

> T5: Two years, started without role-playing, with role-playing, coming the spy role, decide the different kinds of roles… I used this similar strategy [role-playing online collaboration] in other courses, altogether I think it is the seventh year I am using this strategy. From what I have seen in the students' personal logbooks and forums, students are very happy to collaborate online in groups with different roles… It is the fifth edition of the IATI [the acronym name of a course]. Before IATI, I used this similar strategy in other courses, altogether I think it is the seventh year I am using this strategy [role-playing online group work].

Table 15 Stage 2: role-playing online collaborative learning activity[28]

Role	Function

[28] This table was translated from a table in Italian that published in the online learning environment of a course taught by T5.

President	Send the first message to the group forum with details of the roles and general organisation and the agenda of the week
Publisher	Make the final version of the group work and publish to the group forum according to the deadline of submission
Moderator	Moderate and activate the communication in the group forum, organise and create new columns for a better organisation of the forum
Seeker	Based on the content of lesson, search and publish two significant resources (websites or articles)
Editor	Publish a summary (5 lines) in the section of "Diary of the lesson" according to the deadline of submission
Spy	Peer in the other groups and report back about everything that useful to make progress of the group work in other groups within 3-4 days after the beginning of the lesson

The other one was T6 from Case B, and the group work was mainly self-regulated by students themselves, which might not guarantee an efficient collaboration among students due to the potential issues such as social loafing.

> T6: I will tell students: what you need to do is to organize between yourselves… I don't intervene it unless they have some questions or they want to make clarified.

Rejection of CSCL

There were eight teachers who did not adopt CSCL in large class teaching, and there were mainly four reasons for their rejection. The first one was because teachers already adopt traditional face-to-face group work as a subsequent learning activity after traditional lecturing to maintain teaching quality in large class.

> T3: For master course, classes are about 80 people. The only collaborative interaction is when I gave a question to the group and let the group to discuss about this. Sometimes I did this in the class when there is an open issue I want to introduce, then I ask people to think, I just moderate the discussion and summarize it in the end.

> T7: What I do is make sure that the whole is not like the rows, and the tables and chairs are in groups and provide physical materials for students to interact with… I go around and if I hear something that need challenges: what about this, and why that happens? So add some extra complication and get the group to debate, then you get the group to choose which scenario they found most challenging and share the big group, so collaboratively they come to a sense of what might be acceptable, what possibilities are. It also helps them to find out norm of behaviours they can judge what most of people think about that. It is not necessary the right thing but it is part of understanding as a community of practice…In this activity, they get the amount of time and depth of discussion - that is their favourite session every year.

> T8: I think it is important that we enable people to do in small groups because reflective people can be quite introverted, it is not that they don't want to share their idea because they want to keep it by themselves. Sometimes they are just unsure and they want to be more confident when they make a statement… When you got a room with 15 groups, you can see whether they are engaged, interested, or bored. When you got 130 students, that's more difficult. If they work in pairs, you let them to choose who they sit with or talk with, you tend to find they share between the two of them. So you are trying to be aware of who might be more cautious and then encourage them in two when other students work in 5 or 6.

> T9: In the second year, we do group work, which is writing blogs. The group has to create a blog and kind of learn about public writing and produce something with geography, trying to get them to see what happened in the world today relevant to geographer, to bring geography alive. So they have to link if something happened with geographical article or idea. It's an idea to bring geography alive. I have done it through small groups, some of seminar works I do, e.g. I get students to consider different media sources and think about representation of Africa in the sources and the groups have to present their finding to the whole group. I quite often do that. If I am in a lecturing situation, students might be divided into small groups, so the feedback might be to the whole group. It is kind of feedback to each other. So I did do some collaborative learning. What I don't do is I don't particularly use technology for it.

The second reason for the rejection of CSCL was they never use any eLearning strategies in large class teaching. There was one teacher from Case A, who was already occupied with current workload without extra time to explore new things.

> T1: I thought about it [online teaching] but I never try really to… I have ten internships in one year and follow some PhD students, even I have a class 140 people, and I don't have time…

The third reason for the rejection of CSCL was they had unsuccessful experience in using eLearning (online forum) for large class teaching, thus, they had a negative impression on using technologies in teaching generally.

> T2: I don't believe in online teaching. I don't believe in online teaching in the other class, either. It [online discussion board] is extremely time consuming. If you have a large class, the students are really interested, and they make lots of questions. If they are at home and they are studying, they really like to keep in touch and to understand what s/he thinks, so they make a lot of questions. Then you have some students that want to be remembered, those your notice they don't care, but they want you to remember their names when your correct their exams. So you have to answer them, they make stupid questions, they try to look in the lecture use the words that are not quite uncommon, they look in the dictionary to rephrase the question and so on. But the questions are empty and uninteresting. Then they start to speak that they don't understand anything and mistakes the forum for a place where they can… for support group, in the sense that they don't understand anything of the class, and they try to ask very completely basic questions like "could you repeat from the start what you said today?" Maybe not in this formulation, but the idea is I haven't understood a word, could you repeat everything? Obviously, you cannot.

> T3: I wasn't happy for numbers of reasons, some of reasons are from me: I am not an online person. I don't like to check always the students' questions; that's not me. I don't like it. So that's probably one of the main reasons why I drop this option. I don't like to be online. It's very time-consuming and also I thought I [my delivery] was much less than I could deliver in the class. So if I pay tutors for being online, I would prefer to pay tutors for being in the class for even less hours. The quality of teaching that I can give online, in my view, is less than I can give in the class. Maybe this is because I am not comfortable with this type of interaction; I prefer the real life interaction. So in the end I dropped it.

The last reason was they already achieved quality teaching in large classes they expected with current teaching approach, thus, they were not motivated to adopt CSCL.

> T7: So my questions that I build on are all getting them that sophisticated understanding of the strategies that located within epistemological approach. We don't need to say these words in the beginning, until when they submit their plans, it is really clear, and those are their plan for their assignments. We have really high amount of distinctions and merits on that module and really good

> outcome in terms of where they started. You can see the development of their thinking in the online activities.
>
> T10: I haven't [use collaborative learning], I was advised by the university to try some new things, but I didn't. I think partly because I have been doing it so long, so I might be old-fashioned approach. On the other hand, it works well, and students like it and I get good feedback from students and they perform well in exams.

4.6.3 Strategies in large class teaching

There were several strategies adopted by teachers in large class teaching except CSCL (or traditional face-to-face collaborative learning). The first one was recorded lessons. Recorded lessons were initially created for disabled students, and later T1 found it was also useful for students with difficulties in studying generally. Thus, the recordings of lessons were open to all the students in the class.

> T2: Since we don't have lot of materials for blind persons, you should read and record an entire book, but you don't find people like reading and recording the books and make them available for blind persons. So they don't have the possibility to read the book practically. So for these students, we recorded the classes, almost everybody in this university record the classes…maybe the blind students are present in the class but they need to repeat the lessons. I give this opportunity to all students to pick up the recordings if they like because it exists. So for some people, they have particular difficulties in passing the class and doing the exams, I give the possibility to take the recordings to listen at home because many students work, they don't have the possibility to follow the course. So many people, I know, they ask in the office for the recording of the class.

The second strategy was the course website. T4 used the course website as a replacement for the learning environment provided by the university to disseminate learning materials to students.

> T4: I have prepared some years ago, a website with all my notes and practical information about the course also in the first page of the slides and the web. There is a page they could download the lessons… I use Web to put things online and I never use things like didactic provided by the university, some people ask me and I just give them the link I prepared and I must say I want to learn how it work. In ESSE3 [the online learning environment provided by the university], I put a link to my web page, so they could click and check the materials I put online.

The third one was using Padlet[29]. T7 used it to collect students' comments on teaching through this online collaborative tool efficiently.

> T7: I have used one called wallwisher (now it is called Padlet), which you can post your notes and they can be put together in a big place. So the feedback from the sessions can be displaced in one place. We can make it anonymous, so people can add to other people's thought and move things into groups. That is a quite useful thing.

The fourth one was online personal journals. Online personal journals is a common function in the learning environments such as Moodle and Blackboard, and it helps students to keep a learning

[29] It is an online platform, which supports user to create and collaborate easily. Http://padlet.com

diary that reflect on what they learnt, what they did not understand. This function not only allows teachers to track students' learning in the process but also to maintain direct individual contact with students online.

> T5: All the time when I spoke with students, what they want is just to have time to speak with the professor personally, not in person or face to face, e.g. they are very happy to discuss with me by emails. When I have online courses, I open the personal logbook for students, I really have a strong impression that they like this, they can contact me directly without other students and I answer them personally.

> T8: I don't think a quality course will offer lectures to a large group of students and then not follows that up. It is absolutely crucial that you work collaboratively with them either through reflective journals, through discussion boards, small groups of students, or with your personal tutors… So if they engage with the activities in Blackboard electronically, it shows that they are building their knowledge towards reflective journals.

The fifth one was online discussion board. Although theoretically online discussion board allows both the teacher-student interaction and student-student interaction (Garrison et al., 1999), based on the experience of T8 and T10, it was mainly used to maintain teacher-student interaction.

> T8: We have to look at those answers [in the online discussion board] and say: yes, they really get it or no, we need to ask a little bit more about this because they haven't quite understood it. If they understand all the activities, they will move progressively towards building a good plan for their assignments and writing a good assignment.

> T10: We also have a discussion board in the Blackboard. Every module I teach has a discussion board, they can interact with each other and with me, the teacher through messaging. Every time there is a message, it will automatically send to the emails. So you can go and check it. This is very useful as students can ask questions anonymously if they are embarrassed to ask some simple questions or if they would like to make a critical comment on the lectures. They wouldn't make it if it is not anonymous. It definitely improves teaching and learning experience… If they all use the discussion board all the time, it will be impossible. But in practice, most of them, half of the all, only use it occasionally, they usually ask quite specific questions, sometimes they ask interesting questions even make suggestions occasionally students write me that something they watched something in TV or YouTube that is relevant. But mostly the questions in the discussion board are specific, questions I usually answered are like: how many questions are in the exam? Is correct to say such and such? It is a significant job to keep the discussion board but it is not unmanageable mainly because most of students are quite silent, some of them don't even read it very much.

The sixth one was reduction in topics. T3 restructured the topics in the teaching activities in order to go deep enough in the selected topics for enhancing students' understanding of the subject.

> T3: This year I took the liberal decision, something I have done in the last year, is to reduce some amounts of topics I worked on in favour of going deeply into the actual sources. It is difficult to be critical on a handbook, sources are much richer such as the idea of working on specific papers and reading through the papers, make them more critical about the evidence with more details on the logic. I think it works very well as my impression is an improvement in teaching and students' understanding of the topics.

The last strategy was walking around during lecturing. T4 adopted it to reduce the physical space between him and his students, and also to interact with students in the classroom of a large class.

> T4: Don't let students sit the last row, I never sit during my teaching and I always walk around and see where students are following me or not. I look at the faces of people and try to identify someone and talk to them.

4.6.4 Comparison between Case A and Case B

Based on the cross-case analysis, there were some similarities and differences between Case A and Case B. The similarities were about teachers' perception of class size effect, lecturing as the dominant teaching method, and two challenges (the reduced interaction between teacher and student; the difficulty in checking students' understanding) in large class teaching. The differences came from institutional support and the way of organising teaching in large classes. Institutional support was composed of two aspects. The first one was professional training and pedagogical support for teachers. Case B provided training opportunities for teachers to improve their teaching profession, and there was also a teaching excellence unit that provided supports on embedding technologies in teaching activities.

> T6: When I came to University X, it was called PG certificate in higher education, where you take a number of classes or workshops. It takes you through different theories of pedagogy and also it gives you to reflect on your own practice. A little part I was doing here, and you write a written document reflecting on your own, so you think about all of those things like assessment, course design, and different techniques.

> T6: So I design an E-tivity[30] and I was thinking use Tony[31]'s and he sent the E-tivity template, which I used [to design online group work]…

> T8: We got librarians make all the links on Blackboard, got teaching excellence unit who taught us how to do it.

Teachers in Case A started teaching without any training and there was not a teaching excellence unit like the one in Case B that supported teachers to innovate teaching practice.

> T2: Officially you should have a tutor, someone that teach you how to teach, practically these tutors don't teach you anything because they don't come with you in the class, they only ask if everything is OK… you started alone; you don't have any idea about how to teach. So you start trying and seeing how it works and I think at the beginning, it is a matter of instinct, some people have a good instinct then work better, other people don't have the good instinct and have problems.

> T3: I never had any training about the way I teach or suggestions about the way I teach. I mean for me it's entirely from my own thought and the way I think teaching should go. I think some formal help would help.

[30] It is a term coined by Gilly Salmon in her book E-moderating. An E-tivity involves learners interacting with one another and with the teacher in an online communication environment in order to complete a particular task.
[31] It is a pseudonym to preserve their anonymity in the research project based on ethical considerations. He is a researcher in the teaching excellence unit at Case B.

The second aspect of institutional support was financial encouragement on teaching innovation. Case B provided specific funds that encouraged teachers to conduct pedagogic research (Appendix A) while no similar information were found from Case A. In addition to the difference on institutional support, the way of organising teaching in large classes was also different. Teachers from Case B worked in team while teachers from Case A worked alone. Evidences from teachers' quotation were already presented in Table 14.

The comparison identified the differences on the institutional support and the way of organising teaching in large classes between Case A and Case B, and these differences influenced the strategies adopted by teachers in the two cases. Teachers from Case B were trained, and they got supports in teaching. They adopted strategies (such as online personal journal, online discussion board, and traditional face-to-face group work) that emphasised on teacher-student interaction and student-student interaction. Teachers from Case A worked alone without formal training and support in teaching, and they adopted strategies (such as recorded lessons, course website) that emphasised on student-content interaction.

4.7 Discussion and summary

4.7.1 Class size effect: quality teaching in large university classes

This inquiry provided the following points to rethink the class size effect. Firstly, the definition of class size is important to study the issue of class size effect. The class size is usually defined merely by the number of students in the class. In this inquiry, large class teaching organised differently between Case A and Case B: teachers in Case B worked in teams while teachers in Case A worked alone. The teacher-student ratio became a more important factor to the class size effect rather than the class size i.e. the number of students itself. Secondly, the definition of the effect is also important. Previous studies mainly used students' academic performance measured by exam scores to investigate the class size effect (Hancock, 1996; Kennedy & Siegfried, 1997; Kokkelenbery et al., 2006; Westerlund, 2008; Bradley et al., 2008; De Paola et al., 2013; Diette & Raghav, 2015).

Though exam scores are quantitative evidences of students' academic performance, they are not the only criteria to represent learning outcome. Other factors that influence indirectly on learning outcome such as interaction and feedback in the learning process should be considered to define the effect with a complete set of criteria. Thirdly, students in higher education are more capable of becoming self-regulated learners compared to students in primary and secondary education. In this inquiry, one participant mentioned an advantage of large class teaching, which indicated students themselves might have a positive impact on learning in the class setting.

4.7.2 Large class teaching: "experiments" versus daily practices

Existing literatures presents various eLearning's impact on quality teaching in large classes while this inquiry focuses on teachers' daily practice in large class teaching. The result of this inquiry indicates there are potential progresses for quality teaching in large classes due to the wide gap between the actual implementations and educational experiments in the "laboratories". For instance, in theory, there are three types of interaction in the online learning environment including student-content interaction, teacher-student interaction, and student-student interaction to ensure quality teaching (Garrison et al., 1999; Vaughan et al., 2013). However, in reality, participants in this inquiry who used online discussion boards fail to realise three types of interaction all together. Another example could be Twitter for student engagement. Junco et al. (2011) had a successful experience in using Twitter to engage both teacher and student in the learning process. One participant in this inquiry tried Twitter, which did not have any positive effect on students' learning[32]. Besides, the evidence in this inquiry confirms large class teaching has some benefits. T2 indicated one advantage of large classes in her experience was a group of active students made inputs during her lecturing, which raised interesting topics beyond her plan. This is consistent with previous studies on the benefits in large classes (Hess, 2001; Wang & Zhang, 2011; Qi & Wang,

[32] "I got a Twitter identity and I often said to students if you want to ask me questions or there are links you see are interesting then put that on Twitter but that' not really… I am not found that really taken-off in any way. (Quoted from T6)"

2009) that more students in the classroom might become an opportunity for more creativity and innovation, which provides more ideas to think critically.

4.7.3 Summary

This inquiry explored the situation of large class teaching in traditional universities. Ten teachers, who had both at least five years of teaching experience and classes with at least fifty students, participated in this inquiry. The research results were: firstly, participants perceived the teaching quality in large classes was limited compared to small classes, and the limitation was due to two challenges: the reduced teacher-student interaction and the difficulty in checking students' understanding in the teaching and learning process. Secondly, there were only two participants adopted CSCL in large class teaching, although CSCL had the potentials to solve problems for quality teaching in large classes. One participant was from Case A, and she was a professor in education who used CSCL (combined with role-playing) efficiently. The other participant was from Case B. She did not use CSCL as efficient as the participant from Case A due to the absence of individual accountability in the group work. Other eight participants rejected CSCL in large class teaching, and there were several reasons. Some teachers adopted traditional face-to-face group work as an interactive activity combined with traditional lecturing. Some teacher never use any eLearning in large class teaching, not to say adopt CSCL. Some teachers had unsuccessful experience in using online forums, thus they had a negative impression on using technologies in teaching. Some teachers already achieved the quality they expected in large class teaching, thus, they were not motivated to add new things. Thirdly, participants adopted both eLearning such as online personal journals, online discussion boards, course websites, and recorded lessons and non-eLearning strategies such as walking around during lectures, and reduction in topics to improve the teaching quality in large classes. Though teachers from two cases adopted various strategies in large class teaching, many strategies were not helpful to solve two challenges perceived by teachers for quality teaching in practice. In sum, the impact of CSCL on quality teaching in large classes such as students' academic performance is still unclear as there are few evidences collected from

this exploration. In the next stage, the inquiry will focus on implementing CSCL in an authentic educational context to examine its impact for quality large class teaching.

5 Stage 3: Implementation of computer-supported collaborative learning for quality teaching in large classes

5.1 Research questions

Quality teaching in large classes has challenges. Cooper & Robinson (2003) argued students were not motivated to learn in large class due to their anonymity and the feeling of isolation in the classroom. Ahlfeldt et al. (2005) pointed traditional lecturing, as the prevalent method in teaching large classes, reduced student engagement. Besides, researchers also showed that the large class setting reduced students' cognitive development (Wulff et al., 1987; Carbone & Greenberg, 1998) and even academic performance measured by test scores (Bandiera et al., 2010) due to the insufficiency of interaction and feedback in the teaching and learning process. In sum, all these issues threaten the teaching quality in large classes.

Theoretically, CSCL is an effective strategy to deal with the problems in teaching large classes. Firstly, it helps to build up a learning community for all the involved students, which might reduce the feeling of isolation and improve students' motivation to learn (Rovai, 2002). Secondly, it improves the interaction among students through group work, which facilitates active engagement in the learning process (Blumenfeld et al., 2006). Thirdly, it enhances cognitive development by providing new possibilities for students' engagement in academic debates (Golbeck & El-Moslimany, 2013). However, it is not easy to realise effective collaboration in practice due to the issues such as social loafing and process losses, which frustrated students' contribution in the group work (Capdeferro & Romero, 2012). This inquiry aimed to examine the impact of CSCL on quality teaching in an authentic large class setting. The research questions were:

Main question:

What are the impacts of CSCL on quality teaching in large classes?

Sub questions:

1. Does CSCL help to achieve quality teaching in large classes?

2. Does traditional lecturing blended with CSCL achieve higher quality compared to mere traditional lecturing in large classes?

3. Does different form of CSCL have different effect on quality teaching in large classes?

5.2 Related studies

Existing studies indicated several benefits of using collaborative learning for quality large class teaching in higher education. Firstly, it enhanced students' active engagement in the learning process. McInerney & Fink (2003) found team-based learning changed the way of students' interaction with the lecturer. Students, who interacted with the lecturer mainly for the grading of examination in the past, started discussing with the instructor on the scientific concepts and process in the subject after implementing group work. Secondly, collaborative learning enhanced students' academic performance. It enhanced the student-student interaction, which facilitated students to achieve a higher level of understanding through experiencing new perspectives (Said, 2013; Tlhoaele et al., 2014). Some studies indicated the learning enhancement by quantitative comparison. Yamarik (2007) divided students into two groups: collaborative learning and traditional lecturing. The comparison on exam score between two groups indicated a 3-4 percent of improvement in the group of collaborative learning. Marburger (2005) discovered a non-significant difference on the score of multiple-choice questions between two groups, but a significant better performance in the group of collaborative learning on the written assignment. For studies with two-group (collaborative learning versus traditional learning) design, results might be biased by the lecturers' personal preference in teaching approach rather than the effectiveness of teaching approach itself (Yamarik, 2007). To avoid the instructor bias, Kelly et al. (2010) compared the exam score between students in the collaborative learning currently and students with traditional lecturing in the past. It indicated a significant difference on students' academic

performance. Though these studies provide evidences that students in the collaborative learning group performed better than those in the traditional lecturing group, it is not sufficient to infer that the improvement of academic performance results from collaborative learning due to potential factors that contribute to academic performance such as students' general intelligence.

For studies specifically focus on CSCL, results were also indefinite in terms of the impact of CSCL for quality teaching in large classes. On the one hand, there were positive evidences that indicated CSCL improved students' academic performance, which were collected from questionnaires (Hommes et al., 2014), focus group (Leger et al., 2013), and students' self-reported materials on the accomplishment of course objectives (Dougherty & Andercheck, 2014). On the other hand, there were also negative evidences that students were not motivated to collaborate online (Alexander, 2006) and even experienced frustration in collaboration (Capdeferro & Romero, 2012).

To sum up, there were three issues in the existing literatures. Firstly, studies that argued CSCL improved the teaching quality in large classes usually provided either qualitative evidences (Hommes et al., 2014; Leger et al., 2013; Dougherty & Andercheck, 2014) or quantitative evidences (Marburger, 2005; Yamarik, 2007) rather than a combination of both evidences. Secondly, studies argued the quality improvement by CSCL compared to traditional lecturing method required more evidences due to the biases from the design of comparison (Yamarik, 2007; Kelly et al., 2010). Thirdly, few studies explore the effect of CSCL for quality teaching in terms of the collaboration form (Nicol & Boyle, 2003).

5.3 Methodology

5.3.1 Rationale for adopting design-based research

Design-based research, also known as "design experiments" (Brown, 1992), "design research" (Cobb, 2001), "development research" (van den Akker, 1999; Reeves, 2000), is a research methodology that blends empirical educational research with the theory-driven design of learning

environments. It aims to understand how, when, and why educational innovations work in practice; and it helps people to understand the relationships among educational theory, designed artefact, and practice (Design-based Research collective, 2003). The inquiry of Stage 3 was to investigate the impact of CSCL for quality large class teaching in an authentic educational context through designing and implementing CSCL activities. We chose design-based research as the methodology for two reasons. Firstly, it suited for the research situation – to study the learning phenomena in the authentic learning context. Secondly, it suited for the research purpose – to implement CSCL for quality teaching. Quality teaching itself was a reflective practice that required continuous improvement. Design-based research, as a method composed of iterative cycles of developing, testing, and implementing specific designs for learning, supported in improving practice continuously.

5.3.2 Impacts of CSCL on quality teaching in large classes

Based on both the results of previous two inquiries and the existing literatures on the conceptions of quality teaching, CSCL's advantages and disadvantages in learning, we drew a mind map on the potential impacts of CSCL on quality teaching in large classes. Figure 4 presents this mind map. It was composed of four issues (understanding, interaction, motivation, and academic benefits), and each issue had several aspects.

Figure 4 Stage 3: a mind map of CSCL for quality teaching in large classes

We selected students' understanding for two reasons. Firstly, it was considered as the most important element for quality teaching both from educational researchers' point of view (Biggs, 1980; Ghislandi, 2005; Entwistle, 2009) and practitioners' point of view from the inquiry of Stage 1. Secondly, it was related to both the challenge of large class teaching in practice from the inquiry of Stage 2 and the benefits of collaborative learning in theory (Laurillard, 2012). On the one hand, the result of Stage 2 found university teachers felt it difficult to check students' understanding in the process; on the other hand, Laurillard (2012) claimed the fact that students learnt collaboratively in groups actually made it practically possible for the instructor to check students' understanding and provide feedback in groups. Furthermore, we divided this issue into two specific aspects for it was both a learning outcome (Biggs, 1980; Ghislandi, 2005; Entwistle, 2009)

and a process of knowledge construction through feedback from the instructor and advanced peers (Pask, 1976a; Vygotsky, 1978; Laurillard, 2012).

We selected interaction for it was crucial to learning based on the constructivist learning theory (Vygotsky, 1978; Littleton & Light, 1999). Interaction had three aspects including teacher-student interaction, student-student interaction, and student-content interaction (Moore, 1989; Garrison, 1999).

We selected motivation for two reasons: firstly, quality teaching should motivate students to learn (Ryan & Deci, 2000; Nico & Macfarlane-Dick, 2006). Therefore, this inquiry aimed to explore if CSCL contributed to quality teaching in large classes by motivating students. Secondly, CSCL might have negative effects on students' motivation due to the process losses and the free rider effect. The process losses refer to the resources that used in the coordination during the group work, which result in a less efficient learning progress compared to study alone (Steiner, 1992; Hertel, 2011). The free rider effect refers to the phenomenon that some members do not contribute to the group work (Kerr & Bruun, 1983; Morris & Hayes, 1997; Joyce, 1999).

Existing literatures also argued that collaborative learning was helpful for critical thinking and personalised learning (Panitz, 1999; Laal & Ghodsi, 2012), and we summarised these two aspects as a general issue of academic benefits.

5.3.3 Defining the levels of understanding.

Students' understanding was recognised as the most important element for quality teaching as mentioned above. We adopted SOLO Taxonomy (Biggs & Collis, 1982) to define the levels of understanding. Table 16 presents the levels of understanding and students' competences when they reach the corresponding level. According to this taxonomy, at a more superficial level understanding depends on the quantity of information the learner is able to acquire; while at a deep level understanding depends on more qualitative aspects such as the capacity to use the acquired information to make other inferences or connections of various kinds and of growing complexity. Further study carried out on this taxonomy (Dudley & Baxter, 2009) indicated that

students reached a deep understanding of a subject only when they exhibited the capacities described in the last two levels belonging to the qualitative phase of understanding listed below.

Table 16 Stage 3: SOLO Taxonomy

	Levels of Understanding	Examples of Ability
Quantitative phase	Pre-structural	Misses point
	Uni-structural	Identify, do simple procedure
	Multi-structural	Enumerate, describe, list, combine
Qualitative phase	Relational	Compare, explain causes, analyse, relate, apply
	Extended abstract	Theorise, generalise, hypothesise, reflect

(The table was made based on a figure in the Assessment Toolkit from University of New South Wales[33])

5.3.4 An authentic learning context

This inquiry was conducted in a mandatory undergraduate course - Philosophy of Sciences (shorten in PoS), which is held in the Faculty of Cognitive Science at University of Trento. Though PoS is scheduled in the 2nd year of undergraduate study, it is always composed of students from different academic years due to the fact that some students failed to pass the exam of PoS for the first time of registration, thus, they might register for PoS several times until they pass. The number of students in PoS is around 200[34]. PoS has six credits, and the lessons usually go from the middle of February to the end of March (7 hours a week, overall length is 42 hours). The instructor assessed students in a final written exam with five options of exam time in one academic year[35]. Before the implementation of CSCL in PoS, students were only taught by traditional lecturing. In addition, there was only one instructor in PoS without any teaching assistant, and students were divided into three rooms due to the large number. The instructor was in one of the three rooms, and other two rooms were connected with the instructor's room by live streaming. From the instructor point of view, it was difficult to interact with students. From the student point of view,

[33] The assessment toolkit is retrieved from https://teaching.unsw.edu.au/printpdf/531

[34] This is only a predictive number of students that provided by the instructor of this course. It is impossible to calculate the exact number of students in PoS for two reasons: firstly, the registration is only for participating the final exam and there is a possibility that students who registered for the exam did not participate finally. Secondly, the attendance of traditional lectures is only optional for students, thus, it is impossible to calculate the number of students actually attended the lessons.

[35] The five options of the exam time are usually in June, July (or in later June), September, January next year, and February next year.

the subject was particularly difficult, which was supported by the evidence that many students tried several times of the final exam to pass and some even registered several times.

With the aim to change the situation of PoS, we collaborated with the instructor of PoS – Professor Sara Dellantonio, and two CSCL activities were designed together[36] for improving the teaching quality of PoS. To avoid the risk of negative effect on delivering PoS in a wholly new way which both the instructor herself and students were not familiar with, we kept the traditional lectures and added these two CSCL activities that were voluntary for students' participation. Both activities were implemented in Moodle, which was an open-source learning environment adopted by the university.

5.3.5 Design of CSCL activities

Activity 1: An online community for questions and answers

The first activity was an online learning community for questions and answers (shorten in QA). QA was open access to all the students enrolled to PoS, and students were given the possibility to ask questions on the topics discussed during classes or on the learning materials. All kinds of questions were encouraged. The first answer to the posted question came from students who were asked to express their explanation as clearly and as deeply as possible. This approach was to improve students' engagement for deeper cognitive development beyond the classroom. Students had a week to answer the question posed by their peers. After that, the teacher commented both the question and the answer directly in the forum, specifying which questions were particularly interesting and why as well as which answers were correct/incorrect and why. People who posted at least five good questions or three good answers in the online forum got one bonus point for the final exam (the full mark was 30 points)[37].

[36] The instructor of PoS was more responsible for the content of two activities since it was discipline-dependent while we was more responsible for the structure of two activities as it was about pedagogy and design for learning.

[37] The instructor thought it is more difficult and time consuming to give a good (fully elaborated) answer than to think of a good (i.e. nontrivial) question. For this reason, the number of questions/answers required for the bonus was unequal.

Activity 2: Group works on collaborative writing with blind peer assessment

The second activity was group works on collaborative writing with blind peer assessment (shorten in GW). In GW, the instructor assigned each group a paper written by a philosopher (e.g. Duhem, Poincaré, Carnap, Hanson, Kuhn, Popper, Lakatos, Feyerabend). The topics of these papers were about "what is scientific progress"; "can we consider 'science' as a privileged form of knowledge"; "how can we distinguish scientific from non-scientific theories"; "can we verify a theory", etc (Appendix B). GW was composed three stages. In the first stage, each group wrote a report for explaining and defending the argument of the author. In the second stage, groups working on connected topics but different authors had to exchange their reports. Reports were anonymous and each group had to review them specifying the strengths/weaknesses of the arguments as well as of other aspects of the text. In the last stage, the instructor evaluated independently both the reports made by the groups and the blind peer assessment based on the guideline provided by the instructor (Appendix C). Both the result of blind peer assessment and the instructor's review for students' group work were not included as a part of the final assessment of individual student. In fact, the bonus for this work did not depend on the scoring of the work, but every student who participated into GW could equally benefit from it. Students with the bonus can replace one of the questions in the final exam (approx. 7 questions in total) with a different question of their own choice concerning any topic of the course and answer to it. To participate in GW, students were required a registration in the online forum, where they indicated the group members and their preference of the philosopher they would like to work on. There were two reasons for choosing self-selection group formation rather than random group formation. Firstly, students might be more willing to work with their friends or acquaintances rather than working with strangers and this might results in more effective collaboration; secondly, working with people you are familiar with might reduce the possibility of "social loafing" or "free rider" effect (Kerr & Bruun, 1983; Morris & Hayes, 1997; Joyce, 1999). Besides, to ensure the effective collaboration and the

flexibility of group formation, we allowed students to form groups of 2-4 students (Delucchi, 2006).

Summary: activities design

We designed two CSCL activities to explore if the different form of collaboration influenced the teaching quality differently. Table 17 presents a summary of the two activities. QA was an informal form of collaboration, and students learnt together in this online community by asking and answering questions. The instructor regularly checked the updates of the forum to provide comments. QA aimed to facilitate discussion on the learning topics among peers and with the teacher in the teaching and learning process, so it started at the beginning of the lessons. GW was a formal form of collaboration, and students worked only with their group members for writing a paper. The instructor did not intervene during the group work. GW required a general understanding of all the content in the course, so the actual group work started at the end of the lessons.

Table 17 Stage 3: summary of the two CSCL activities design

	Activity 1 (QA)	Activity 2 (GW)
Form	Informal collaboration: no pre-defined groups	Formal collaboration: self-formation groups with 2-4 group members
Purpose	To provide opportunities for teacher-student interaction and student-student interaction in the learning process	To enhance students' understanding of the learning subject through exchanging ideas with peers during the collaborative writing group work and blind peer assessment
Implementation time	At the beginning of the traditional lectures	At the end of the traditional lectures
Forum design	Every student can access and participate in the forum for QA	Every group has a separated space in the forum for GW that can be only accessed by the members of the group
Role of the instructor	The instructor evaluated both the questions and answers posted in the end of discussions for every thread.	The instructor assigned the tasks, organised the blind peer assessment, and evaluated the reports from groups based on SOLO Taxonomy.

5.3.5 Instruments

Survey

We conducted a survey to understand students' learning experience (Appendix D). In PoS, attendance was not mandatory for students in the faculty; therefore, the survey targeted different type of students in terms of their attendance of lecturing and their participation in the two CSCL

activities. Figure 5 presents the structure of the survey. Part A collected students' demographic information. Part B explored students' opinion about PoS and the two optional CSCL activities in general. Part C understood how those did not attend lectures prepare for the final exam, and the possibility for them to participate in the CSCL activities. Part D explored students' experience in participating the CSCL activities. Part E provided open spaces for students to comment on traditional lecturing, QA, GW, etc.

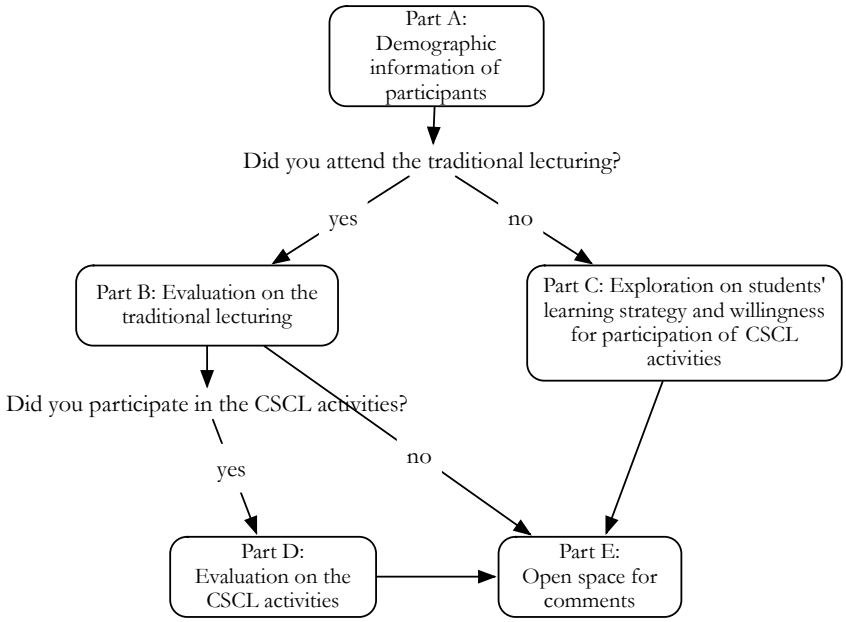


Figure 5 Stage 3: structure of the survey

Questions in Part D were about the impact of CSCL on quality teaching based on the theoretical framework mentioned in the previous section, and Table 18 presents the questions[38].

Table 18 Stage 3: questions designed for CSCL activities

Questions in the survey	Theoretical idea in the design
It provides a place to interact with the teacher beyond the classroom	Interaction with the instructor
It provides a place to interact with peers beyond the classroom	Interaction with peers
It provides extra valuable materials (e.g. questions, answers, papers) to improve my understanding on the subject	Interaction with content
I get helpful feedback from peers	Feedback from peers
I get helpful feedback from the teacher	Feedback from the instructor
It helps to improve my skill of formulating my ideas and discussing with others	General skill for interaction
It helps me to think critically	Academic benefit: critical thinking
It motivates me to learn actively	Motivation
I am able to learn something according to my interest	Academic benefit: personalised learning
It helps me to understand key concepts in the course	Learning outcome
It helps me to build links among concepts in the course	Learning outcome

[38] The last three questions with * were only targeted to students participated in GW.

It wastes my time to explain to others	Process losses
*Some members in my group do not contribute to the group work	Free rider effect
*we invest a lot of time to coordinate the group administration rather than co-creating the group product	Process losses
*I learn more effectively when alone compared to learn in the group	Learning effectiveness: individual learning versus group learning

Interview

We conducted in-depth interview to explore students' experience in participating the CSCL activities. The questions of interview were mainly designed based on students' comments in the open space of the survey. Besides, we also asked questions based on interviewees' specific responses to explore emerging issues during the interview.

Online forum

We used online forums in Moodle to implement the two CSCL activities. There were two types of data provided by the online forum. The first type of data was directly from students and the instructor during the two CSCL activities, and the content of data were mainly about the topics of subject in PoS. The second type of data was directly from the server of Moodle, and they were logs about all the users' behaviour in the forums.

5.6 Data collection

5.6.1 Activity 1 and Activity 2

Table 19 presents a summary of students' participation in the two CSCL activities. In QA, there were 58 posts in total including 13 discussion topics and 45 replies. Thirteen students contributed 35 posts, and the instructor contributed 23 posts. In GW, there were 91 posts in total including 39 discussion topics and 52 replies. Thirty-one students contributed 49 posts while the instructor contributed 42 posts. Different to the posts in QA, most of posts in GW were about groups uploaded the final written reports and the instructor organised blind peer assessment among groups. Very few posts were about idea exchange during the group work.

Table 19 Stage 3: students' participation in activity 1 and activity 2

	Activity 1 (QA)	Activity 2 (GW)
Timeframe	February 18, 2014 – April 13, 2014	March 24, 2014 – May 18, 2014

	Note: April 13, 2014 was the deadline for the instructor to intervene in the QA. The forum for QA was still open for students to interact with peers after that date.	Note: March 24 – April 20: group work April 21 – May 11: blind peer assessment May 12 – May 18: the instructor's review
Participation	220 students Note: students were counted as participants in QA when she or he viewed the forum of QA at least once.	52 students: 20 groups 6 groups: 4 members 4 groups: 3 members 8 groups: 2 members Note: 2 groups gave up in the middle

5.6.2 Survey

We published the survey in the online forum of PoS. There were totally 76 responses (Male 15; Female 61). Fifty-eight students attended the traditional lectures and eighteen students only registered to PoS without attending the lessons. Twenty-three students only participated in QA, twenty-two students only participated in GW, and seven students participated in both QA and GW. For those students attended the lessons, 70% of students confirmed PoS was a course with a large amount of information; 84% of students liked the traditional lecturing the most (7% selected QA, 9% selected GW).

5.6.3 In-depth interview

Four students participated voluntarily in the interview to share their experience in QA and GW. Two students participated only in QA, one student participated only in GW, and one student participated in both QA and GW. The number of students participated in the interview was very limited, and a possible explanation was because we conducted the interview in English. On the one hand, most of the students in PoS were Italian students and all the undergraduate courses in this faculty were in Italian; therefore, students might not be confident to express their ideas in English. On the other hand, we preferred conducting the interview by ourselves rather than others for ensuring the interview quality, but the main investigator was not capable of conducting the interview in Italian.

5.6.4 Forum logs

Since students in GW used their forum as a place to upload their final written report rather than a place to collaborate with group members, data collection from forum logs focused on the forum of QA. We downloaded the logs from the Moodle, and the timeframe of the logs were from 18/2/2014 to 23/2/2015[39]. There were totally 3844 views from 220 students.

5.6.5 Exam scores

There were two exam scores collected in this inquiry. The first one was the score of university entrance exam, and the second one was the final exam score of PoS. To understand if CSCL has a positive impact on quality enhancement, a possible quantitative evidence was from students' final exam score. In this inquiry, the final exam score of PoS can be used to present the most important element of teaching quality – students' understanding of the learning subject, because the exam composed of several open questions rather than multiple-choice questions. We also asked the instructor to map her own scoring criteria to SOLO Taxonomy (Table 20). Previous studies indicated that students' general intelligence (Chamorro-Premuzic & Furnham, 2004; Chamorro-Premuzic & Furnham, 2008) might influence the exam score, therefore, the score of university entrance exam[40] was collected from the secretary of the faculty to present students' general intelligence level.

Table 20 Stage 3: the SOLO Taxonomy-based scoring

Score	Evidence of students' understanding in the written exam	SOLO Taxonomy
0-17	I do not understand …	Pre-structural
18-22	I have a basic understanding of the topic	Uni-structural
23-26	I have gathered lots of information on this topic	Multi-structural
27-28	I can see the connections between the information I have gathered	Rational
29-30	By reflecting and evaluating on my learning, I am able to look at the bigger picture and link lots of different ideas together	Extended abstract

[39] In the academic year 2013/2014, PoS started on 18/2/2014. The PoS in the academic year 2014/2015 started on 24/2/2015. Thus, we collected forum logs of QA from 18/2/2014 to 23/2/2015.

[40] A test was designed to select the students' for the admission at the university, which does not change from a structural point of view from one year to another. It measures various aspect of students' capacities including Logic, Mathematics, Italian, English, and Informatics.

5.7 Data analysis

5.7.1 Descriptive statistics

Descriptive statistics provided a quantitative description on students' participation in QA, instructor's review on reports in GW, and the survey result. Table 21 presents a summary of posts contributed in QA, which was an example of descriptive statistical analysis in the inquiry of Stage 3. Since the log file created by Moodle server was only raw data with the format of "time, IP address, user name, action and information[41]", therefore, we used Microsoft Excel and Google Refine to present and summarise the data.

Table 21 Stage 3: a summary of posts in the activity 1

Topics	Created on	Finished on	Num. of reply by whom	Num. of views[42]
Some clarification on the class of February 21th	24/2/2014	4/3/2014	Student: 2; Instructor: 1	227
Logic: Deduction	28/2/2014	4/3/2014	Student: 1; Instructor: 1	203
Poincaré and the idea of science	26/2/2014	4/3/2014	Student: 4; Instructor: 3	240
Science and metaphysics	27/2/2014	11/3/2014	Student: 2; Instructor: 3	150
Galileo Galilei	5/3/2014	11/3/2014	Student: 2; Instructor: 2	110
The problem of verificationism (logical empiricism)	5/3/2014	11/3/2014	Student: 3; Instructor: 2	157
26/02 Logical empiricism	27/2/2014	16/3/2014	Student: 8; Instructor: 5	323
Ambiguity of the word "verification"	11/3/2014	23/3/2014	Student: 0; Instructor: 1	117
Feyerabend and the idea of incommensurability	28/3/2014	9/4/2014	Student: 1; Instructor: 1	117
Universal principles and cosmologies	21/3/2014	3/4/2014	Student: 2; Instructor: 1	127
The bonus receivers of QA	17/5/2014	N/A	Student: 0; Instructor: 0	127
Questions sent to me by email	11/6/2014	N/A	Student: 0; Instructor: 0	109
Lakatos	26/6/2014	N/A	Student: 0; Instructor: 0	57

5.7.2 Inferential statistics

T-test analysis

To examine if CSCL improved students' understanding of the learning subject, we used t-test to compare the exam score between students who participated in CSCL activities (experiment group) and those who did not (control group). In the academic year 2013/2014, there were many students

[41] Action refers to users' behavior in the forum such as view posts or add/update posts. Information refers to the topic where the user' behavior occur such as "Galileo Galilei" in Table 21.
[42] The number of views only refers to students' view.

participated in QA, thus, to have similar number of students in the control group, we also selected students registered for PoS in the academic year 2012/2013. Table 22 presents the selection criteria for experiment group and control group, and we only selected students who met all the criteria. We conducted the t-test in R 3.2.0 using stats package (R Core Team, 2014).

Table 22 Stage 3: selection criteria for the experiment group and control group

Students in the experiment group	Students in the control group:
1. The first registration for PoS was in 2013/2014 academic year 2. Participated in at least one of the two CSCL activities 3. Had at least one record of final exam score within the academic year 2013/2014 for analysis	1. The first registration for PoS was in 2012/2013 academic year 2. Did not participate in any CSCL activity in PoS 2013/2014 3. Had at least one record of final exam score within the academic year 2012/2013 for analysis OR 1. The first registration for PoS was in 2013/2014 academic year 2. Did not participate in any CSCL activity in 2013/2014 academic year 3. Had at least one record of final exam score within the academic year 2013/2014 for analysis

Regression analysis: a linear mixed model

A linear mixed model is a statistical model composed of both fixed effects and random effects, and it is especially useful when there are repeated measurements (Field et al., 2012). We selected it for two reasons: firstly, PoS provided five options of exam time in one academic year and many students took the final exam for several times, it required the analysis considered the issue that individual student had several exam scores (repeated measurements). Secondly, there are two types of variable that influence students' exam score. The first type is observed variables (fixed effects) such as general intelligence (Chamorro-Premuzic & Furnham, 2004; Chamorro-Premuzic & Furnham, 2008), gender (Pomerantz, Altermatt & Saxon, 2002; Hyde & Kling, 2000; Wilberg & Lynn, 1999), and CSCL activities that we aimed to investigate in this inquiry. The second type is latent variables (random effects) used for considering individual difference such as learning motivation, engagement, etc.

We conducted the mixed model analysis in R 3.2.0 using lme4 package (Bates et al., 2014). Table 23 presents the mixed model and the explanation of variables in the model. The dataset was composed of both the experiment group and the control group mentioned above.

Table 23 Stage 3: mixed model construction

The linear mixed model: $voto \sim entrance + gender + forum + groupwork + bonuseffect + examtime + (1\|matricola)$		
Variable name	Note	The range of data
Voto	Exam score of PoS. This variable presents students' understanding of the subject.	[18 - 31[43]]
Entrance	Exam score of university entrance exam. This variable presents students' general intelligence.	[0 - 100]
Gender	Gender	0: female; 1: male
Forum	The number of views in QA (student engagement in QA)	[0 - ∞)
Groupwork	The instructor's review in GW from excellent, very good, good, adequate to inadequate	0, 1, 2, 3, 4, 5[44]
Bonuseffect	The bonus for students' participation in GW is they can replace one question in the final exam and answer to that question. This variable presents the effect of bonus on the exam score.	0: students who did not participate in GW 1: students who participated in GW
Examtime	There were five options of exam time. This variable presents the times that a student participated in the exam.	1 (first time), 2, 3, 4, 5 (fifth time)
1|matricola	Matricola is a six-digit student identity. We used this variable to consider the effect of individual difference to exam score.	(0, 1)

5.7.3 Thematic analysis

Thematic analysis is a qualitative analysis method to identify themes in the data. We used it to analyse students' comments in the open space of the survey and interview transcriptions. Table 24 presents an example of analysis, and this theme shows CSCL improved students' understanding.

Table 24 Stage 3: thematic analysis

Theme: understanding
Interview: When I did not understand something, my friends in the group told me what the point was; on the other hand, when my friends did not understand something, I tried to explain it to them. It was really good and interesting…as the subject is difficult, and we needed to compare our opinions. Open space in the survey: It offered me a space for discussion and for a constructive debate. It was useful to understand the topics in depth.

5.8 Research results

5.8.1 The impact of CSCL on large class teaching

Table 25 presents the survey result of learning experience in two CSCL activities. For students who attended the traditional lessons, more than 50% of students confirmed almost all the benefits

[43] The full mark of the exam is 30, and the minimum mark to pass the exam is 18. When a student performed outstandingly in the exam

[44] Zero presents students who did not participate in GW. From one to five, it respectively presents from "inadequate" to "excellent".

of CSCL in their experience. The only exception was the item about personalised learning. Only some students (40% in GA, 48% in GW) thought they were able to learn things according to their interest. For those who did not attend the traditional lessons, 50% of students read the posts of QA to prepare the final exam; 58% of students were willing to participate if QA kept open to the time for final exam[45]; 89% of students though it helpful to post questions in QA.

Table 25 Stage 3: learning experience in activity 1 and activity 2

Items in the survey with the answer of "Agree" or "Disagree"	Students agree (%)	
	Activity 1 (QA)	Activity 2 (GW)
It provides a place to interact with the teacher beyond the classroom	83%	52%
It provides a place to interact with peers beyond the classroom	63%	90%
It provides extra valuable materials to improve my understanding of the subject	83%	86%
I get helpful feedback from peers	60%	76%
I get helpful feedback from the teacher	90%	97%
It helps to improve my skill of formulating my ideas and discussing with others	53%	66%
It helps me to think critically	50%	86%
It motivates me to learn actively	53%	62%
I am able to learn something according to my interest	40%	48%
It helps me to understand key concepts in the course	73%	62%
It helps me to build links among concepts in the course	60%	76%
It wastes my time to explain to others	17%	3%
Some members in my group do not contribute to the group work	NA	34%
We invest a lot of time to coordinate the group administratively rather than co-creating the group product	NA	3%
I learn more effectively when alone compared to learn in groups	NA	76%

Beside the result of designed items about learning experience in CSCL activities, students' comments in the open spaces of the survey and the interview transcriptions also indicated positive impacts of QA and GW for interaction, feedback, understanding, personalised learning, etc. and negative impacts such as social loafing and process losses (Table 26). Unexpectedly, we found social loafing in QA had a positive impact on loafers' learning.

Table 26 Stage 3: result of thematic analysis

Themes	Quotation	Data source
Interaction	More interaction with the teacher who had the opportunity to show us how to respond properly. It was helpful to have the opportunity to ask questions to peers.	Survey(QA)
	I had the opportunity to meet with a mate, to exchange opinions and to address some notions that were unclear to me.	Interview (GW)

[45] The QA forum (with the instructor's intervention) was from February 18, 2014 – April 13, 2014. The first time for final exam was on June 13, 2014.

Feedback	It was helpful to have the teacher's feedback on the questions and answers.	Survey (GW)
Understanding	Although I did not participate actively asking questions or giving answer, to read the contributions of others helped me to clarify some doubts. It was helpful to have the opportunity to go back to unclear issues.	Survey(QA)
	It offered me a space for discussion and for a constructive debate. It was useful to understand the topics in depth. The group work allowed me to deepen some issues related to two philosophers discussed in class. I had the opportunity to meet with a mate, to exchange opinions and to address some notions that were unclear to me. It was very useful to have an exchange with the peers and especially to explore a topic of my choice, which certainly helped in a deeper understanding of the authors. One of the assigned tasks was to evaluate the work of another group. This gave us the opportunity to rethink our own product and to understand that some aspects needed to be improved.	Survey(GW)
	It was helpful when I had some unclear points because I could discuss with other people. Maybe in class I was not able to ask someone for a consult, but with the platform, I could because it is the purpose of the forum, I could get answer from other people and also from the teacher. Also reading others' post, I could see: Hey, I did not fully understand this point; let us see how they reply. Sometimes I thought I understood it well but I did not actually, so when I saw the questions, I realized that I was not that sure.	Interview (QA)
	I really enjoyed reviewing the work of others. I had to study that part for the exam too. Without reading the work of others, I had not reflected on it so much, it helped me to see the relevant questions, the author's point, and how his view relates to others. Therefore, it was complete. In fact, I feel I know better the author I studied with my work group than the other authors I studied in the course because I had a chance to reflect more on that. When I did not understand something, my friends in the group told me what the point was; on the other hand, when my friends did not understand something, I tried to explain it to them. It was really good and interesting…as the subject is difficult, and we needed to compare our opinions.	Interview (GW)
Writing skill	It was useful to write down our thoughts instead of expressing them verbally.	Survey(GW)
Personalised learning	It was very useful to have an exchange with the peers and especially to explore a topic of my choice, which certainly helped in a deeper understanding of the authors.	Survey (GW)
Social loafing (positive)	When I focused on Philosophy of Sciences, many questions have already posted in the forum, so I just read it and it was not necessary that I post questions.	Interview(QA)
	Although I did not participate actively asking questions or giving answer, to read the contributions of others helped me to clarify some doubts.	Survey (QA)
Process losses	I want to say that I find group work a waste of time because you have to put more people agree and discuss the matter, as well as arrange meetings etc..	Survey (GW)

5.8.2 Blended learning for quality enhancement

Result of descriptive statistics

To understand if CSCL improve the teaching quality in the large class setting, we compared the exam score of two groups (experiment and control)[46]. Figure 6 presents the distribution of students' exam score, which visually indicated that students in the experiment group performed better than those did in the control group. Half of the experiment-group students got a score higher than 24, which indicated they reached the multi-structural level of understanding in SOLO Taxonomy. Half of the control-group students only got a score higher than 22, which presented the uni-structural level. Students in the experiment group achieved a higher level of understanding compared to those in the control group.

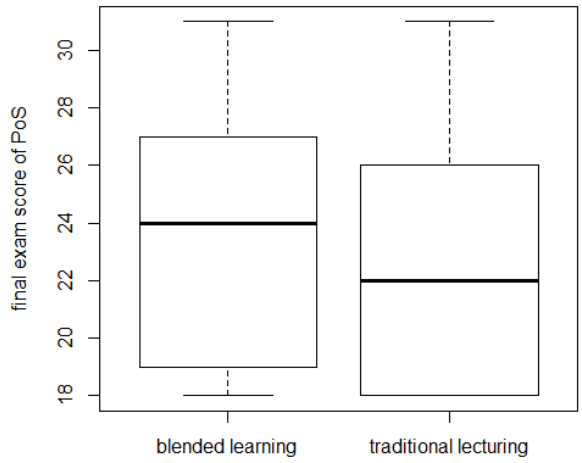


Figure 6 Stage 3: distribution of final exam score

Result of t-test analysis

To understand the significance of the difference of students' exam score between two groups, we conducted t-test analysis. The result indicated there was not a significant difference

[46] There were 145 students in the experiment group and 112 students in the control group.

(t(234.429)=2.1044, p>0.1) between students in the experiment group (M=23.53571, SE=4.278437) and students in the control group (M=22.42069, SE=4.124232).

Result of regression analysis

We ran a multiple regression to predict students' exam score from university entrance exam, gender, forum participation, performance of group work, bonus effect, and the times of taking exam. Besides, we also set up student identity as a random effect to account for the individual difference (learning motivation, engagement, etc.) contributed to the exam score. Table 27 presents the analysis result. Among all the observed variables, university entrance exam and forum participation were two factors that contributed to students' academic performance significantly in statistics. Besides, students who received the bonus in GW got a 3-point improvement in the exam score. The Akaike Criterion (AIC) and the Bayesian Information Criterion (BIC) are indices of fit that take into account the parsimony of the model. Smaller AIC (resp. BIC) values are indicative of a better fit to the data. LogLik denotes the log-likelihood of this mixed linear model, whereas S.D. matricola denotes the standard deviations of this latent variable. In this model, the latent variable matricola is assumed to be normally distributed with zero means and unknown standard deviations. Figure 7 presents a screenshot on the result of extracting the modes of the random effects in this model. Each matricola had an independent intercept, which confirmed the existence of individual differences (such as learning motivation and engagement) influence academic performance.

Table 27 Stage 3: result of regression analysis

$voto \sim entrance + gender + forum + groupwork + bonuseffect + examtime + (1\|matricola)$				
	Estimate	SE	*t*	*p*
Latent variables:				
S.D. matricola	2.829e-07			
Observed variables:				
intercept	16.129429	1.137188	14.184	< .001
entrance	0.129642	0.020777	6.240	< .001
gender	-0.735783	0.675223	-1.090	0.27684
forum	0.025200	0.008459	2.979	<0.01
bonuseffect	3.052136	2.272658	1.343	0.18043
groupwork	-0.619763	0.561907	-1.103	0.27104

	examtime	0.502276	0.338405	1.484	0.13893
Goodness-of-fit statistics:					
	R^2	0.166			
	AIC	1537.89			
	BIC	1570.342			
	LogLik	-759.945			
	Deviance	1507.5			

```
> ranef(lmer(voto~entrance+gender+forum+bonuseffect+groupwork+examtime
+(1|matricola), data=posdat))
$matricola
         (Intercept)
115353 -1.767547e-14
141368  8.866002e-15
147160 -1.148995e-14
148722 -3.681720e-14
151248 -1.811803e-15
151425  4.178717e-14
152893 -1.203921e-14
153142 -5.440117e-15
153358  1.310261e-14
153361 -1.632401e-14
153368  3.199661e-14
153371  2.624779e-14
```

Figure 7 Stage 3: conditional modes of the random effects

5.8.3 Forms of CSCL for quality teaching

We designed two forms of CSCL in this inquiry: formal collaborative learning (GW) and informal collaborative learning (QA). Based on students' experience, we found these two forms of CSCL had both common benefits for quality teaching and different effects on learning. For the common benefits, firstly, students confirmed they got feedback from peers (60% in QA, 76% in GW) and from the instructor (90% in QA, 97% in GW). Secondly, both activities helped students to understand key concepts in PoS (73% in QA, 62% in GW) and to build links among concepts in PoS (60% in QA, 76% in GW). Thirdly, both of them improved students' problem-solving skills such as formulating ideas and discussing with others (53% in QA, 66% in GW). Finally, both of them provided valuable materials to improve students' understanding of the learning subject (83% in QA, 86% in GW).

There were two different effects on learning in terms of the collaboration form. The first one was interaction in learning. There were 83% of students thought QA was more helpful to interact with the instructor (52% in GW), and 90% of students thought GW was more helpful to interact with

peers (63% in QA). The second one was social loafing effect. In GW, it decreased active participants' contribution to the group work[47]. In QA, it did not affect active participants' contribution, and it provided those contributions as materials for inactive participants to learn.

A possible explanation of these different effects was the activity design. In QA, the instructor checked the forum posts regularly, and commented on the questions and answers posted by students. There was a strong teaching presence in QA based on the Community of Inquiry framework (Garrison et al., 1999). In GW, the instructor mainly presented in the beginning of the activity for assigning learning materials for each group and in the end of the activity for assessing group work, therefore, the teaching presence was not as strong as the one in QA for the learning process. Meanwhile, students worked closely with their group members, therefore students were more aware of the student-student interaction in GW. For social loafing effect, we designed QA as an informal collaborative learning, in which all the students were in one group for helping each other to learn, and there was not a group product required by the end of QA. In GW, groups were composed of two to four students, and each group had to submit a report by the end. Thus, students cared if their group members contributed or not, because they worked together for that group product.

5.9 Discussion and summary

5.9.1 Social loafing: disadvantage versus advantage

The available literatures indicate social loafing has a negative effect on collaborative learning (McBroom & Reed, 1994; McCorkle et al., 1999; Hansen, 2006; Shimazoe & Aldrich, 2010). Students participated in GW also confirmed this issue in the open space of the survey. However, students' experience in QA showed social loafing might also have – at least in certain cases – a positive effect on learning. We designed QA to increase the cognitive interaction among students and to facilitate the instructor to provide more feedback to the students in the context of a large

[47] We collected this evidence from the survey, and no one indicated this issue in the interview.

class. In QA, the social loafing issue was particularly obvious due to the significant contrast between the number of the contributors (12 students and the instructor) and of the viewers (220 students). We also found this contrast in the summary of posts in QA (Table 21). In fact, it did not lead to a negative effect on students' learning.

Firstly, students who contributed to the forum, they did not affect by loafers (viewers) but they developed their understanding in the process of their contributions. For those question raisers, they got answers from peers and the instructor to improve their understanding of the subject. For those answer makers, they reflected on what they learnt and explained to others, which deepened their understanding. Secondly, the loafers also developed their understanding of the subject by reading those posts, for they interacted with the learning content. Actually, the written questions and answers in the forum provided a stable archive for students to reflect on what they learnt in order to enhance their understanding of the learning subject. The loafers in QA could be also interpreted as legitimate peripheral participants, which suggested by the theory of Community of Practice (Lave & Wenger, 1991).

5.9.2 CSCL for deep understanding

To help students achieve a deep understanding of the learning subject, it was an important element of quality teaching (Entwistle, 2009). We found the two CSCL activities designed in this inquiry helped to improve teaching quality in the large class setting especially from the point of students' understanding. Laurillard (2012) argued that collaborative learning supported two types of learning cycles: one was peer-communication cycle and the other was peer-modelling cycle. The former supported idea exchange, where students gained diverse viewpoints. The latter provided students to understand how others learn, thus, students improved their learning skills in collaboration. QA mainly facilitated the peer-communication cycle for it enhanced idea exchange between the instructor and students, and among students themselves. GW facilitated both the peer-communication cycle and the peer-modelling cycle because students not only gained their peers' idea of the subject but also perceived their peers' learning approach during collaboration. In SOLO

Taxonomy (Biggs, 1980), the last two levels[48] present students' deep understanding (Dudley & Baxter, 2009; Smith & Colby, 2007). Students who learn through collaboration are more likely to achieve these two levels of understanding as they keep constructing critically their knowledge structure by comparing it with others; in the meantime, they learn to study more effectively by observing the learning approach of advanced peers in the group.

5.9.3 The importance of quality lecturing

In line with the existing literature on collaborative learning in large classes (Slusser & Erickson, 2006; Leger et al., 2013), in this study we adopted a blended approach (traditional lecturing supplemented by voluntary CSCL activities). All the collected data provided evidence that in the students' view collaborative learning provided more opportunities for them to interact with the instructor and their peers, motivated them to exchange idea, facilitated their cognitive development, and allowed them to learn more actively. However, data from both the survey and interviews[49] showed students considered the traditional lectures, i.e. the face-to-face lessons where the instructor introduced the topics, as the most important and helpful activity of PoS. Their notes on the lessons were very important materials to reflect on what they learnt and to prepare the exam. Thus, quality lecturing remains a necessary component of quality large class teaching.

5.9.4 Summary

In this inquiry, we designed and implemented two CSCL activities in an undergraduate class (with more than 200 students) to investigate the impact of CSCL on quality teaching in large classes. Data were collected from the survey of learning experience, in-depth interview, forum logs, and students' exam score. The results were: firstly, CSCL helped to achieve quality teaching in large classes for it not only enhanced students' motivation and engagement in the learning process but also facilitated students to deepen their understanding through the teacher-student interaction and

[48] Relational (such as the ability of comparing, explaining causes, analysing, relating, applying) and extended abstract (such as the ability of theorising, generalising, hypothesising, reflecting)

[49] One student suggested the teacher should ask students to sign the attendance sheet as she thought the traditional lectures are necessary.

student-student interaction beyond the classroom. Secondly, the issue about whether traditional lecturing blended with CSCL achieved higher quality compared to mere traditional lecturing in large classes was still inconclusive from the quantitative analysis point of view. On the one hand, there was not a statistically significant difference on the exam score between students with blended learning and those with only traditional lecturing. On the other hand, students' participation in QA, one of the two CSCL activities, was a significant predictor for students' academic performance. Thirdly, different form of CSCL had both some common benefits for teaching quality and some different effects on learning. The common benefits were due to the nature of collaborative learning such as the enhancement of feedback, cognitive development, and general skills. There were two different effects: interaction and social loafing effect. For interaction, QA more focused on the teacher-student interaction while GW more focused on the student-student interaction. For social loafing effect, it violated students' contribution in GW but also facilitated loafers' learning in QA. As the different effects were influenced by the activity design, so we will explore how to help instructors to design collaborative activities in the next-step work to maximise the benefits of CSCL and to minimise the problems of CSCL.

6. Evaluation and ethical considerations

6.1 Validity, reliability, and generalisability

6.1.1 Comparison between qualitative and quantitative research

Validity, reliability, and generalisability are three issues for evaluating a study, and they means different things in different research paradigms. Table 28 presents a comparison on the validity, reliability, and generalisability between qualitative research and quantitative research. A fundamental difference between two research paradigms is the different theoretical perspective held by researchers.

Table 28: Validity, reliability, and generalisability in qualitative and quantitative research

	Qualitative Research	Quantitative Research

Validity	Precision of description	Precision of measurement
Reliability	Consistency of coding	Consistency of results
Generalisability	Analytic generalisability	Statistical generalisability

Quantitative research is rooted in positivist perspective that the world is made up of observable, measurable facts (Glesne & Peshkin, 1992). Therefore, in quantitative research, validity refers to the precision of measurement i.e. whether the issues that the research truly measures were the issues intended to be measured or how truthful the research results are (Golafshani, 2003). Reliability refers to the consistency of research results i.e. whether we will obtain consistent results in identical situations on different occasions (Mayan, 2009). Generalisability refers to the statistical criterion i.e. the representativeness of the sample to the whole population (Yin, 2003; Donmoyer, 2008). In sum, the evaluation of a quantitative study emphasises on the representatives of sample data in the whole population and the precision for measuring facts.

Qualitative research is rooted in interpretivist perspective, and inquiries are conducted in a naturalistic approach to understand a phenomenon in context-specific settings. Validity refers to the precision of data description i.e. whether the description of the phenomenon we provide can be found in the data (Mayan, 2009). Reliability refers to the consistency of coding i.e. whether our coding will be consistent with others' coding on the same corpus (Mayan, 2009; Noble & Smith, 2015). Generalisability refers to the theoretical robustness i.e. a theory or general social processes of a phenomenon being studies might have much wider applicability than the particular case studied (Yin, 2003). In sum, the evaluation of a qualitative study emphasises on the trustworthiness of the data interpretation and the transferability of the research findings to similar settings (Golafshani, 2003).

6.1.2 Strategies for validity, reliability, and generalisability

In this three-stage study, the inquiry of both Stage 1 and Stage 2 were case study, which were in the qualitative research paradigm; the inquiry of Stage 3 was a mixed method research that composed of both qualitative and quantitative research. Table 29 presents a summary on the

strategies we used to maintain validity, reliability, and generalisability in three stages. There were three common strategies used in three stages: member check, triangulation in data source, transparency, and purposive sampling.

Table 29 Strategies adopted in this three-stage study

	Validity	Reliability	Generalisability
Stage 1	Member check Thick description Transparency	Inter-coder agreement[50] Prolonged engagement Triangulation in data source	Purposive sampling
Stage 2	Member check Thick description Transparency	Triangulation in data source	Purposive sampling
Stage 3	Member check Statistics Transparency	Triangulation in data source, method	Purposive sampling

Member check, also refers to member or respondent validation, is a strategy used to optimize the validity of qualitative research findings (Creswell, 2013), where participants were asked to evaluate one or more of the following situation (Sandelowski, 2008):

1. Researchers accurately rendered their experiences that were the target of study
2. Researchers fully captured the meaning those experiences had for them
3. Researchers' interpretive accounts of those experiences do justice to them.

The three situations respectively are: descriptive validity, interpretive validity, and theoretical validity (Maxwell, 1992). Since we interpreted the participants' experience from time to time during interview as a link for asking further questions (the third situation – theoretical validity), thus, member check was a strategy used in this three-stage study.

Triangulation means having at least two types of method, or data sources, or theories to explore the same issue in order to provide corroborating evidence (Bryman, 2012). In all the stages, data were collected from at least two channels such as interview with classroom observation, online forum access (Stage 1), interview with information from university websites (Stage 2), and survey,

[50] We invited Brenda Padilla Rodriguez, who was a PhD candidate in eLearning from University of Leicester, to co-code two excerpts of interviews to check the reliability of our own coding.

interview, forum logs, etc. (Stage 3). Therefore, we used triangulation to achieve a reliable research result.

Transparency is the benchmark for writing research - the need to be explicit, clear and open about the methods and procedures used (Hiles, 2008; Moravcsik, 2014). In each stage of inquiry, we explained the reasons for selecting a specific methodology and the detailed procedures for analysing data with examples. Besides, by dividing the entire study into three stages of inquiry in writing, we afford readers access to our decisions about changing research focus and research questions for a transparent research process. We uploaded all the original interview transcripts and field notes into an online space for people who interested in the topics of this dissertation to read[51]. Purposive sampling is a non-probability sampling strategy used in qualitative research, and it aims to select a sample that has the characteristics relevant to the research questions (Oliver, 2006). Participants in this three-stage study were selected based on their representativeness on the research questions. To increase the generalisability of qualitative studies, the sample size should achieve a certain number based on the relevant studies. We recruited 17 university teachers to explore their perception of quality teaching (Stage 1), and previous studies on teaching beliefs had similar sample size such as 17 in Kember & Kwan (2000)' study, 13 in Samuelowicz and Bain (1992)'s study, 18 in Gonzalez (2010)'s study, and 17 in McConnell & Zhao (2006)'s study. In Stage 2, there were two universities composed of 10 university participants. The sample size was not ideal but it was acceptable in qualitative research (Sandelowski, 1995; Fugard & Potts, 2015). In Stage 3, there were totally 76 survey responses, and the response rate from desirable subjects[52] was 72%.

[51] The raw data in the online space is not open to the public. It requires to apply access permission by sending an email to yangnanbnu@foxmail.com

[52] The desirable subjects refer to students either participated in the GW or had at least 13 views in the QA forum (there were 13 topics). There were totally 61 responses (52 from attendants in the traditional lectures, 9 from self-study students), who participated in two CSCL activities, in the survey. There were 85 students, who actually participated in the two CSCL activities. Thus, the response rate from desirable subjects was 72%.

There were also strategies used in some stages of this study to assure the research quality: thick description and statistics. Thick description means researchers *"looking at the rich details of the case, sorting out the complex layers of understanding that structure the social world* (Dawson, 2010)*"*, therefore, readers experience a sense of verisimilitude when they read the researchers' account (Ponterotto, 2006). The inquiries of Stage 1 and Stage 2 were case study, and we selected many quotations with the aim to provide rich details of teaching situation in higher education. In Stage 3, we used statistics to assess the validity of analysis result such as t-test analysis for examining if the difference on exam score between experiment group and control group was significant. We also adopted a linear mixed model rather than simply a linear model to take account of latent variables that influenced students' exam score.

6.2 Ethical considerations

6.2.1 The ethical appraisal framework

In this study, we adopted the ethical appraisal framework, which was based on Stutchbury & Alison (2009)'s work, to guide an ethical research. Table 30 presents a summary of a four-dimensional ethical thinking with benchmarks and appraisal elements. The consequential dimension of ethical thinking is concerned with the research outcome, with the aim to maximise the benefits of a study and to minimise potential risks in a research project. The ecological dimension of ethical thinking is concerned with the research environment, with the aim to identify the resources and norms for conducting research, and the responsibilities to people supporting this research. The relational dimension of ethical thinking is concerned with the relationship between the researcher and the research participants, with the aim to establish effective relationships with all parties to the research. The deontological dimension of ethical thinking is concerned with how the research is carried out with the aim to minimise the risk of potential harm to any party to the research.

Table 30 The ethical appraisal framework

Ethical thinking	Ethical benchmark	Appraisal element

Consequential	Research should be worthwhile	Research focus
Ecological	Research should be conducted responsibly	Research approach
Relational	Research should be conducted respectfully	Research methods
Deontological	Research should be 'done right'	Research obligations

(This table was developed based on the detailed explanation of the ethical appraisal framework on the website[53])

6.2.2 Reflections on the ethical considerations

The reflections on the ethical considerations in this study are organised based on the four-dimension ethical appraisal framework.

Is my research worthwhile? (Consequential dimension)

In this three-stage study, we had different research focus in different stages. The rationale for changing the research focus was guided by consequential dimension of ethical thinking, which was to maximise the benefit of participants – university teachers. Initially, we started this study (Stage 1) with the aim to understand the impact of eLearning for quality teaching in higher education. Seventeen university teachers from different disciplines were involved in the inquiry to understand their perception of quality teaching and their practice for achieving the quality they expected. The research result showed that the quality of teaching in large classes was usually limited although teachers already achieved the quality they expected in small classes with many strategies. Thus, the inquiry of Stage 2 focused on quality teaching in large classes, as it was a real problem for university teachers. CSCL was selected as a specific strategy for large class teaching as our interest was eLearning for quality teaching. Ten teachers[54] were involved in the inquiry to explore if they adopted CSCL for quality large class teaching. The research result showed firstly, most of participants did not use CSCL in large class teaching; secondly, many adopted strategies were not effective to solve the two problems[55] of quality teaching in large classes mentioned by participants. To explore if CSCL helps to achieve quality teaching in large classes, in the inquiry of Stage 3, we collaborated with a teacher in my own faculty, who teaches an undergraduate course with more than 200 students. We designed and implemented two CSCL activities in the online forums. The

[53] http://www2.le.ac.uk/colleges/ssah/research/ethics/eaf
[54] Five teachers were from an Italian university, and five teachers were from a British university.
[55] Teachers had less interaction with students; and it was difficult for teachers to check students' understanding.

research results showed CSCL had a positive impact on quality teaching in large classes by enhancing interaction (teacher-student, student-student, student-content) in learning and students' understanding of the learning subject through collaboration with peers.

Am I a responsible researcher? (Ecological dimension)

In the first two stages of inquiry, in-depth interview was the main instrument for data collection. To assure the quality of data collection, it required the interviewer established a good relationship with participants; thus, interviewees were willing to share their own opinions and experiences. In this study, it is necessary for us to keep cultural sensitivity, as participants were university teachers from Italy, UK, and China with different cultures generally. One issue we found regarding to the cultural difference was their attitudes to signing the informed consent form. For participants from Italy and UK, they considered the form as a necessary step before conducting interview based on ethical concerns; thus, they read and signed it without extra explanation on the form itself. For participants from China, in the beginning of recruitment, we encountered some teachers who refused to participate in this study because they did not want to sign the form. The only possibility for them to participate was not to sign the form, which was not ethical from our point of view. There were also some teachers suggested us to contact the head of their faculties, and they would participate if the head agreed. In this process, we were becoming aware of the importance of cultural sensitivity. We learnt to approach participants according to their cultures.

Am I a respectful researcher? (Relational dimension)

In this study, an essential issue for reflection was recruitment. The majority participants of this three-stage study were the busiest people at universities – professors; thus, it was not easy to invite them for an in-depth interview that lasts for about one hour. There were three steps we used for recruitment. The first step was to invite acquainted professors. Though the probability for them to participate in the study seems to be higher compared to those unacquainted ones, it was necessary to estimate if they were interested in the topic of the study or not before sending

invitations. The second step was to invite professors who were contacts of participants in this study. The third step was to invite professors without any contact. It was very important to prepare a concise and professional email for making a good impression in the first contact. As professors were occupied by teaching, research, and administrative works; thus, it is always necessary to reflect on how to present our work to them for raising their interest in participating. One issue that motivated professors' participation in this study was they were interested in knowing how professors from other universities, and even countries perceived quality teaching. It became an opportunity for us to compare the opinions of the current participant with previous ones during the interview.

Am I doing these right? (Deontological dimension)

Reciprocity and keeping promises are two issues of my refection in this dimension of ethical thinking. As mentioned above, it was not easy to recruit professors, thus, we were always grateful when they accepted the invitation. We made ourselves available if they would like to get any information or we could be helpful in some way. By doing this, we established a reciprocal relationship with participants. For example, one participant expressed the uncertainty of trying a teaching strategy in the large class setting, which he had adopted in small classes, during the interview. After the interview, we sent him an activity design (Appendix E) based on the strategy he described, which aimed to maximise the interaction in learning and his teaching time in the large class setting. For keeping promises, we made participants aware that they can withdraw their participation at any time, which was in the informed consent forms (Appendix F). Besides, we ensured the confidentiality of data in two means. The first mean was to exclude the names of institutions involved in the first two stages of inquiry, where the majority of professors in this study were involved. The second mean was to use pseudonyms when names were mentioned in the interview transcriptions.

In sum, the ethical appraisal framework provided us a systematic approach to conduct an ethical and quality research. Besides, the ethical guideline for educational research (BERA, 2011) was also

adopted to keep ethical considerations in the process rather than only an ethics approval in the very beginning of a research project.

7 Conclusion

7.1 Introduction

eLearning might lead to two possibilities for quality teaching in higher education: impetus and inhibition (Laurillard, 2001; Walkington, 2013). Its impact depends on how it is designed and used (Feenberg, 2001). Quality is a complex issue in higher education due to its diverse cultures (Harvey & Green, 1993), its various stakeholders, and its different ways for analysing, thus, this study started exploring the impact of eLearning on quality teaching in higher education by understanding how university teachers perceive quality teaching and what they do in practice to achieve the quality they expected. The main research question was:

What is the impact of eLearning on quality teaching in higher education?

Sub questions were:

1. What is university teachers' perception of quality teaching?

2. What problems do university teachers face for quality teaching?

3. How do university teachers use any eLearning or non-eLearning strategies for quality teaching?

In the sub questions, we did not emphasise eLearning because we aimed to explore university teachers' adoption of eLearning in reality rather than possibilities of eLearning adoption in theory. Besides, we chose university teachers as the research subject for two reasons. Firstly, they were one of the key stakeholders in the teaching and learning process, which was the centre gravity of higher education system (Higher Level Group on the Modernisation of Higher Education, 2013); secondly, they had the transformational leadership in the teaching and learning process, and they decided what types of eLearning will be embedded in practice and how. It was urgent to explore their perception of quality teaching as it will be a core part of the shared quality framework among all the stakeholders in higher education system, with the aim to enhance quality teaching efficiently.

Furthermore, it was also important to understand both the problems they faced and the strategies they adopted in practice. We hoped, by conducting this study, we got a chance to compare the theoretical impact of eLearning proposed by researchers and the actual impact of eLearning in practice shared by practitioners. Therefore, we were able to reflect on quality enhancement through embedding technologies rationally.

This study was composed of three stages, in which we continuously explored the situation of university teaching and focused on making intervention to improve the teaching quality in higher education. Section 7.2 is a synthesis of empirical findings in this three-stage study with the rationale behind the adjustment of research questions and focuses in the whole research journey. Section 7.3 presents the implications of this study, in which we hoped for contributing to the research fields involved in this study and the practice of university teaching. Section 7.4 summarises the limitations of this study, in which we revealed several issues that can be improved in future studies. Section 7.5 provides future trends, which is worthwhile to investigate in the near future.

7.2 Empirical findings

In this three-stage study, initially, we explored university teachers' perception of quality teaching and teaching practice to understand the impact of eLearning on quality teaching in higher education. University teachers' perception of quality teaching is consistent with educational researchers' point view that – quality teaching is not only the mediation for learning in terms of content design, teaching and learning process, assessment, and learning outcome but also a reflective practice. Furthermore, the most common perception of quality teaching among university teachers is defined by learning outcome – students' deep understanding of the learning subject. There are three main issues that hinder university teachers to achieve the teaching quality they expected: plagiarism, large class teaching, and promotion pressure. For strategies in practice, university teachers adopted eLearning strategies such as Twitter, online forum, and online group work to facilitate the dissemination of learning material and the interaction (teacher-student, and

student-student) in the learning process; they also adopted non-eLearning strategies to facilitate students' engagement, students' understanding, and to bring new perspectives in the learning process.

In Stage 1, we realised that the impact of eLearning on quality teaching in higher education should be discussed in two cases: one is teachers from traditional universities, who teach face-to-face; the other one is teachers from open universities or teachers from traditional universities, who offer distance learning programs. In the former context, teachers tend to adopt more non-eLearning strategies in teaching practice. Possible explanations could be on the one hand, they are experts in the field of their research interests rather than pedagogic professionals, so they might lack knowledge on how to embed eLearning in teaching effectively; on the other hand, they are able to teach students face-to-face, in which eLearning strategies seem to be optional for them. In the latter context, teachers mainly organise teaching and learning activities in distance, in which eLearning becomes a must for quality teaching.

The impact of eLearning on quality teaching is limited in traditional universities. Firstly, based on participants' experience, non-eLearning strategies such as Socratic teaching, reduction in topics, and using few slides solved problems more target the common perception of quality teaching i.e. students' understanding of the learning subject. eLearning strategies mainly facilitate the teacher-student and student-student interaction in learning and the dissemination of learning materials. Secondly, eLearning has not reached its full potential in teaching practice of traditional universities when we compared the actual impact of eLearning in this inquiry and the potential impact of eLearning from the existing literatures (McKeachie, 2007; Palloff & Pratt, 2007; Laurillard, 2012). In this inquiry, teachers, who already achieved quality teaching in small classes with both eLearning and non-eLearning strategies, still faced challenges in large class teaching. Therefore, we decided to explore large class teaching with a specific eLearning strategy, which has the potential to solve the problem of quality teaching in large classes. CSCL was selected because it has the potentials to solve the problems such as reduced interaction and decreased learning outcome in large class

teaching (Jacobs & Ward, 2000; Laurillard, 2012; Leger et al., 2013; Dougherty & Andercheck, 2014; Hommes et al., 2014).

In Stage 2, we explored both teachers' strategies and the adoption of CSCL in large class teaching for understanding the impact of CSCL on quality teaching in large classes. University teachers confirmed that the quality of large class teaching was limited compared to the quality of small classes teaching. This limitation was mainly due to the insufficient interaction with students and the difficulty in checking students' understanding based on teachers' own experience. In this inquiry, the dominant teaching strategy we found in large class teaching was traditional lecturing. Though CSCL was theoretically a solution for quality teaching in large classes (Jacobs & Ward, 2000; Laurillard, 2012; Leger et al., 2013; Dougherty & Andercheck, 2014; Hommes et al., 2014), it has not widely adopted in practice. There were several reasons for teachers to reject CSCL in practice. Firstly, some teachers already adopted face-to-face group work as a subsequent learning activity after traditional lecturing for quality teaching in large classes, thus, it is not necessary for them to adopt CSCL. Secondly, some teacher has never tried any eLearning strategies, not to mention adopting CSCL. Thirdly, some teachers had unsuccessful experience in using eLearning for large class teaching in the past; thus, they had a negative impression on using technologies in teaching generally. Lastly, there were some teachers already achieved the quality they expected, so they were not motivated to adopt CSCL.

Beside a very limited adoption of CSCL, teachers used strategies including recorded lessons, course website, reduction in topics, walking around during lecturing, and online personal journals boards, etc. Most of these strategies did not target the two issues (insufficient teacher-student interaction, and the difficulty in checking students' understanding) in quality large class teaching. As participants in the inquiry of Stage 2 came from two universities: one was an Italian university (Case A) and the other was a British university (Case B), we were able to compare the situation of large class teaching in these two cases. The difference between two cases were: firstly, teachers in Case A started teaching without any training, and there was not a teaching excellence unit like the

one in Case that supported teachers to innovate teaching practice. Secondly, Case B encouraged teachers to conduct pedagogic research by providing funds while no similar information was found in Case A. Besides, teachers in Case B worked in teams when teaching large classes while teachers in Case A worked alone. These contextual differences between two cases influenced the strategies adopted by teachers. As teachers in Case B were trained and supported in teaching; they adopted strategies (such as online personal journal, online discussion boards) that emphasised on teacher-student interaction and student-student interaction. Teachers in Case A worked alone without training and support in teaching; they adopted strategies (such as recorded lessons, course website) that emphasised on student-content interaction, which did not target the two challenges in the limited quality of large class teaching.

The inquiry of Stage 2 showed that CSCL had not adopted widely in practice. Thus, in the inquiry of Stage 3, we investigated the impact of CSCL on quality teaching in large classes by designing and implementing CSCL in an authentic educational context. We collaborated with Prof. Sara Dellantonio and designed two CSCL activities together (one was online learning community for questions and answers, shorten in QA; the other one was collaborative writing group work with blind peer assessment, shorten in GW) in her course – Philosophy of Science – an undergraduate course with around 200 students. There were 220 students participated in QA and 52 students participated in GW. Data were collected from the learning experience survey, in-depth interview with students, students' learning behaviour from forum logs, forum posts, the instructor's evaluation on GW, and final exam score.

The result of data analysis showed that CSCL helped to achieve quality teaching in PoS by enhancing students' motivation and engagement in the learning process, facilitating students to deepen their understanding through the teacher-student interaction and student-student interaction beyond the classroom. Besides, we constructed a mixed model to analyse both the fixed effects (such as gender, general intelligence, teaching approach) and random effects caused by individual differences (such as learning motivation, and learning engagement) that contributed to

students' academic performance measured by the final exam score. It showed that QA, one of the two CSCL activities, was a significant predictor for students' final exam score. Last but not least, different form of CSCL had both common benefits for quality teaching and different effects on learning. The common benefits were due to the nature of collaborative learning that enhances feedback, cognitive development, and general skills. There were two different effects discovered in this study: interaction, and social loafing effect. For interaction, students confirmed more teacher-student interaction in QA and more student-student interaction in GW. This difference was resulted from the design of activities – how the instructor intervenes in two activities. For social loafing effect, it violated students' contribution in GW and it facilitated loafers' learning in QA without influencing other students' contribution in QA.

7.3 Implications

7.3.1 Theoretical implication

Quality teaching in higher education

University teachers' perception of quality teaching was explored in this study. The result showed that practitioners' perception was consistent with the concepts of quality teaching proposed by educational researchers. Quality teaching as designing coherent knowledge, which was consistent with McKeachie (2007)'s idea of organising content in a meaningful way for learners construction connected with prior knowledge. Quality teaching as maintaining interaction with students, which was consistent with Garrison (1999)'s teaching presence in the Community of Inquiry framework. More evidences on the consistency was summarised in Table 8. Besides, there were also some perception of quality teaching discovered from practitioners' perspective such as delivering learning content using multimedia, teaching cutting-edge knowledge, preparing content for different levels of students, and assessment for screening students who have reached a certain level of understanding with those who have not.

Teaching beliefs and practice

Existing studies (Kember & Kwan, 2002; Olafsdottir, 2014) indicated large class teaching and promotion pressure were factors that cause the gap between teaching beliefs and practice. In this study, we found consistent evidences that university teachers had difficulty in achieving the teaching quality they expected due to the two factors mentioned above. Furthermore, we discovered plagiarism was the third factor resulted in the gap between teachers' perception of quality teaching and the actual quality in practice. Besides, there were also some inconsistencies between research findings of this study and previous studies. Samuelowicz & Bain (1992) divided the conception of teaching by the study level: for undergraduate students, it was transmission of knowledge and changing students' conceptions; for postgraduate students, it was supporting student learning. In this study, the majority of participants declared that their perception of quality teaching did not change due to the study level, and the common perception was students' deep understanding of the learning subject.

Social loafing as legitimate peripheral participation

Existing literatures indicated social loafing had a negative effect on collaborative learning (McCorkle et al., 1999; McBroom & Reed, 1994; Hansen, 2006; Shimazoe & Aldrich, 2010). In this study, we got consistent evidences from the survey about students' learning experience in GW. Besides, unexpectedly, we also found social loafing might have a positive effect on learning based on the analysis of forum logs in QA and factors that contribute to students' final exam score. Possible explanations on the positive effect were: firstly, contributors of the forum discussion did not affect by loafers because they developed their understanding of the learning subject in the process of their contributions. Secondly, though the loafers did not contributed to the learning community, but they improved their understanding of the learning subject by reading the posts. Therefore, the behaviour of loafing can be interpreted as legitimate peripheral participation in the learning community based on the theory of Community of Practice (Lave & Wenger, 1991).

7.3.2 Policy implication

Quality teaching in higher education: training and support

In Stage 2, we explored the situation of teaching large classes in two universities; one was an Italian one (Case A), and the other was a British one (Case B). It showed that teachers' strategies of teaching large classes were much influenced by the resources provided by the institutions. Teachers from Case B, who got professional training and pedagogical support from the teaching excellence unit, used strategies emphasised on teacher-student interaction and student-student interaction. Besides, they were more motivated to do research on teaching and learning for the institution provided funds targeted innovative teaching. Teachers from Case A, who did not have professional training and worked along in teaching large classes without any support, used strategies mainly emphasised on student-content interaction. Therefore, it is crucial for institutions to aware the importance of pedagogic guidance and resources provision to quality teaching practice.

Recognition of teaching in academic promotion

Promotion pressure was a factor that results in the gap between teachers' perception of quality teaching and the actual quality in teaching practice, which found in both this study and previous studies (Kember & Kwan, 2002; Olafsdottir, 2014). Under the pressure of promoting their academic career, the improvement of teaching quality is usually not the priority for university teachers' work. They tend to spend more time on applying for grants, conducting research, and writing papers, for these activities are directly connected to the promotion. Therefore, to encourage teachers paying more attention to the teaching quality, it requires more recognition of teaching in the evaluation system for academic promotion from the policy level.

7.4 Limitations

In this study, there are several limitations in terms of sampling, data collection, and data analysis. For the limitation of sampling, we used convenience sampling and snow sampling to recruit university teachers in the inquiry of Stage 1. Besides, the sampling size in Stage 2 was only ten,

which was not ideal for a multiple case study as each case was composed of only five participants. For the limitation of data collection, in-depth interview was the main instrument used for collecting data in both Stage 1 and Stage 2. Though supplemental data were also collected from classroom observation and the online course, these data sources were limited as they came from few participants in this study. For data analysis, we did not include the contents of forum posts because they were subject-specific questions and answers that required expertise in that field, and we were not qualified to evaluate them in order to present students' understanding level. Last but not least, though one of the two CSCL activities was a significant predictor to students' academic performance based on the mixed model analysis, we were not able to conclude that traditional lecturing blended with CSCL activities achieved a significant quality improvement compared to mere traditional lecturing. Firstly, the difference on students' academic performance between experiment group and control group were not statistically significant. Secondly, the attendance of traditional lecturing was optional to students and there was not an attendance sheet for recording students' participation, thus, we did not include the lectures attendance in the mixed model.

7.5 Recommendations for future work

There are two directions for future work. The first one is learning design for efficient collaboration. In this study, we found the different effects of CSCL on learning were influenced by the activity design, thus, it is important to assure the quality of activity design for a quality collaboration among learners. We will explore the essential elements for guiding teachers to design efficient collaborative learning activities, with the aim to maximise the benefits of collaborative learning and to minimise the negative impacts of collaboration on students' learning. The second one is computer-assisted forum analysis. Online learning community helps to deepen students' understanding of the learning subject through discussions and academic debate, and it provides an opportunity for teachers to track students' learning progress and to give feedback in the learning process. In general, teachers have to read the posts and then provide feedback or comments

manually. This type of instructor intervention in the online forum might result in an unmanageable workload for teachers in the large class setting, especially when the number of active participants is large. Thus, it is crucial to embed technologies such as natural language processing or machine learning for analysing the forum posts automatically and generating a concentrated version of posts, which will save teachers' time and facilitate teachers to provide more feedback to students.

Development and initial evaluation of Designing Effective Collaboration Among Students (DECAS)

Introduction

Designing Effective Collaboration Among Students (DECAS) is a self-assessment tool for teachers to reflect on their own knowledge about how to design collaborative activities. The motivation to develop DECAS is in this study, we understand the design of activities much influence the impact of collaborative activities in students' learning. Putting students in groups does not guarantee a true collaboration among students themselves. Only a well-designed collaborative activity might facilitate an efficient collaboration among students and minimise negative issues in collaboration that violate learning effectiveness when students working in groups.

What does DECAS include?

DECAS is composed of two parts (Appendix G). The first part is six essential elements for designing effective collaborative activities including learning outcome, collaborative activities, roles of participants, cultivation, intervention, and assessment. Teachers could assess their own knowledge on these elements according to four levels of understanding including naive, novice, apprentice, and master understanding (Mansilla & Gardner, 1998). The second part is three types of resources on each essential element that aims to improve teachers' skills based on self-assessment result of their understanding level. Online useful resources target teachers with naive understanding, which motivate them to design a collaborative activity in practice. Scientific papers and reports target teachers with novice understanding, which facilitate them to enhance their

design skills through reading others' reflections in designing and implementing collaborative tasks. Monographs target teachers with apprentice understanding, which allow them to compare their own structured knowledge with others and help them in achieving the master understanding.

The core of DECAS: six essential elements

The core of DECAS is the first part – six essential elements - that teachers need to consider for developing effective collaborative activities. These elements were developed based on the existing literatures related to collaborative learning and research findings and field experiences of this three-stage study. The first element is learning outcome. Biggs & Tang (2011) argued that the design of learning activities and assessment should directly address the intended learning outcome. Therefore, teachers need to think the intended learning outcome they would like their students to achieve through collaborative learning. A well-written learning outcome not only helps teachers to select an appropriate activity but also motivates students to participate. The second element is collaborative activities. After defining the learning outcome, it is important to select a proper collaborative activity (role-playing[56], dyads[57], jigsaw[58], debate[59]) and adjust/redesign it according to the teaching context such as the number of learners, the physical/virtual place for learning, learners' background (language proficiency, culture), supporting team (personal tutors or teaching assistants), etc. The third element is roles of participants. To assure all the members participate actively in the collaboration, an efficient way is to create positive interdependence among members. One type of the positive interdependence is by defining roles in the collaboration. Each member takes a certain responsibility of the group work such as summariser, elaborator, and encourager of participation (Ghislandi, 2012; Johnson & Johnson, 2012). It might help to avoid social loafing and status sensitivity. The fourth element is cultivation. In the theory of Community

[56] It refers to the playing of roles generally in an educational setting (Yardley-Matwiejczuk, 1997).
[57] In general, it refers to students work in a group of two (Roschelle & Teasley, 1995).
[58] It is a method of organising classroom activity that makes students dependent on each other to succeed. It breaks classes into groups and breaks assignments into pieces that the group assembles to complete the (jigsaw) puzzle (Perkins et al., 2001).
[59] Debate is a good way to develop students' critical thinking skills (van Amelsvoort, 2006).

of Practice, it takes time for participants to develop a sense of belonging to a group (Wenger et al., 2002). Thus, it is crucial to embed team-building strategies such as making a group name as an identity belonging, or designing warm-up activities such as making a short video to introduce all the members (Paolino & Ghislandi, 2007) before the designed collaborative activity. The fifth element is intervention. In the constructionism learning theory, the role of teachers is the facilitator in the learning process. Furthermore, as students might invest time and effort to organise group work, the intervention of teachers will guide them to collaborative with each other more effectively. It is crucial for teachers to think about both the time (ex ante, in itinere, ex post) and the approach (cognitive scaffolding i.e. critical feedback on the learning subject; management approach i.e. opening post or closing remark; technical support such as providing brief introduction on a software that students are not familiar with) of the intervention. The last element is assessment. The way of assessing influenced much on the learning approach adopted by students (Entwistle, 1988; Ramsden, 1992; Scouller & Prosser, 1994). Thus, teachers need to choose appropriate assessment methods in terms of time (formative, summative) and evaluators (instructor, peer) based on the expected learning outcomes and collaborative activities.

Initial evaluation of DECAS

Due to the limitation of time and resources, we do not validate DECAS by implementing it in daily teaching practice as some study did (Ghislandi & Cumer, 2012). We conducted an initial evaluation to understand if there are missed essential elements for designing effective collaborative activities in DECAS, and if teachers are interested to adopt it in practice. To implement the evaluation, we designed a short survey composed of the participants' demographic information and questions for evaluating DECAS (Appendix H). Ten teachers participated in the initial evaluation of DECAS. Table 31 presents participants' general information. Among ten participants, six of them were interested in adopting DECAS in designing collaborative activities, and there were four participants, who proposed new elements or supportive ideas for existing elements in DECAS.

Table 31 DECAS: characteristics of participants

No.	Discipline	Country	Year of teaching experience
T1	Education	UK	22
T2	Business technology	Canada	8
T3	Surgery	Kenya	19
T4	Engineering graphical design	Spain	19
T5	Media	UK	9
T6	Psychology	UK	49
T7	Education	UK	20
T8	Engineering	Portugal	37
T9	Psychology/Education	Mexico	6
T10	Philosophy of science/Psychology	Italy	14

Table 32 presents participants' impression of DECAS, which quoted directly from their comments, and categorised into two types: affirmative and constructive. Affirmative comments showed participants' positive attitude towards DECAS. Constructive comments indicated possible improvements on DECAS including restructuring a concise and interactive DECAS for teachers' self-reflection (T1, T9), and providing practical suggestions on selecting specific collaborative activities based on the expected learning outcome and the context (T8, T10).

Table 32 Impressions of DECAS

Affirmative comments
T1: I think this is a well-structured framework for thinking about designing collaborative tasks for large class teaching. It is well thought through, well explained and offers both overview information and a range of follow-up material. It is evidently based on strong academic thinking about pedagogy. The overview information for each element is concise and yet offers sufficient exemplification and further links through footnotes to remain accessible but also offer clarification. The sourcing of open educational resources and the DECAS' own creative commons licencing will maximise both the audience and the use of the materials by this audience.
T2: It should be required for every course that is to be thought of as transformational for students
T3: Impressive
T4: Quite positive as a tool to design the frame in collaborating educational tasks.
T5: It looks as if it has potential. However, empirical evidences would be needed in order for me to integrate it into my own teaching practice.
T6: Well thought-out, with an excellent and useful list of supplementary resources
T7: It addresses a very important topic for teachers and students. It is particularly difficult for teachers to promote and assess collaboration among students. It is relevant for students since working in a team and group work are skills that conflict with competition in academic environments. The levels adopted for understanding of teachers are original and represent reality. The issues of identification of teacher´s knowledge are appropriate.
T9: Part 2 is very useful. I wish there were links for all of the resources mentioned.
Constructive comments

T1: I wondered what readers would make of the interactive nature of the DECAS form in terms of how they should engage with the questions and why they would? I assume this is to offer a chance for self-reflection and evaluation and that you are expecting open-ended, qualitative responses. These comments may well be valuable in themselves. Some clearer information about this in the introduction would be useful - suggesting that readers categorise themselves into one of the four categories - and some linking text between parts 1 and 2 might be useful to explain how to use these comments in planning what to read and access next. Another option is to suggest a self-ranking (numerically) to be able to review the patterns and therefore needs more readily. This could link in with the four categories of teacher knowledge. The four levels of knowledge could be described more clearly. I appreciate they have been taken from an academic publication but they could be interpreted for a practitioner into more accessible language.

T8: The only suggestion I have is to include indicators that will help structure and identify the appropriate answers to the questions made.

T9: Lots of text... My first impression was questioning: Is it even worth reading? I think a different layout could help. Less text, more figures or tables. Also, for part 1, my self-assessment, what if I think I am a master, but I am not?

T10: Not bad but kind of vague ... For example it would be useful to relate specific types of collaborative activities with specific learning outcomes and maybe with suggestions about which topic might need which activity. For example - if you study law, you need to learn a lot on contents and for leaning you need (at least also) a lot of time alone on your books. However, it might be very useful to have group work for argumentation (learning how to use the law you studied in practice for making your point) or you might have a group-work for correcting memorization/understanding/interpretation of the law.

Table 33 presents participants' proposed new elements of DECAS based on their opinions and teaching experience. The first suggestion was to define the nature of collaboration by differentiate group work and team work, which will influence the selection of collaborative activities and roles of participants. The second suggestion was to consider learning profile such as students' prior learning, student engagement, learning approach in the design. The last suggestion was to think the learning framework in the design for being aware of how learning is being defined.

Table 33 Proposed new elements of DECAS

Group work vs. team work	T1: One thing, which could be included in the discussion of collaborative activities and also roles of participants is the difference between group work and team work. In the latter, there is an explicit understanding that the collective team can achieve something individuals couldn't and is often associated with either skills mapping and/or specialised roles being undertaken by individual team members.
Learning profile	T4: The context and the profile of the students. We have to consider those questions in the context of developing the task and even the groups T7: The students' prior learning, planning for differentiation, student engagement in the learning, reflecting on how the students learn.
Framework	T9: It all depends on the framework you want to use. I use an interaction-based approach. It might be the same, but the way of conceptualising it is different from collaboration. Neither approach is wrong. It is just different.

Based on the result of initial evaluation of DECAS, we had the following reflections. Firstly, it is important to figure out the connections among each essential element of DECAS rather than

listing them separately. Secondly, there might be a discrepancy between the real level of knowledge achieved by teachers and the assumed level of knowledge that teachers thought. Thirdly, specific indicators of each essential element are required for teachers to measure their knowledge level objectively. To improve DECAS, there are several issues for the future work. Firstly, figuring out indicators of each essential element, which will the prerequisite for detecting the connections among essential elements. Secondly, it is important to review and analyse collaborative patterns (i.e. dyads, jigsaw, etc.) in the existing literatures from the essential elements' point of view. Thirdly, constructing a pedagogical pattern selector, which will automatically recommend a design of collaborative activity based on teachers' decisions on the essential elements. Fourthly, collecting and organising supplemental materials based on the indicators of each essential element, which will provided more tailored guidance for teachers to improve their knowledge of collaborative learning. Last but not least, establishing a community for teachers to exchange their experience about designing and implementing collaborative learning, and to improve continuously their skills in practice.

The current DECAS was only a paper version while the DECAS 2.0 will be an interactive online tool composed of three parts. The first part, focusing on implementing collaborative activity in practice, is a pedagogical pattern selector that guides teachers to select a proper collaborative actively. The second part, focusing on enhancing knowledge of designing collaborative learning, is a self-assessment rubric that provided tailored materials based on the result of teachers' self-assessment. The third part, focusing on cultivating a community of practice on collaboration design, is an open space for discussing both the problems they faced and the strategies they used in implementing collaborative learning. In sum, we hope DECAS 2.0 will become a handy tool to support teachers in designing and implementing effective collaborative learning in practice.

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Yin, R. K. (2008). Case study research: design and methods (4th ed.). Thousand Oaks, CA: Sage
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Appendixes

Appendix A: Financial support on pedagogic research in Case B

Note: This fund information was collected from the official website of Case B, which provided an evidence that this institution facilitate quality teaching by providing financial support on pedagogic research. To preserve the anonymity of cases in the research project, we does not provide the website link.

Teaching Enhancement Project Fund

The University's Student Experience Enhancement Group (SEEG) provides funding for teaching enhancement activities.
Stream A will provide funding of up to £15,000 per project to encourage pedagogic research on strategic developments in learning and teaching.
Stream A: Encouraging pedagogic research on strategic developments
Applications for Stream A funding are invited for projects which involve the application and development of pedagogical theory and practice and/or address strategic themes identified by the Student Experience Enhancement Group (SEEG). These are currently:

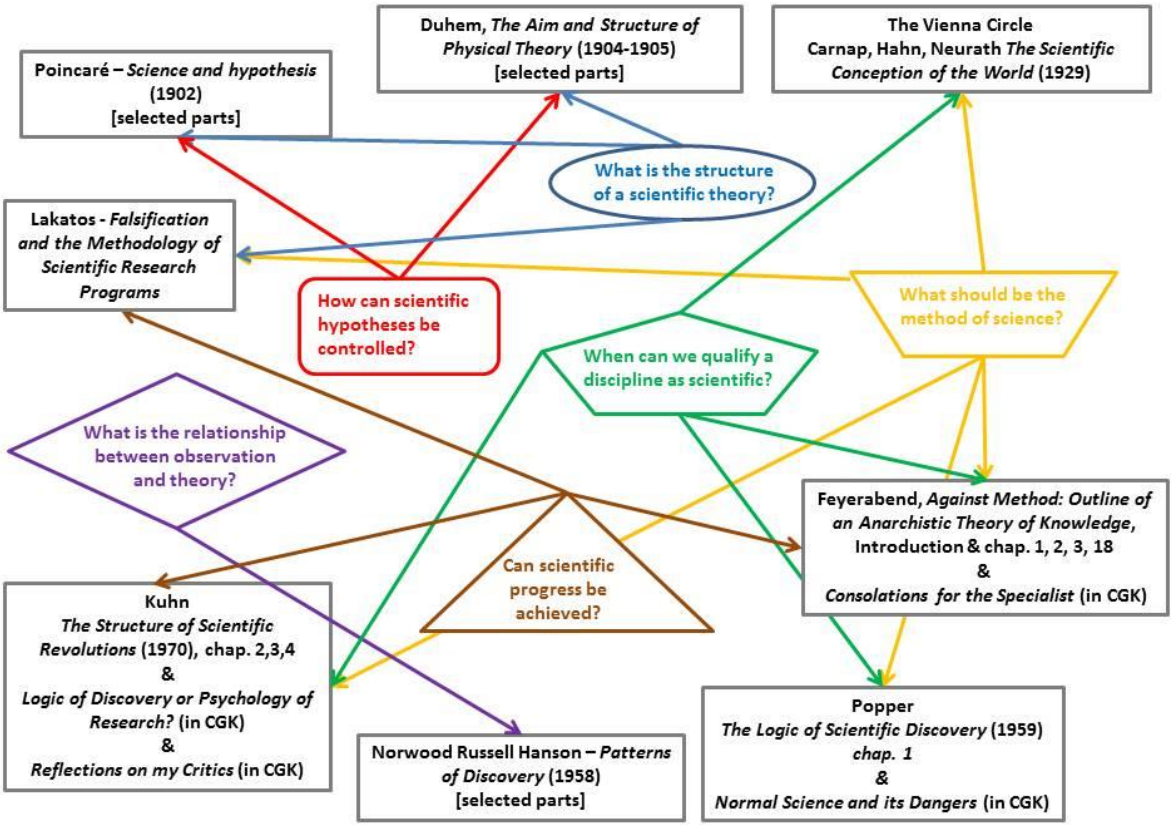
- Assessment and feedback
- Information, advice and guidance to students
- Lecture capture systems
- Peer Mentoring
- Student Employability
- Students and staff working in partnership

Stream B will provide amounts of between £2,000 and £3,000 for projects, which develop new activities and strategies for learning, teaching and assessment within a department or college
Stream B: Supporting new learning, teaching and assessment activities
Stream B funding will provide opportunities for 'pump-priming' or developmental activities which enhance learning, teaching and assessment and support the University's Learning and Teaching Strategy. These initiatives can address themes local to a department or college and focus on a specific aspect, which leads to concrete and practical outcomes. Projects could include:

- Innovation in teaching and assessment practice
- Developing new and innovative teaching and learning resources
- Developing students' learning or transferable skills;
- Engaging in small scale research and evaluation projects relating to curriculum development;
- Developing new and innovative teaching and learning resources to support Education for Sustainable Development (ESD)

Appendix B: Topics and learning materials for activity 2

Note: This diagram presents the topics (coloured geometric figures) and the learning materials (black rectangles) used in CSCL activity 2. The arrows show which author/text was linked to which question that students should work on. (Text indicated with CGK are chapters of the famous Criticism and the Growth of Knowledge: Proceedings of the International Colloquium in the Philosophy of Science (edited by Musgrave and Lakatos, London, 1965, Vol. 4).



Appendix C: Guideline for peer assessment in activity 2

Note: This guideline was written by the instructor Prof. Sara Dellantonio to guide both students' blind peer assessment and her review on students' written report.

1. The text is well written? Syntax, grammar and spelling correct? The style is fluid?
2. The text is formulated in a clear manner? Do you understand the contents?
3. Do you think that this work will be useful to understand the related questions? Would you recommend it to your peer who did not understand the issues addressed in this work?
4. Is the topic covered in sufficient depth or is only analysed superficially? Are there specific aspects that needed further study?
5. Other aspects? Is there anything further that you would like to mention in the review based on your writing competence?

Appendix D: Survey of the stage-3 inquiry

The survey for learning experience in PoS 2014

Dear participants,
Thank you very much for participating in this survey on the course *Philosophy of Science* 2014. This survey aims to understand your learning experience on the two collaborative activities designed in the course: Domande sul corso and Lavori di gruppo. Though it will only take you probably less than five minutes to finish the survey, your valuable input will be very helpful to improve the design for providing a better learning experience next year. To protect all the participants, we keep the survey anonymous.

Thank you again for your participation.

Section A: Participants' information:

1. Gender (M/F):
2. Year of enrollment at university (e.g. 2010/2011):
3. The number of exams has been done:
4. Is the first time to the exam? ( )
   a. Yes, it is the first time
   b. No, I have done once
   c. No, I have done twice
   d. No, I have done more than twice

For those students who attend the lessons:

Section B: Course's information
Multiple choices question: please find the following features to describe this course: ( )

a. Introductory course with large amount of information
b. The concepts need to be learnt are abstract and hard to understand
c. Limited interaction with the teacher in the classroom

5. One choice question: which part of this course do you like the most?( )
   a. The lectures
   b. Domande sul corso
   c. Lavori di gruppo

Section C: Learning Experience
Please read the following statements and fill *Y* if you agree and *N* if you do not agree based on your learning experience. In case you did not participate in the "Domande sul corso" or "Lavori di gruppo", please fill *0* instead.

	Domande sul corso	Lavori di gruppo
7. It provides a place to interact with the teacher beyond the classroom		
8. It provides a place to interact with peers beyond the classroom		
9. It provides extra valuable materials (e.g. questions, answers, papers) to improve my understanding on the subject		
10. I get helpful feedback from peers		
11. I get helpful feedback from the teacher		
12. It helps to improve my skill of formulating my ideas and discussing with others		
13. It helps me to think critically		

14.	It motivates me to learn actively		
15.	I am able to learn something according to my interest		
16.	It helps me to understand key concepts in the course		
17.	It helps me to build links among concepts in the course		
18.	It wastes my time to explain to others		
19.	Some members in my group do not contribute to the group work		
20.	We invest a lot of time to coordinate the group administratively rather than co-creating the group product		
21.	I learn more effectively when alone compared to learn in the group		

Section D: Open Space
Please feel free to write down anything you would like us to know about your experience in this course (it could be your experience in the classroom, in the forum, in the group work, etc.)

For those students who register to the course without attending the lessons:
During preparing the exam, which is your situation?

a. I only use the uploaded handouts and materials to prepare.
b. I also read the contents of the forum "Social Network" to prepare.
c. I also read the contents of the forum "Domande sul corso" to prepare.
d. I read both the forum "Social Network" and "Domande sul corso" with the uploaded handouts and materials.

If the forum "Domande sul corso" opens during the last phase of preparation for the exam, would you like to attend?

a. Yes
b. No

Do you think it will be useful to post questions?

a. Yes
b. No

Note: Here is an English version of the survey, which format was adapted in this paper version. The original survey (Italian version) was conducted online by the following link http://goo.gl/t2KQ5j.

Appendix E: Activity design

Note: This activity was designed for one participant in this study after he indicated his willingness to use group work in large class teaching but he did not know how to organise due to the large number of students. This is an evidence that we would like to help our participants according to the Deontological dimension of the ethical framework.

Name of activity: collaborative reading
Objective of activity:
To help learners' understand the concept of (*defined by the teachers*) in the collaborative learning environment.

Summary of activities

Activities	Place	Time (max.)	Students involved	Teacher involved
A1: Explain the task	Classroom	15 min	√	√
A2: Assign students into groups	Classroom/Online	10/ 30 min	√	√
A3: Group reading	Online	60 min	√	
A4: Peers' interaction				
A5: Teacher's facilitation	Classroom	50 min	√	√
A6: Individual task	Online	60 min	√	
A7: Group task	Online	60 min	√	
A8: Peer's feedback	Online	30 min	√	
A9: Teacher's feedback	Classroom	60 min	√	√

Detailed Procedures:
A1: Explain to students that this is a collaborative reading task, which requires them to work in groups. They will be assessed based on this task (individual accountability and group output) and then disseminate the papers for the task online forum in ESS3

A2: Let them to select members for their own groups (4-5 person/group) or use other methods to group students

A3: After students read the paper, they could discuss in the groups.

A4: If they have any difficulty in understanding the paper or the task, they could write the questions in the forum to get help from other groups.

A5: If the problem has not solved, the teacher provides a time to explain in front of all the students in the classroom

A6: After the teachers' explanation, students are more confident to do their own task and they need to decide which task they do within their own group (the maximum of summary is 200):

> *Individual Task 1: Make a summary on the research question and research design (methodology, how to answer the research question) in the paper*
> *Individual Task 2: Make a summary on the literature review and original contribution in the paper*
> *Individual Task 3: Make a summary on the data collection and analysis (methods, procedures)*
> *Individual Task 4: Make a summary on the result and conclusion*

A7: After submit the individual task in the forum, they work together to complete the group task:

> *Grouu Task 1: Figure out one concept you learnt from the paper with explanation on what you have learnt at least three points*
> *Group Task 2: Provide three reasons to support your group' opinion on whether this paper is good/bad*

A8: After submit the group task in the forum; students are required to provide feedback on others' work with at least three comments.

A9: The teacher read all the posts submitted by students (both individual task and group task); then provide feedback on their learning activities in the classroom.

Appendix F: Informed consent forms in the study

Informed Consent Form

Online Collaboration for Deep Understanding in Large Class*

Research Purpose
To understand if online collaboration will help students to achieve deep understanding on the learning subject in the large class setting.
What you will do in this research
Participation in this study is voluntary, during the interview, you will be asked several questions regarding to the research topics. The interview will take approximately 30 minutes. With your permission, the interview will be recorded.
Confidentiality
Your responses to interview questions will be kept confidential and they will not be linked to you personally. Your name will not appear on any documents and your interview will be assigned a number (i.e. Interview #1) to assure anonymity.
Benefit
If you are interested in the research findings, the final report will be shared with you.
To Contact the Researcher
If you have questions, concerns or suggestions about this research, please contact: Nan Yang, Corso Bettini n31, Doctoral School of Psychological Sciences and Education, University of Trento, 38068, Rovereto (TN), +39 0464 808306, nan.yang@unitn.it. You may also contact the faculty member supervising this work: Patrizia Ghislandi, Professor, Corso Bettini n31, Department of Psychology and Cognitive Science, University of Trento, 38068, Rovereto (TN), +39 0464 808305, patrizia.ghislandi@unitn.it.
Agreement:
The nature and purpose of this research have been sufficiently explained and I agree to participate in this study. I understand that I am free to withdraw at any time.
Signature: _____ Date: _____
Participant Name: _____

*The current informed consent form is used in the intervention phase.

Informed Consent for Online Participants

Online Collaboration for Deep Understanding in Large Class

Research Purpose
To understand if online collaboration will help students to achieve deep understanding on the learning subject in the large class setting.
What you will do in this research
This research is in the collaboration with the course Philosophy of Science taught by prof. Sara Dellantonio in the Faculty of Cognitive Science at University of Trento, people who will participate in the online forum of the course are invited to join the research by allowing the researcher to collect the posts in the online forum for research purpose.
Confidentiality
Your posts in the online forum will not be linked to you personally. Your name will not appear on any documents, and your posts will be assigned a number (i.e. Posts #1) to assure anonymity.
Benefit
If you are interested in the research findings, the final report will be shared with you.
To Contact the Researcher
If you have questions, concerns or suggestions about this research, please contact: Nan Yang, Corso Bettini n31, Doctoral School of Psychological Sciences and Education, University of Trento, 38068, Rovereto (TN), +39 0464 808306, nan.yang@unitn.it. You may also contact the faculty member supervising this work: Patrizia Ghislandi, Professor, Corso Bettini n31, Department of Psychology and Cognitive Science, University of Trento, 38068, Rovereto (TN), +39 0464 808305, patrizia.ghislandi@unitn.it.
Agreement:
The nature and purpose of this research have been sufficiently explained and I agree to participate in this study. I understand that I am free to withdraw at any time.
Signature: _____ Date: _____
Participant Name: _____

Appendix G: A tool on how to design effective collaborative learning

Note: This is a paper version of DECAS, and it is a tool developed to help teachers with design of collaborative learning activities after this three-stage study.

Designing Effective Collaboration Among Students
Nan Yang
Nan.yang@unitn.it
Doctoral School of Psychological Sciences and Education,
University of Trento

Introduction

Designing Effective Collaboration Among Students (DECAS) is a self-assessment tool for teachers to reflect on their own knowledge about how to design collaborative activities, which supplemented with tailored resources to improve teachers' skills according to their levels of knowledge. DECAS is composed of two parts.

In Part 1, there are six essential elements (*learning outcome, collaborative activities, roles of participants, cultivation, intervention, and assessment*) for designing effective collaborative activities. Teachers could assess their own knowledge on these elements with the following four levels of understanding (Mansilla & Gardner, 1998):

A. Naive understanding: intuitive knowledge with little reflection on the ways of the expression and communication of knowledge
B. Novice understanding: rituals and mechanisms of knowledge with the ability of mechanistic expression and communication of knowledge
C. Apprentice understanding: models of thinking with the ability of flexible and appropriate expression and communication of knowledge
D. Master understanding: integrative and critical thinking with the ability of creative expression and communication of knowledge

In Part 2, there are three types of resources on each essential element to improve teachers' skills based on the self-assessment result of their understanding level. Online useful resources target teachers with naive understanding, which motivate them to design a collaborative activity in practice. Scientific papers and reports target teachers with novice understanding, which facilitate them to enhance their design skills through reading others' reflections in designing and implementing collaborative tasks. Monographs target teachers with apprentice understanding, which allow them to compare their own structured knowledge with others and help them in achieving the master understanding.

Part 1: Essential elements for designing a collaborative task:

1. *Learning outcome* is a set of clear statements that describe expected learning achievement. A well-written learning outcome helps teachers to select the appropriate teaching strategy target the intended learning outcome. It also helps learners to learn more effectively as they know what they will gain from a particular learning activity and where they will arrive by the end of learning.

What is your understanding on this topic? ( )

Note: In designing a collaborative task, learning outcome could be written according to the character of collaboration, e.g. "learners are able to distinguish between A and B by discussing with peers" or "learners are able to solve problem C by working in a group".

2. *Collaborative activities*. After defining the learning outcome, it is important to select a proper collaborative activity (role-playing[60], dyads[61], jigsaw[62], debate[63]) and adjust/redesign it according to the teaching context such as the number of learners, the physical/virtual place for learning, learners' background (language proficiency, culture), supporting team (personal tutors or teaching assistants), etc.

What is your understanding on this topic? ( )

Note: Different collaborative activities are targeted for different learning outcomes or different learning context such as role-playing is a good activity for a learning outcome that students are capable of distinguishing or identifying certain perspectives; Jigsaw is a good activity for a learning context where students need to learn large amount of materials efficiently.

3. *Roles of participants*. Collaborative learning means two or more learners working together. To assure all the members participate actively in the collaboration, an efficient way is to create positive interdependence among members. One type of the positive interdependence is by defining roles in the collaboration. Each member takes a certain responsibility of the group work such as summarizer, elaborator, and encourager of participation (Johnson & Johnson, 2012).

What is your understanding on this topic? ( )

Note: To ensure the individual accountability, usually there is only one member play a specific role. Otherwise, it is more likely to have social loafing effect (Mullen, Johnson & Salas, 1991). Besides, the number of group member should not be more than six in an efficient collaboration (Davis, 2009).

4. *Cultivation*. Putting students in groups does not guarantee a true collaboration. It takes time to develop a sense of belonging to a group, thus, it is crucial to embed team-building strategies such as making a group name as an identity belonging, or designing warm-up activities (such as making a short video to introduce all the members) before the designed collaborative activity.

What is your understanding level on this topic? ( )

Note: Two theories discussed the cultivation in collaboration. One is cooperative learning (Johnson & Johnson, 1990), and the other one is community of practice (Wenger, 1998). In cooperative learning, cultivation is a group processing strategy, in which group members reflect on helpful actions in the collaboration and decide what next-step actions for the group goal. In the theory of community of practice, there are several stages to develop a community with different level of energy and developmental tensions. The strategy of cultivation should adapt to the specific needs in different stages (Wenger, 2002).

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[60] It refers to the playing of roles generally in an educational setting (Yardley-Matwiejczuk, 1997).
[61] In general, it refers to students work in a group of two (Roschelle & Teasley, 1995).
[62] It is a method of organising classroom activity that makes students dependent on each other to succeed. It breaks classes into groups and breaks assignments into pieces that the group assembles to complete the (jigsaw) puzzle (Perkins et al., 2001).
[63] Debate is a good way to develop students' critical thinking skills (van Amelsvoort, 2006).

5. *Intervention.* Though the collaboration is among learners, the teacher still plays an indispensable role during the process of their group work. When designing the collaborative task, it is necessary to think about the time of intervention i.e. in the beginning, in the middle, in the end or the mix of different time. It is also and the approach (e.g. cognitive approach such as critical feedback on the learning subject or management approach such as opening post or closing remark or technical support such as providing brief introduction on a software that students are not familiar with) for the intervention.

   What is your understanding on this topic? ( )

   Note: Based on the paradigm of constructivist teaching, an important role for teachers is instructional scaffolding that means supporting learners cognitively to achieve the expected learning outcome (Sawyer, 2006). A content intervention is a scaffolding strategy in the collaborative learning. Besides, the design of other supports is a strategy to maintain a positive teacher-student relationship for student engagement (Klem & Connell, 2004).

6. *Assessment* plays a vital role in the learning process as the way of assessment influences strongly on the learning approach adopted by students (Entwistle, 1988; Ramsden, 1992; Scouller & Prosser, 1994). In a collaborative task, it is especially necessary to combine both the group assessment and individual assessment to avoid social loafing effect in the group work (Harkins & Szymanski, 1989; Piezon & Donaldson, 2005).

   What is your understanding on this topic? ( )

   Note: In a group work, you can design a multiple strategy of assessment by considering both the time for assessing (summative and formative) and the role of assessor (teacher and peer) according to the expected learning outcome and the learning context.

Part 2: Supplemental resources

Materials for naive understanding (web sources)

Learning Outcome

1. Developing & writing course-level student learning outcomes. University of Rhode Island.
2. Writing learning outcomes: some suggestions. Oxford Brookes University
3. Tips on Writing Learning Outcomes. University of Illinois at Urbana-Champaign

Collaborative activities

1. Collaborative activities. Center for Teaching & Learning Excellence, University of Utah
2. Collaborative learning activities. The Teaching Commons.
3. Building Dynamic Groups. The Ohio State University

Roles of Participants

1. Cooperative Group Role Cards
2. Student Roles. Starting Point - Teaching Entry Level Geoscience.
3. Roles and Responsibilities for Group Members. Center for Teaching & Learning. Humber College.

Cultivation

1. Group Processing. Starting Point - Teaching Entry Level Geoscience.
2. The Nature of Group Processing. Integrating New Technologies Into the Methods of Education

3. Building Teamwork Process Skills in Students. Center for Teaching and Learning, University of California, Berkeley.

Intervention

1. How can I monitor groups?. Eberly Center – Teaching Excellence & Educational Innovation, University of Carnegie Mellon
2. Facilitating and Monitoring Group Work. Support for Teaching, University of New South Wales, Australia
3. Implementing group work in the classroom. Centre for Teaching Excellence, University of Waterloo

Assessment

1. How can I assess group work? Eberly Center – Teaching Excellence & Educational Innovation, University of Carnegie Mellon
2. Methods for assessing group work. Centre for Teaching Excellence, University of Waterloo
3. Assessing group work. Teaching and Learning Development Unit, University of Sussex

Materials for novice understanding (scientific articles or report)

Learning Outcome

1. Kennedy, D., Hyland, A., & Ryan, N. (2007). Writing and using learning outcomes. *A Practical Guide.*
2. Brian Bowe & Marian Fitzmaurice. (n.d.) Guide to writing learning outcomes. (2nd edition). Dublin Institute of Technology.
3. Osters, S., & Tiu, F. S. (2008). Writing Measurable Learning Outcomes. In 3rd Annual Texas A&M Assessment Conf.

Collaborative activities

1. Cohen, E. G., Lotan, R. A., Scarloss, B. A., & Arellano, A. R. (1999). Complex instruction: Equity in cooperative learning classrooms. *Theory into practice*, *38*(2), 80-86
2. Sharan, Y., & Sharan, S. (1990). Group investigation expands cooperative learning. *Educational leadership*, *47*(4), 17-21
3. David W. Johnson, Roger T. Johnson, and Dean Tjosvold. "Constructive Controversy: The Value of Intellectual Opposition." Morton Deutsch and Peter T. Coleman, eds. *The Handbook of Conflict Resolution: Theory and Practice* San Francisco: Jossey-Bas Publishers, 2000, pp. 65-85.

Role of Participants

1. Siciliano, J. I. (2001). How to incorporate cooperative learning principles in the classroom: It's more than just putting students in teams. *Journal of Management Education*, 25(1), 8-20.
2. Hernández-Leo, D, Villasclaras-Fernández, E. D., Asensio-Pérez, J. I, Dimitriadis, Y., Jorrín-Abellán, I. M., Ruiz-Requies, I., & Rubia-Avi, B. (2006). COLLAGE: A collaborative Learning Design editor based on patterns. *Educational Technology & Society*, 9(1), 58-71.
3. De Laat, M., & Lally, V. (2004). It's not so easy: Researching the complexity of emergent participant roles and awareness in asynchronous networked learning discussions. *Journal of Computer Assisted Learning*, 20(3), 165-171.

Cultivation

1. Michaelsen, L. K., & Sweet, M. (2008). The essential elements of team-based learning. *New directions for teaching and learning*, *2008*(116), 7-27.
2. Brewer, S., & Klein, J. D. (2006). Type of positive interdependence and affiliation motive in an asynchronous, collaborative learning environment. *Educational technology research and development*, 54(4), 331-354.
3. Ghaith, G. M., Shaaban, K. A., & Harkous, S. A. (2007). An investigation of the relationship between forms of positive interdependence, social support, and selected aspects of classroom climate. *System*, 35(2), 229-240.

Intervention

1. Webb, N. M., Franke, M. L., Ing, M., Chan, A., De, T., Freund, D., & Battey, D. (2007). The Role of Teacher Discourse in Effective Groupwork. Graduate School of Education & Information Studies, University of California, Los Angeles. Available online: https://www.cse.ucla.edu/products/reports/R726.pdf
2. Webb, N. M. (2009). The teacher's role in promoting collaborative dialogue in the classroom. *British Journal of Educational Psychology*, 79(1), 1-28.
3. MacQuarrie, S. (2013). Briefing and debriefing: Investigating the role of the teacher within group work science lessons. *International Journal of Educational Research*, 62, 87-99.

Assessment

1. Nicol, D. J., & Macfarlane-Dick, D. (2006). Formative assessment and self-regulated learning: a model and seven principles of good feedback practice. *Studies in higher education*, 31(2), 199-218.
2. Harlen, W., & James, M. (1997). Assessment and learning: differences and relationships between formative and summative assessment. *Assessment in Education*, 4(3), 365-379.
3. Topping, K. (1998). Peer assessment between students in colleges and universities. *Review of Educational Research*, 68(3), 249-276.

Materials for apprentice understanding (monographs)

Learning Outcome

1. Biggs, J. B., & Collis, K. F. (1982). Evaluating the quality of learning. New York: Academic Press.
2. Anderson, L. W., Krathwohl, D. R., Airasian, P. W., Cruikshank, K. A., Mayer, R. E., Pintrich, P. R., ... & Wittrock, M. C. (2001). A taxonomy for learning, teaching, and assessing: A revision of Bloom's taxonomy of educational objectives, abridged edition. White Plains, NY: Longman.
3. Biggs, J. (2003). Teaching for Quality Learning at University. Buckingham: Open University Press.

Collaborative activities

1. Palloff, R. M., & Pratt, K. (2010). Collaborating online: Learning together in community (Vol. 32). John Wiley & Sons.
2. Jaques, D., & Salmon, G. (2006). Learning in groups: A handbook for face-to-face and online environments. Routledge
3. Wenger, E. (1998). Communities of practice: Learning, meaning, and identity. Cambridge University Press.

Roles of Participants

1. Barkley, E.F., Cross, K.P., & Major, C.H. (2005). Collaborative learning techniques. San Francisco: Jossey-Bass

2. Millis, B. J., and Cottell, P. G., Jr. (1998). Cooperative learning for higher education faculty. American Council on Education, Series on Higher Education. The Oryx Press, Phoenix, AZ.
3. Jolliffe, W. (2007). Cooperative learning in the classroom: Putting it into practice. Sage.

Cultivation

1. Sibley, J. & Ostafichuk, P. (2014). Getting Started with Team-Based Learning Sterling, VA: Stylus.
2. Wenger, E., McDermott, R. A., & Snyder, W. (2002). Cultivating communities of practice: A guide to managing knowledge. Boston: Harvard Business Press.
3. Cohen, E. G., & Lotan, R. A. (2014). Designing Groupwork: Strategies for the Heterogeneous Classroom Third Edition. Teachers College Press.

Intervention

1. Stronge, J. H. (2007). Qualities of effective teachers. Association for Supervision & Curriculum Development
2. Cowan, J. (2006). On Becoming An Innovative University Teacher: Reflection In Action: Reflection in Action. McGraw-Hill International.
3. Hay, I. (2011). Inspiring Academics: Learning With The World's Great University Teachers: Learning with the World's Great University Teachers. McGraw-Hill International.

Assessment

1. Gardner, J. N. (2012). Assessment and learning. Sage.
2. Naylor, S., Keogh, B., & Goldsworthy, A. (2004). Active Assessment: thinking, learning and assessment in science. David Fulton Publishers.
3. Blanchard, J. (2009). Teaching, learning and assessment. McGraw-Hill International.

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Entwistle, N., & Waterston, S. (1988). Approaches to studying and levels of processing in university students. *British Journal of Educational Psychology*,*58*(3), 258-265.

Harkins, S. G., & Szymanski, K. (1989). Social loafing and group evaluation. Journal of Personality and Social Psychology, 56(6), 934.

Johnson, D. W., Johnson, R. T., Stanne, M. B., & Garibaldi, A. (1990). Impact of group processing on achievement in cooperative groups. The Journal of Social Psychology, 130(4), 507-516.

Johnson, D. W., & Johnson, F. P. (2012). Joining together: Group theory and group skills. Pearson.

Klem, A. M., & Connell, J. P. (2004). Relationships matter: Linking teacher support to student engagement and achievement. Journal of school health, 74(7), 262-273.

Mansilla, V. B., & Gardner, H. (1998). What are the qualities of understanding?. *Teaching for understanding: Linking research with practice. San Francisco, CA: Jossey-Bass Publishers*, 161-196.

Mullen, B., Johnson, C., & Salas, E. (1991). Productivity loss in brainstorming groups: A meta-analytic integration. Basic and applied social psychology, 12(1), 3-23.

Piezon, S. L., & Donaldson, R. L. (2005). Online groups and social loafing: Understanding student-group interactions. Online Journal of Distance Learning Administration, 8(4).

Perkins, D. V., & Saris, R. N. (2001). A" jigsaw classroom" technique for undergraduate statistics courses. Teaching of psychology, 28(2), 111-113.

Ramsden, P. (1992). Learning to Teach in Higher Education, Routledge.

Sawyer, R. Keith. (2006). The Cambridge Handbook of the Learning Sciences. New York: Cambridge University Press.

Roschelle, J., & Teasley, S. D. (1995, January). The construction of shared knowledge in collaborative problem solving. In Computer supported collaborative learning (pp. 69-97). Springer Berlin Heidelberg.
Scouller, K. M., & Prosser, M. (1994). Students' experiences in studying for multiple choice question examinations. *Studies in Higher Education*, *19*(3), 267-279.
Van Amelsvoort, M. A. A. (2006). A space for debate. How diagrams support collaborative argumentation-based learning (Doctoral dissertation).
Retrieved [14/10/2014] from: http://dspace.library.uu.nl/handle/1874/13355
Wenger, E. (1998). Communities of practice: learning, meaning, and identity. Cambridge: Cambridge University Press.
Wenger, E., McDermott, R., and Snyder W. (2002). Cultivating communities of practice: A guide to managing knowledge. Boston, MA: Harvard Business School Publishing.
Yardley-Matwiejczuk, K. M. (1997). Role-playing: theory and practice. Sage.

Appendix H: Survey of DECAS

Note: Here attach the contents of the online survey to invite university teachers for evaluating DECAS.

DECAS (Designing Effective Collaboration Among Students) is a self-assessment tool for teachers to reflect on how to design activities for effective collaborative learning.

Note: The personal information about participants (name and email) will be used for potentially further contact only, and it will not be published as data in any research project.

Part 1: General information

1. Name, Surname:

2. Year of teaching experience:

3. Discipline:

4. Name of Institution:

5. Email:

Part 2: Evaluation of DECAS

1. What is your impression about DECAS version 1.0?

2. Are you interested in adopting DECAS when you design collaborative tasks? Yes/No

3. Based on your opinions and experience, are there other important elements for designing collaborative tasks that are missed in this tool? Yes/No (If yes, could you please list the elements and explain the reasons?)

Appendix I: a summary of this three-stage study

	Stage 1: open exploration	Stage 2: focused exploration	Stage 3: intervention
Research purpose	To explore the impact of eLearning for quality teaching in higher education	To explore the situation of university teachers' adoption of Computer-Supported Collaborative Learning (CSCL) for quality teaching in large classes	To implement CSCL in an authentic educational context in which the impact of CSCL on quality teaching in large classes is examined
Research questions	1 Main question: What is the impact of eLearning on quality teaching in higher education? Sub questions: 1.1 What is university teachers' perception of quality teaching? 1.2 What problems do university teachers face in quality teaching? 1.3 What strategies do university teachers use for quality teaching in practice, and how do they use them?	2 Main question: Do university teachers use CSCL for quality teaching in large classes? Sub questions: 2.1 From the university teachers' perception of quality teaching, does the class size matter? 2.2 If university teachers use CSCL in large class teaching, how do they use it? 2.3 If university teachers do not use CSCL in large class teaching, what strategies do university teachers use for quality teaching in large classes?	3 Main question: What are the impacts of CSCL on quality teaching in large classes? Sub questions: 3.1 Does CSCL help to achieve quality teaching in large classes? 3.2 Does the traditional lecturing blended with CSCL achieve higher quality compared to mere traditional lecturing in large classes? 3.3 Does different forms of CSCL have different effect on quality teaching in large classes?

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Methodology	Case study	Case study	Design-based research
Instruments	In-depth interview	In-depth interview	Survey, in-depth interview, designed experiment
Participants	17 university teachers Disciplines: Philosophy (1), Psychology (1), Cognitive Science (2), Computer Science (1), Education (1), Media and Communication (2), English Education (1), Medicine (1), Economics (2), Marketing (1), Statistics (1), Accounting (1), Agroforestry (1), and Structure Engineering (1) Countries: Italy (5), UK (7), China (5) Educational context: traditional university (12), open university (5) Teaching approach : traditional face-to-face teaching (5), blended teaching (6), distance teaching (8)	10 university teachers: Disciplines: Psychology (3), Philosophy (1), Education (3), Geography (1), Media and Communication (1), and Linguistics (1) Countries: Italy (5), UK (5) Case A: 5 teachers from a traditional university in Italy Case B: 5 teachers from a traditional university in UK Sampling criteria : 1. 5+ years of teaching experience in HE 2. Teach classes with 50+ students	Two CSCL activities were implemented in Philosophy of Science (an undergraduate course) in 2013/2014 academic year Activity 1 (informal collaboration): There is an online forum for students to discuss the topics in the course. The instructor will evaluate the questions and answers in every topic posted. Participants: 220 students Activity 2 (formal collaboration): The instructor assign a philosopher with relevant learning materials to every self-selected group for writing a short paper about this philosopher's idea on the specific topics. After finish the report, every group will receive a short paper written by their peers to make a blind assessment. Finally, the instructor will evaluate all the short papers and send the feedbacks to all the groups. Participants: 52 students (20 groups)

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Research findings	1. University teachers' perception of quality teaching was complex, which includes five aspects: content design, teaching and learning process, assessment, learning outcome, and reflective practice. The most common perception of quality teaching was students' deep understanding of the learning subject. 2. There were three main problems on quality teaching faced by university teachers: plagiarism, large class, and promotion pressure. Large class teaching was the most common problem. Teachers who already achieved quality teaching in small classes with both eLearning and non-eLearning strategies still faced quality challenges in the large class setting. 3. The impact of eLearning on quality teaching depended on the educational context. For distance education, eLearning was a must. For teachers who teach students face-to-face, eLearning was a supplementary option. The impact of eLearning on teaching in traditional universities was limited.	1. University teachers confirmed the teaching quality in large classes was limited compared to small classes. This limitation was due to two issues: reduced interaction with students and the difficulty in checking students' understanding in the learning process. 2. CSCL was not widely adopted in practice. Among ten participants, only two adopted it. One was a professor in education, and she designed role-playing collaborative learning in the online forum. The other was a lecturer in media and communication, and she designed online tasks and let students to work in groups by themselves. 3. There were various non-eLearning and eLearning strategies adopted by those participants who did not adopt CSCL. However, most of these strategies did not target the two issues that result in the limited quality of large class teaching. The two cases had both similarities (traditional lecturing as the dominant method, perception of class size effect) and differences (institutional support, organisation of teaching) in large class teaching.	1. CSCL helped to achieve quality teaching in large classes by increasing teacher-student interaction, student-student interaction, and student-content interaction as well as enhancing students' motivation and engagement in learning. 2. The academic performance of students who participated CSCL activities achieved a higher level of understanding than those in the traditional-lecturing group measured by the final exam score with a non-significant statistical difference (T-test). The result of a linear mixed model, indicated CSCL activity 1 was a significant predictor to students' academic performance measured by the final exam. 3. The two CSCL activities were confirmed by students for the positive impact on getting feedback from the teachers and peers. The difference was activity 1 (online learning community for questions and answers) was more helpful to increase the teacher-student interaction while activity 2 (collaborative writing with blind peer assessment) was more helpful for critical thinking and the student-student interaction.

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Reflections for the further inquiry	1. Most of teachers in traditional universities in this inquiry had the possibility to teach students face-to-face, especially in small classes, teachers were able to introduce more interactive activities within the classroom. Thus, eLearning is not so necessary for quality teaching compared to distance education. 2. Quality teaching in large classes was emerged as the most common problem in this inquiry, which could be a research focus in the next stage. 3. One participant in this inquiry used online group work to add interactive activities that usually lacked in teaching large classes, Computer-Supported Collaborative Learning (CSCL) might be a specific eLearning strategy for quality teaching in large classes.	1. The majority of participants in this inquiry rejected CSCL in practice, and there were several reasons: 1) Already have face-to-face group work as a subsequent learning activity after traditional lecturing for quality teaching in large classes: 4 teachers in Case B 2) Never use any eLearning in large class teaching: 1 teacher in Case A 3) They had unsuccessful experience in using eLearning (online forums) for large class teaching: 2 teachers in Case A 4) Already achieve quality teaching in large classes: 1 teacher in Case B 2. Due to the fact of a very limited adoption of CSCL in practice, its impact on quality teaching in large classes was still not clear. It required the further inquiry to implement CSCL in an authentic learning context for understanding its impact.	The different forms of CSCL influenced students' learning differently. This difference was due to the design of two activities: Activity 1 required the instructor to intervene more frequently by evaluating both the questions and answers posted by students, which explained that more students (83%) confirmed the teacher-student interaction compared to activity 2 (52%). Activity 2 required students to work together with less intervention by the instructor in the process, which explained more students (90%) confirmed the student-student interaction compared to activity 1 (63%) Considering there were also negative impacts found in this inquiry (social loafing and process losses), it required the next inquiry to explore how to design effective collaboration among students for maximising the positive impacts and minimising the negative impacts.