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Training teacher-researchers through online collective academic supervision: Evidence from a postgraduate teacher education programme

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Abstract

Collective academic supervision (CAS) is a collective model for students' academic supervision to reduce their isolation and as a measure to establish a congenial culture and to develop networks with their peers. Most studies focus on the benefits of online CAS, leaving the pedagogical process and students' learning experiences understudied. This research examines the participation and learning experience of a cohort of Master of Education (MEd) students in online supervision that took place on a Moodle platform. This article reports a case study of Moodle-based CAS in Hong Kong that aims to train postgraduate students into teacher-researchers. A class of MEd students and their supervisors were observed, and their online dialogues were analysed. The bio-ecological student engagement model was used to explain the online supervision process. The results indicated that the students' learning was situated and embodied in the online social processes facilitated by peers' and supervisors' replies. The online interaction behaviours mainly included proposing questions or problems, providing information or solutions, and making comments. The findings have provided an exemplary case regarding the application of the online learning environment in supporting CAS and active research-based learning. The productive online CAS seems to benefit both teacher candidates and their supervisors by promoting the co-construction of the knowledge and skills of educational research, although more evidence is needed.

KEYWORDS
collective academic supervision, interaction analysis, online discussion groups, teacher education, teacher-researcher

1 | INTRODUCTION

Integrating research components into teacher education programme has become an international trend for educating reflective teacher-researchers and improving their teaching practices (OECD, 2005; Brew & Saunders, 2020). Academic supervision thus plays a critical role in fostering teacher candidates' research capability and contributes to their positive academic experience (Beaudin et al., 2016), successful degree completion (Beaudin et al., 2016), learning autonomy (Brew & Saunders, 2020), and professional competencies (Niemi & Nevgi, 2014). In particular, online collaborative learning community has proved to be a catalyst to promote academic supervision

(e.g., MacKeogh, 2006; Jaldemark & Lindberg, 2013). The existing studies, however, have mostly focused on supervising undergraduate (e.g., MacKeogh, 2006; Jaldemark & Lindberg, 2013) and doctoral (e.g., Wisker et al., 2007; Lundgren-Resenterra & Crosta, 2019) students, leaving the population of Master's students understudied. This study is thus dedicated to filling this research gap through examining computer-mediated academic supervision in the context of training early childhood professionals in a Master of Education (MEd) programme at a university in Hong Kong. It aims to find out in what ways and to what extent the new supervision model can actively engage the teacher candidates in the design of their degree research projects.

1.1 | Online collective academic supervision (CAS)

Collective academic supervision (CAS) is a collective model for students' academic supervision to reduce their isolation and as a measure to establish a congenial culture and to develop networks with their peers (Nordentoft et al., 2013). This model enables effective supervision and offers students systematic, progressive, and academic input from peers and supervisors that could encourage their thinking and writing process. On the one hand, it can enhance academic staff's supervision effectiveness by allowing them to supervise a class of students at a time. In particular, if the supervisors of a specific program use the same model for collective academic supervision, they can create a common reference point to share with other colleagues, from which supervision at universities can be evaluated, criticized and developed (Nordentoft et al., 2013). On the other hand, CAS could increase and qualify students' participation and academic learning by stimulating their motivation to study and to write academic assignments. Therefore, CAS is proved to be very useful for postgraduate research supervision (Nordentoft et al., 2013), which has faced many challenges, such as the decreasing supervisor-student ratio and the increasing pressure for timely completion and active supervision (McCallin & Nayar, 2012). CAS has been implemented to tackle these challenges (e.g., Wichmann-Hansen et al., 2015; Boud & Lee, 2005), as it encourages peer feedback in addition to supervisor's feedback (Wisker et al., 2007; Rushton et al., 2017) and aims to promote students' academic participation and research capacity (Fenge, 2012). Stracke (2010), for instance, set up peer group meetings in a doctoral programme, with the supervisor playing a moderator's role. Informal self-evaluation a semester later revealed that the learning community reduced the sense of isolation and enabled the students to experience postgraduate research as a journey undertaken together (Stracke, 2010).

Recently, online collective academic supervision is becoming very popular, as many open-source learning platforms have been developed and widely adopted (Brooks, 2018). For instance, MacKeogh (2006) reported an innovative approach to undergraduate research supervision that combined online, peer supervision and face-to-face meetings. Taking place on an open-source learning platform called Moodle (Moodle.org), a typical procedure of peer interaction was described as follows:

> Students post research outlines on Moodle, review outlines of other students, and prepare research proposals and literature reviews, taking into account both peer and supervisor feedback. They prepare a draft report and a PowerPoint presentation on their findings. (MacKeogh, 2006, p. 21)

The component of peer supervision extends the traditional supervisor–supervisee dyad to meet the supervisory and learning needs of a particular group (Rushton et al., 2017). MacKeogh's (2006) analysis of the peer interactions on Moodle showed that peer feedback covered topic selection, answering questions on statistics, advising on methods or references, and helping to find participants or distribute questionnaires. Similarly, Jaldemark and Lindberg (2013) examined the application of technology-mediated supervision of undergraduate students' dissertations. They found that novice researchers would benefit from participating in open and public dialogue in an online setting.

In fact, online academic supervision has transformed the traditional, individual supervisory relationship into a collective, participatory process that can capitalize on the strength of CAS. In particular, the CAS model emphasizes that students learn through participation and interaction, involving a learning model that is productive for collaborative learning (Nordentoft et al., 2013). Online CAS can potentially increase students' motivation and participation in academic learning and writing, as the online learning mode could prompt fellow students and supervisors to provide systematic, continual, and informed feedback on individual students' work (Nordentoft et al., 2013). Peers and supervisors as co-participants can thus be studied together to understand how the feedback process is played out in online interactions to facilitate or impede students' learning experience during online CAS.

Many studies have confirmed the benefits of online CAS. For instance, Wisker et al. (2007) studied online CAS as an interacting community of practice (Wenger, 1999). They developed an online supervisory support system that included noticeboard, discussion forum and resource area, and found that online communication systems could enhance learning processes and outcomes (Wisker et al., 2007). Augustsson and Jaldemark (2014) studied supervisors' computer-mediated comments on undergraduate students' dissertation drafts, which were open to fellow students on a learning management system (LMS) platform. They found that the supervisors' comments could be inductively categorized into different patterns, such as recommendation, development and problematising, to shed light on the supervision process. By contrast, Yeh et al. (2008) examined the content, process, and outcome of online peer supervision for training Master's students, using Stiles' (1978) taxonomy of verbal response mode (VRM) to categorize students' utterances[1] in their online messages into 16 categories (e.g., guidance, command, and confirmation) (Stiles, 1978; Chang et al., 2001). They found that online CAS facilitated students' confidence building and interaction (Yeh et al., 2008). Brooks (2018) argued that online supervision of Master's students could broaden the scope of supervisees' learning via

innovative methods of communication, evaluation, and access to resources. Rushton et al. (2017) further summarized the benefits of online CAS to include reduced isolation, increased reflection opportunities, stronger networks, and enhanced wellbeing. Although most studies mentioned above focused on the benefits of online CAS, some studies also mentioned the null effects or even adverse effects of educational technology. A recent random-effects meta-analysis showed that computer-supported collaborative learning has a non-significant influence on learning motivation (Radkowitsch et al., 2020). Similarly, Hu and Hui (2012) conducted an experiment involving 212 university students and found the relationship between technology-mediated learning and learning effectiveness or satisfaction was non-significant. As argued by Selwyn (2014), educational technology may be associated with the risk of reducing learning engagement. There is thus a need for research to better understand the connection between the pedagogical process and students' learning experiences in the computer-mediated collaborative space. To fill this research gap, our research examines the participation and learning experience of a cohort of MEd students in online supervision that took place on a Moodle platform.

1.2 | Teacher as researcher

There are two traditions in the evolution of teacher education in higher education institutions, namely, the Teacher as Researcher (TAR) and the Personal Practical Theory (PPT) (Puustinen et al., 2018). As the TAR paradigm emerged after the PPT paradigm and was aligned with the global trend of encouraging teachers in researching their practices since the 1950s (Richardson, 2001; Snoek & Moens, 2011), this more recent paradigm is regarded as the academisation of teacher education (Simola, 2015), with two distinctive features: (1) pursuing a full-scale academic degree in education at the undergraduate or master levels rather than a practice-oriented diploma or teaching certificate (Puustinen et al., 2018), and (2) participating in research-based learning course to be equipped with applied research skills (Brew & Saunders, 2020). TAR has become an international trend in teacher education (OECD, 2005), with one of the main requirements asking teacher candidates to conduct a research project and write a graduation dissertation in education (Kansanen, 2014).

It is found that teacher candidates have different attitudes toward engagement in research-based teacher education. Niemi and Nevgi (2014) found that teacher candidates valued research as an important component of teacher education and learned to apply research skills in solving professional problems. Dobber et al. (2012), however, reported that some teacher candidates failed to engage in the research processes, leading to less positive learning outcomes. Puustinen et al. (2018) investigated Finnish teacher candidates' attitude toward the system of research-based teacher education. They found that they had varying levels of appreciation, with some teacher candidates struggling to connect educational research with teaching practice. To promote teacher candidates' active learning in research processes, it is critical to get them involved in collaborative peer groups and learned to elaborate their research ideas before making decisions (Dobber et al., 2012). However, there is a lack of research on teacher candidates' engagement in research-based collaborative learning, especially in computer-mediated, asynchronous discussion groups and for those who are pursuing a Master's degree in education.

1.3 | Context of the study

To facilitate the analysis of online CAS in postgraduate teacher education, we employed Bond and Bedenlier's (2019) bio-ecological student engagement model, which aligns with both Bronfenbrenner's (1979) ecological systems theory and Vygotsky's (1962, 1978) social constructivist theory. This model conceptualizes the complex phenomenon of how educational technology affects student engagement in primary, secondary and higher education. The model consists of the macro-, exo-, meso-, and micro-system levels of influences, with a focus on microsystems and their components of the learning space enhanced by technology, which is ultimately affected by external factors at other levels (Bond & Bedenlier, 2019). At the micro-level, which is exactly the focal level of this study, these learning platforms focus on the interactions between learners and their peers, teachers, learning tasks/resources, and technology affordances. Therefore, relationships and interactions between individuals affect the sense of connection, engagement and learning outcomes of students (Bond & Bedenlier, 2019). This bio-ecological student engagement model offers a clear conceptual structure for us to interpret the connections and interactions between supervisors, students and technology to be revealed in the present study. Specifically, strong teacher-student relationships can predict higher levels of student engagement. The use of technology can enhance students' relationships with their peers and lead to their increased engagement.

In this study, the Moodle-based CAS course was developed to implement the '3PBL.

Teaching Model' that was originated from the educational philosophies of student-focused, social constructivist theory (Vygotsky, 1962; Jonassen et al., 1995). '3PBL' refers to problem-based learning (PBL 1), project-based learning (PBL 2), and practice-based learning (PBL 3), indicating that problem-based learning, project-based learning, learning community, and peer learning would be included in this model. Although there are variations in meaning and usage of these generic concepts, the bio-ecological student engagement model proposed by Bond and Bedenlier (2019) helps to pull all of these together to explain how these components may work as a whole during the supervision process. For example, typical problem-based learning could involve a problem designed by an instructor with certain solutions in mind (Sato & Haegele, 2018). In contrast, in the case of our study, the students defined their research problems and came up with their proposals. Accordingly, the learning community emphasizes engagement and development of research skills among students and supervisors to share resources, co-create common knowledge-artefacts, and capture the state-of-the-art understanding of a group. The theoretical structure and the context of our study thus enabled a

more in-depth exploration into supervisors' and peers' feedback, as well as the interaction patterns and behaviours. Specifically, the following questions guided the present study:

1. What kinds of feedback are given by peers and supervisors during online CAS?
2. How do the teacher candidates interact online for research-based learning? In other words, what are the interaction patterns like in the discussion groups?
3. How do the teacher candidates initiate, respond, and provide feedback to others during online CAS? Are there different behaviours existing among different interaction patterns?

2 | METHODOLOGY

2.1 | Participants

The case of online supervision experienced by a 2017–2018 cohort of MEd students (who were also *teacher candidates*) in Early Childhood Education (ECE) at an English-medium, research-intensive university in Hong Kong was studied. The supervision took place in the context of the second part of a compulsory two-part six-credit Research Methods course (12 academic hours) instructed by Peter (pseudonym), the specialism coordinator of MEd(ECE) at the time of the study and one of the co-authors of this article. The cohort had 29 students (28 female and one male). About two-thirds of the students were Mandarin-speaking Chinese natives who had obtained a bachelor's degree at mainland Chinese universities.

2.2 | Pedagogical design of the online CAS

The '3PBL' Moodle-based CAS course was guided by the following pedagogical principles (Li & Fong, 2014):

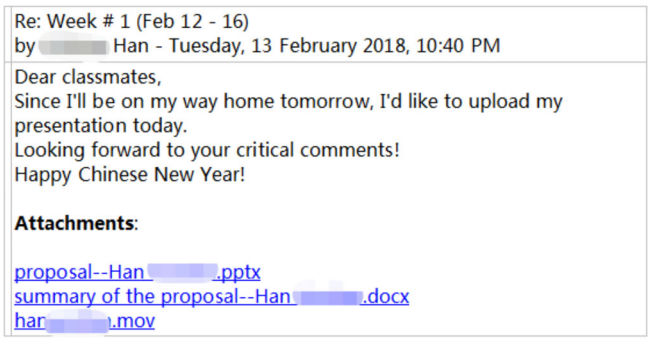
a. *Teacher-student learning community*. This community has a clear division of labour and roles as well as collaboration between the individuals.
b. *Diversified resource sharing*. On the Moodle platform, teachers and students can add text, pictures, audio, video, animation and other types of educational resources in various ways.
c. *Interaction with learning resources*. Student can read learning materials, view class teaching video recordings, conduct self-tests and search for learning information.
d. *Peer learning*. Students can form study groups, check each other's work, reflect on the progress, share ideas, and jointly explore and solve problems. Anyone can ask questions via forums or other networks such as chat and email.
e. *Ongoing evaluations*. The Moodle platform automatically records and counts all students' online behaviours and creates a dynamic e-learning profile that allows teachers to conduct formative assessments.

Accordingly, a Moodle-based '3PBL' CAS model was developed to enhance the students' research proposals. In the Moodle space, each student was required to upload a 5-min videotaped presentation of their proposal, together with a bullet point summary page. In their 5-min presentations and the following discussion, the students were required to (1) articulate how their project addresses relevant literature gaps and their teaching/research context; (2) demonstrate an understanding of the strengths and limitations of the proposed methods and any constraints and challenges that may apply in carrying out the project; and (3) demonstrate an ability to communicate ideas clearly and respond appropriately. The supervision was shared between Peter and a colleague, Beth (pseudonym), and began before the online presentation. After viewing a presentation video, the classmates and supervisors would raise questions and comment on the project concerned. The students were encouraged to raise questions and give comments on the proposed studies shared by their peers; however, these behaviours in the online space were not compulsory. The video presentations and online discussions through feedback were carried out over six consecutive weeks, with 4–6 students sharing in every week.

2.3 | Moodle-based online discussion groups

The Moodle-based online discussion board is similar to the traditional asynchronous bulletin board system (BBS), with its design encouraging peer dialogue and interactive learning. On Moodle, the posts in the same week were listed by date of posting, with the oldest posts shown on top of a webpage. Each post in a list shows the sender's name, the posting date and time, the message text, and attachment(s). Figure 1 shows an example of a post sent by a student.

The instructor, Peter, initiated the presentations of the 4–6 students every week, with an opening message. The students who voluntarily signed up to present in the week would respond to his opening post by clicking 'reply' and posting their new messages or responses. The students could access the Moodle system and post their messages anytime using a computer, tablet, or phone with an Internet connection. Table 1 shows the six weeks' presentation


Re: Week # 1 (Feb 12 - 16)
by Han - Tuesday, 13 February 2018, 10:40 PM

Dear classmates,
Since I'll be on my way home tomorrow, I'd like to upload my presentation today.
Looking forward to your critical comments!
Happy Chinese New Year!

Attachments:

proposal--Han .pptx
summary of the proposal--Han .docx
har .mov

FIGURE 1 An example of a post on the Moodle-based discussion board [Colour figure can be viewed at wileyonlinelibrary.com]

TABLE 1 Weekly participation in online supervision in spring, 2018

Week	Discussion period	Total number of video presentations	Total number of messages	Total number of supervisors' messages	Total number of students' messages	Average number of messages per student
#1	Feb 12–16	4	94	6	88	3.0
#2	Feb 19–23	5	75	6	69	2.4
#3	Feb 26-Mar 2	5	111	9	102	3.5
#4	Mar 5–9	5	85	9	76	2.6
#5	Mar 12–16	4	58	7	51	1.8
#6	Mar 19–23	6	65	7	58	2.0
Average		5	81.3	7.3	74	2.6
Total		29	488	44	518	N.A.

timeline, and the number of posts exchanged in each week. It can be seen from Table 1 that a total of 488 posts were generated in six weeks.

2.4 | Data collection

The primary researcher (first author) conducted a non-participant observation of the class's online activities and collected/downloaded the course syllabus, research proposals, and students' video presentations. We relied on the observations and relevant documents to understand and analyse the interactive discourse of the Moodle-based CAS practice.

2.5 | Qualitative analysis

After familiarizing ourselves with the post content of the three sampled weeks,[2] to address Research Question 1, we adopted a data-driven approach and inductively coded the posts using NVivo 11 (Melbourne, QSR International) to understand the foci of the feedback given by the supervisor and peers. In the initial stage, the segments of text which have specific meaning for understanding the feedback were identified, with a segment defined as 'a word, a single sentence, or several sentences, or it might include a larger paragraph' (Johnson & Christensen, 2012, p. 520). The steps recommended by Creswell (2014) for qualitative data analysis were followed; thus, we read through the posts, labelled portions of each post by referring to the research question, recorded the emerging themes and categories, and tabulated the themes and categories. Through this process, a list of themes was drawn up from the senders' posts; these themes were then categorized. Thus, for example, a higher-level category 'questions raised by peers' subsumes numerous themes such as 'data collection and measurement' and 'sampling and participants'.

To partially address Research Question 2, we described the overall structure of the online interaction using a visual representation of the interactive discussions according to the analysis guidelines of -text-based interaction patterns proposed by Howell-Richardson and Mellar (1996). We made the links between messages explicit among participants. The explicitness of links was dependent upon (1) the use of the 'reply' command on Moodle that automatically marks a post as linked to another; (2) explicit reference to a previous message either by the name of the previous contributor or by post number; and (3) repeating or using a synonym of a key lexical item found in a previous post. We used different types of lines to visualize the three types of links between messages. More details about the procedures of drawing these message maps will be further described in the second part of the 'findings' section to facilitate the explanation of the findings. The approach to visualizing the interactive discourse helped to provide analytical triangulation and enrich our understanding of the processes and patterns of the Moodle-based CAS that have engaged the students.

2.6 | Quantitative analysis

To further analyse the interaction patterns of the six-week online discussions, we adapted the Initiation-Response-Feedback (IRF) coding scheme of classroom interaction (Sinclair & Coulthard, 1975). According to Sinclair and Coulthard's (1975) work, classroom interactions consist of three parts: initiating an interaction, giving responses, and receiving feedback. In this study, the interaction was not restricted to teacher-student interactions but also involved student–student interactions. Therefore, we adapted the coding scheme to code 'initiation', 'response' and 'feedback' and generated three types of interaction: (1) 'initiation without response' (I) which refers to posting their opinions without being replied; (2) 'initiation-response' (IR) which refers to posting their opinions and receiving presenter's single reply; (3) 'initiation-response-feedback' (IRF) which refers to giving feedback after receiving the presenter's response.

Furthermore, to analyse how students initiate, respond, and provide feedback to others (Research Question 3), we adapted another coding scheme for problem-solving discussion behaviours (Hou et al., 2009). Based on students' knowledge-construction level and problem-solving strategies, Hou et al. (2009) classified students' online discussion behaviours into five types: (1) *proposing, defining and*

TABLE 2 The coding scheme for discussion behaviours

Code	Behaviour	Example
P1	Proposing questions or clarifying problems	I have a question on your research. Why do you design K2 children as your target participants? Every year we have a couple of MEd students doing studies on iPad use. This topic is not quite new.
P2	Providing information or proposing solutions	After collecting data, I will calculate how many children like this app and how many children think it is easy to use. Your second research question "How benefit do children receive from using educational apps in kindergarten?" might become more grammatically correct if you change to "What benefits...".
P3	Comparing or discussing existing contributions	I agreed with my classmate's comments that if you would like to know the benefits that the children are getting from the lessons, it seems like using the Technology Accept Model might not be the most appropriate.
P4	Analysing others' contribution	Wonderful presentation, XX (the student's name)! It is always exciting to see how technology is integrated in teaching young children concepts, in this case, mathematics.
P5	Making a summary or conclusion	Yes, you did mention that you will use secondary data, but most of your classmates did not get the point and kept asking you questions about the data. This means that you could have improved your presentation about this point.

Note: The letter 'P' represents 'problem-solving discussion behaviour' in Hou et al. (2009).

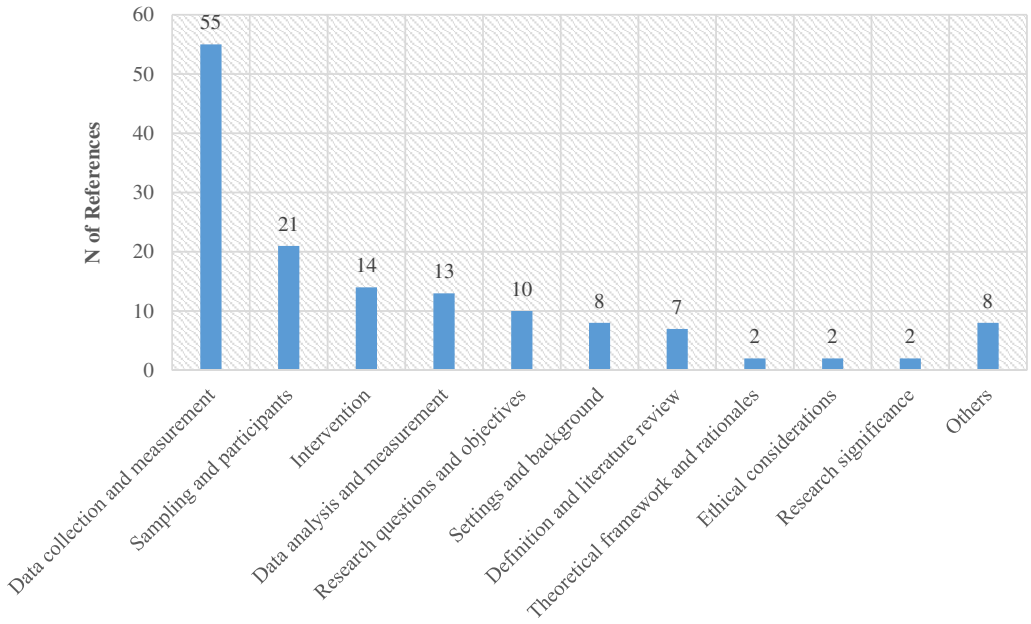


FIGURE 2 Categories of the feedback given by peers [Colour figure can be viewed at wileyonlinelibrary.com]

clarifying problems which include proposing questions or clarifying the problem; (2) *proposing solutions or giving information for possible answers* which involves providing information and proposing solutions to the problem; (3) *comparison, discussion and analysis* which consist of analysing and comparing others' opinions, solutions or information; (4) *summary or conclusion* which means organizing proposed solutions or conclusions; and (5) *other discussions* which refer to those discussions which are irrelevant to the main topic. In the present study, we made the following adaptions. First, we deleted the fifth category since the participants only posted and discussed research problems. Second, we divided the third category into analysing and comparing since making comments was a large proportion of this category (around 60%) in the pilot coding. As shown in Table 2, this study uses the following adapted coding scheme for the content analysis of the posts.

Two coders were trained to understand the coding schemes and conducted the pilot coding using 96 posts before the formal coding to ensure inter-coder reliability. When coding the IRF pattern of six-week online discussions, a post is used as the unit of analysis. The posts were then categorized into initiation, response or feedback following the order of posting. In terms of coding the interaction patterns, the Kappa coefficient was 1.00, which means perfect accuracy

of coding by the two coders. In terms of coding the interaction behaviours using the coding scheme shown in Table 2, the Kappa coefficient was 0.829, 0.917, 0.878, 0.737, and 0.745 for P1 to P5, respectively. The overall Kappa coefficient was 0.861, demonstrating good inter-coder reliability.

After coding the posts, we used Chi-square goodness-of-fit tests to examine whether there existed independent categories of interactions patterns and behaviours in the online discussion groups, with a statistically significant level of difference. Statistical analyses were conducted via the 23rd version of Statistical Package for the Social Sciences (SPSS).

3 | FINDINGS

3.1 | Peers' and supervisors' feedback in online discussion groups

Analyses of the online posts revealed that the students' learning was situated and embodied in the online social processes facilitated by peers' and supervisors' replies that were mostly comprised of questions. Moreover, the Moodle platform and the pedagogical design provided structural (i.e., the Moodle-based platform) and relationship (i.e., the collaborative learning community) support that has promoted the students' willingness to share their academic ideas and refine their research design through incorporating peers' and supervisors' feedback.

3.1.1 | Feedback given by the peers

During the online CAS, peers gave the most feedback on students' presentations and research plans. The feedback given by peers can be categorized into 10 related groups (See Figure 2). These are 'Data Collection and Measurement', 'Sampling and Participants', 'Intervention', 'Data Analysis and Measurement', 'Research Questions and Objectives', 'Settings and Background', 'Definition and Literature Review', 'Theoretical Framework and Rationales', 'Ethical Considerations', and 'Research Significance'. The feedback that could not be covered by the 10 groups was put in the category of 'Others'.

Many questions raised by peers were focused on data collection and measurement, such as 'Will you videotape during the observation process?' and 'What questionnaires will you use to investigate parents' views? Will you develop by yourself or use some existing scales?' For sampling and participants, questions such as the following were asked by the peers: 'You mentioned that only one child would be selected out of the 10 from each workshop, and there will be five boys and five girls. How would the child be selected in each workshop?'; and 'Who are the participants for the interviews? How many participants?'The technical assistance and the pedagogical design (as described in the 'methodology' section) provided structural and relationship support for students. As a range of communicative functions, those presenting, questioning, and responding were made possible in the online space. In the extract below from the week 1 discussion, two students (Amy and Nick, pseudonyms) used these functions in the discussion groups.

Re: Week # 1 (12–16 February)
By Amy - Thursday, 15 February 2018, 7:27 PM

Attached are my research video, PPT and summary for your advice. Look forward to your comments, questions and suggestions. I wish all of you a happy and prosperous CNY of the Dog!
Attachments:
RM2-PPT-Research Proposal.pptx
RP-RM2.mp4
Summary.pdf

Re: Week # 1 (12–16 February)
by Nick - Saturday, 17 February 2018, 1:10 AM

Hi Amy,
You're so fortunate to get secondary data like that! Is this the 2012 study which gave information for "A PROJECT TITLE ANONYMISED" (Anonymised et al., 2012)? If so, is it possible that the data will have less validity because it is over five years old?

Re: Week # 1 (12–16 February)
by Amy - Saturday, 17 February 2018, 11:52 AM

Hi Nick, I appreciate your comments very much! I agree with you that the database does help for my research!
The data is from Peter's project 'A PROJECT TITLE ANONYMISED' conducted around 2008.
Due to my limited time, resources and energy, using the existing data is the best fit for this topic. I will also indicate it as a limitation of my research in the final report.
Yet, the instructional dialogues in Chinese kindergartens did not change a lot according to my observations. Definitely, future longitudinal research might help to test this assumption.
Thanks again for your comments and question!

As the exchanges presented above show, through online interactions, the students were engaged in academic sharing (presenting their research), as well as giving and receiving peer feedback. The peers might share their readings, experiences and thoughts, and the input would provide a source for reflecting upon and improving one's research design.

In total, 369 discussion behaviours were identified in 209 posts from the peers, which aimed to provide feedback on others' proposed research. Most of the discussion behaviours in the feedback (47.15%) were about proposing questions (P1); 26.02% of the discussion behaviours were for analysing others' contribution (P4); 18.70% of the discussion behaviours were for providing information or proposing a solution (P2); 8.13% of the discussion behaviours were for comparing or discussing existing contributions (P3); while none of the discussion behaviours was for making summary or conclusion (P5).

3.1.2 | Feedback given by the supervisors

Peter provided feedback to all students who presented in six weeks. The other project supervisor, Beth, gave comments to the four students under her supervision. Our analysis of the supervisors' feedback identified seven groups of meaning (see Figure 3), namely, 'Research

Topic'; 'Methods (data collection and analysis)'; 'Research Design in General'; 'Research Questions'; 'Sample/Participants'; 'Intervention'; and 'Definition, Theories, and Literature Review'.

To illustrate the supervisors' feedback, in one of his comments, Peter said: 'Every year we have a couple of MEd students doing studies on iPad use. This topic is not very new. So, you need to think more and dig deeper to find something new from this topic. Math is obviously a good topic, relevant to a hot topic – STEM [Science, Technology, Engineering, and Math].' This comment focused on research topic selection. Supervisors also provided feedback on data collection and analysis, such as 'How to observe and measure children's responses? How to quantify their responses and transform them into scientific evidence?'Analysis of Peter's online feedback to the students showed how he guided and directed the novices' thinking and discussion and familiarized them with essential components of a research plan. In the following extract from week 5, Peter was advising Alice on her presentation and proposal.

> Re: Week # 5 (12–16 March)
> by Peter - Thursday, 15 March 2018, 10:47 AM
>
> Dear Alice,
>
> Thanks a lot for your very good presentation online and your prompt responses to the classmates. I share all their concerns and would like to make the following suggestions.
>
> **First**, the topic. I think the topic is unique and interesting in the context of HK. However, you can make some minor changes in your focus. You are proposing to explore how domestic helpers may influence young children's SC [Social Competence] and BP [Behaviour Problem]. This question suggests a quantitative paradigm—confirming a cause-effect relationship between the IV [Independent Variable] and DV [Dependent Variable]. But as you actually prefer to do a case study, you can change the topic to: Stakeholders' Views on the Care-taking of Domestic Helpers in Early Childhood: A Multiple Case Study in HK.
>
> **Second**, the research questions. RQ [Research Question] 1 is also quantitative, indicating that you will observe them for a long time to understand 'how do children develop'. If you will take my suggestion above, you can rewrite your RQs as follows: RQ1: How do parents view the care-taking by domestic helpers? RQ2: How do teachers view...? RQ3: How do young children view...?
>
> **Third**, the sample. In a multiple case study, you need to pay attention to the typicality of your cases. You may need your classmates' help. I assume some cases might show a negative effect, some positive.
>
> **Fourth**, the methods. Again, if you accept my suggestion, you can just use INTERVIEW. Yes, you just need to interview the parents, teachers, and children about this. In addition, if you want to make it more interesting and meaningful, you can even interview the helpers themselves. Your analysis and comparison of their views will be very interesting and will even be publishable. What do you think?
>
> Peter

In the example above, Peter's feedback was concerned with the various components of a research proposal: topic selection, research question, sampling/participants, and research methods. His feedback carried an authoritative tone and seemed effective in pushing the students to revisit their research design from a critical perspective. A total of 114 discussion behaviours were identified in 33 posts. Specifically, 27.19% of the discussion behaviours were for providing information or proposing a solution (P2); proposing questions or clarifying problems (P1) and analysing others' contribution (P4) had an equal proportion which was 24.56%; 17.54% of the discussion behaviours in the feedback were for comparing or discussing existing contribution (P3); while only 6.14% of the discussion behaviours were making summary or conclusion (P5).

To better unveil the functioning of the peers' and the supervisors' feedback in the online CAS, we present the interaction patterns of the online supervision process in the following section.

3.2 | Interaction patterns during the online CAS

Qualitative analyses revealed that in the supervision process, the supervisors' role had been transformed from the owner of knowledge to the facilitator of collaborative learning. Simultaneously, the students became active principal investigators and critical reviewers, constructing their research knowledge and building confidence. To visualize the interaction process, we analysed the collected data and drew the message maps (Howell-Richardson & Mellar, 1996). One message map was drawn for each week; a similar pattern was found across the different weeks, indicating that the interaction pattern remained consistent over time. Figure 4 is an example of a *message*-centric message map focusing on week 5.

In Figure 4, three types of lines represent three different kinds of links:

a. A solid line – Use of the 'reply' command on Moodle that automatically marks a post as linked to another;
b. A broken line with an arrowhead – Explicit reference to a previous message either by the name of the previous contributor or by post number; and
c. A broken line without an arrowhead – Repeating or using a synonym of a key lexical item found in a previous post.

Figure 4 shows that the interaction process was based on student-initiated projects. As shown in Figure 4, posts #9, #20, #28 and #29 were attached with the presenting students' videos and the research proposal summary. The presenting students responded to the questions raised and the comments given by classmates and supervisors accordingly.

Our quantitative analyses further revealed that there were three types of interaction patterns. As shown in Table 3, 24.34% of the posts had no reply, 4.90% of posts involved others' ideas, and only 4.30% initiated follow-up online discussion. Most of the interactions (70.80%) were in response-reply form ($X^2 = 115.584$; $p < 0.001$). It means that most students posted their ideas or questions based on the presenter's project and did not give feedback when they received the presenter's reply.

3.3 | Interaction behaviours in online discussion groups

There was a total of 750 codes for analysing the interaction behaviours. As shown in Table 4, P2 (Providing information or

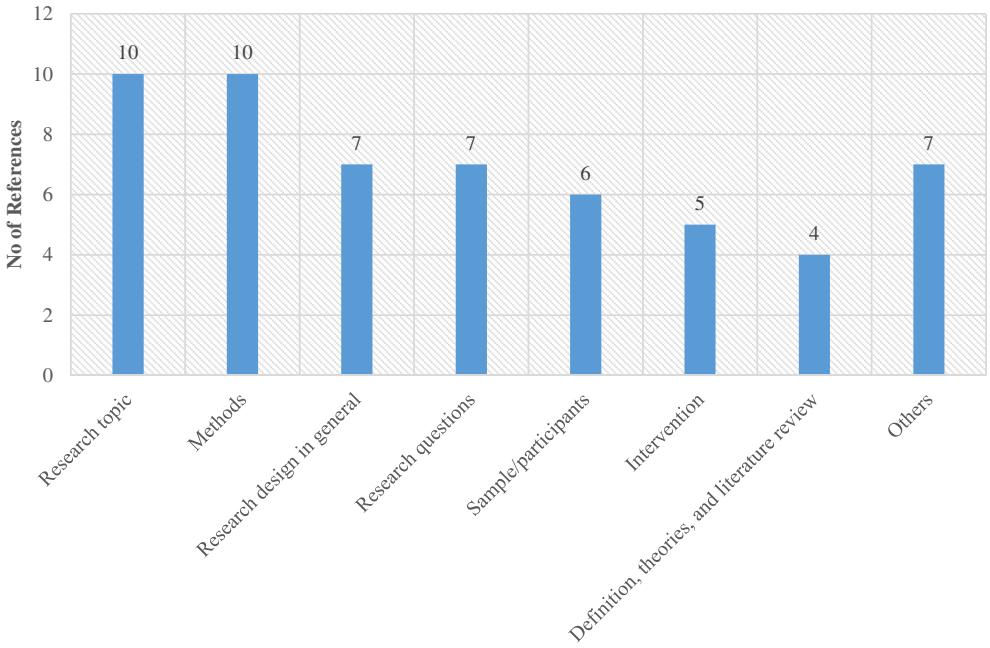


FIGURE 3 Categories of the feedback given by supervisors (Peter and Beth) [Colour figure can be viewed at wileyonlinelibrary.com]

proposing solutions) occupied the largest proportion, which was 29.33%, followed by P1 (Proposing questions or clarifying problems, 28.13%), P4 (Analysing others' contribution, 21.45%), P3 (Comparing or discussing existing contributions, 12.67%), and P5 (Making a summary or conclusion, 8.40%). The result of the Chi-square goodness-of-fit test indicated a significant difference ($\chi^2 = 128.907$; $p < 0.001$), which means that the online interaction behaviours mainly included proposing questions or problems, providing information or solution, and making comments.

Furthermore, we analysed different interaction behaviours in different interaction patterns to explore how students initiate, respond, and provide feedback. The results were shown in Table 5. In terms of initiating discussion, students tended to use P1 (Proposing questions or clarifying problems, 41.82%) and P4 (Analysing others' contribution, 25.67%) ($\chi^2 = 228.480$, $p < 0.001$). In terms of responding to others' initiation, students were likely to use P2 (Providing information or proposing solutions, 45.35%) and P5 (Making a summary or conclusion, 20.93%), while P3 (Comparing or discussing existing contributions) were less frequent ($\chi^2 = 91.065$, $p < 0.001$). The results indicated that proposing questions or problems and making comments mainly function on initiating interaction while providing information or solution and drawing conclusions mainly function on responding. Moreover, providing feedback rarely occurred in online discussions, which means students rarely give feedback after receiving the presenter's responses.

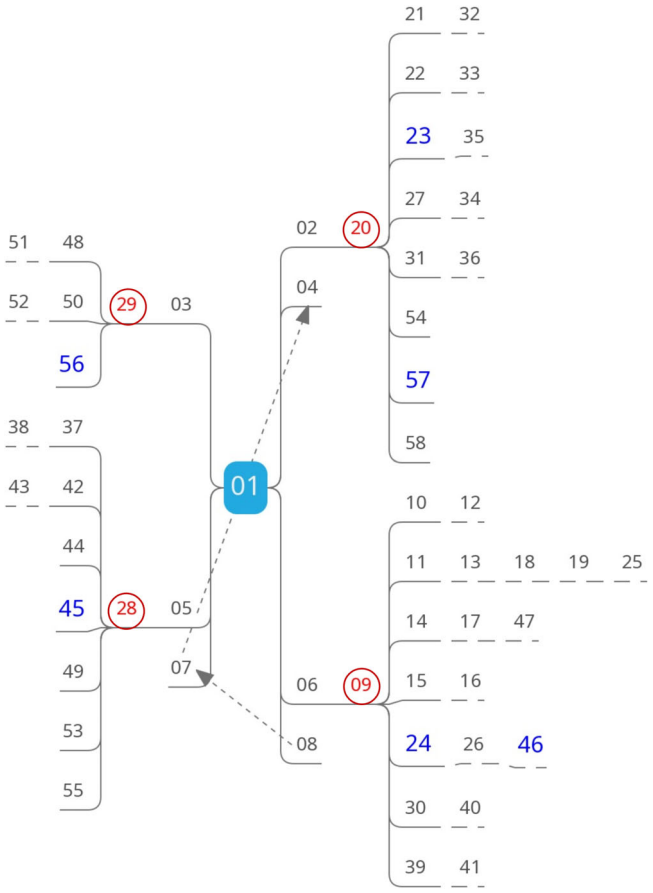


FIGURE 4 Mapping the interaction pattern among the participants in the online CAS.
Notes: The numbers stand for the order of posts. Larger numbers in blue represent supervisors' posts. Numbers in red circles represent presenting students' posts with video presentations. The large number (01) in the middle stands for the supervisor's first post [Colour figure can be viewed at wileyonlinelibrary.com]

4 | DISCUSSION

This study explored a case of online CAS that has engaged taught postgraduate students in designing educational research using the '3PBL' Moodle-based model. We described and analysed the

TABLE 3 The occurrence of different interaction patterns

Interaction pattern	M	SD	Frequency	Percentage (%)	X^2
I: posting with no reply	1.90	5.24	55	24.34	115.584***
I-R: Posting with single reply	5.52	8.54	160	70.80	
I-R-F: Posting-reply-follow up discussion	0.38	0.45	11	4.90	
Total			226		

Note: $N_{student} = 29$; $N_{teacher} = 2$; *** $p < 0.001$.

TABLE 4 The occurrence of different interaction behaviours

Interaction behaviour	M	SD	Frequency	Percentage (%)	χ^2
P1	2.425	3.7684	211	28.13	128.907***
P2	2.529	2.6318	220	29.33	
P3	1.092	1.3694	95	12.67	
P4	1.894	2.7037	161	21.45	
P5	0.733	1.3670	63	8.40	
Total			750	100	

Note: $N_{student} = 29$; $N_{teacher} = 2$; *** $p < 0.001$.

TABLE 5 The occurrence of different interaction Behaviours in different interaction patterns

Interaction behaviour		P1	P2	P3	P4	P5	χ^2
Initiation	M	6.966	3.448	1.724	4.429	0.25	228.480***
	SD	3.365	2.0281	1.1618	2.4408	0.5182	
	Frequency	202	100	50	124	7	
	Percentage (%)	41.82	20.70	10.35	25.67	1.45	
Response	M	0.310	4.034	1.4828	1.250	1.862	91.065***
	SD	0.471	2.784	1.639	2.459	1.827	
	Frequency	29	117	43	35	54	
	Percentage (%)	11.24	45.35	16.67	13.57	20.93	
Feedback	M	0	0.103	0.069	0.069	0.069	1.000
	SD	0	0.310	0.258	0.258	0.258	
	Frequency	0	3	2	2	2	
	Percentage (%)	0	33.33	22.22	22.22	22.22	

Note: $N_{student} = 29$; $N_{teacher} = 2$; *** $p < 0.001$.

supporting system and the interactions among the participants to unveil the pedagogical mechanism of the online CAS and to understand how the teacher candidates learned to be teacher-researcher by presenting and discussing their research plans in the online space.

4.1 | Roles of supervisors and peers in the online CAS

This study showed that the '3PBL' model of online CAS provided a collaborative learning space to integrate students' learning into social networking and facilitate peers' and supervisors' feedback-giving. In this Moodle platform, the students were led by structural and relationship support to share their research ideas and refine their research design. During this online academic supervision, the supervisors played the role of a facilitator of research-based learning. Simultaneously, the students became active principal investigators and critical reviewers in developing their research skills. It is consistent with the findings of existing studies that have widely acknowledged the value of peer interaction and learning and a central role of learners' active participation in their learning process (Boud & Lee, 2005; Harris & Sandor, 2007).

In this '3PBL' model of online CAS, the role of supervisors was shifted to that of a facilitator and one of the many feedback providers, instead of the single advisor in the traditional individual supervisory model. This new role of supervisor as a facilitator was in accordance with some other previous studies on computer-mediated communication in higher education, which reported how supervisors stimulated discussion and coordinated the dialogue (e.g., Harris & Sandor, 2007; Howell-Richardson & Mellar, 1996).

In addition, participatory pedagogy seems to be reflected in this online CAS model to engage students as active learners in sharing their research ideas and absorbing peers' and supervisors' feedback. Engaged in the online discussions, they tended to play the role of the principal investigator of their research projects in constructing the topic, designing the research and holistically considering relevant issues. A new role of peers was also observed: a critical reviewer who reviewed the research presentations of their classmates and provided feedback. The two roles (investigator and reviewer) enabled the students to be engaged in the entire procedure of initiating research and reviewing others' research. Students thus received the learning opportunities to present their research ideas and respond to others' questions, professionally and academically. This might enhance their ability to share and build upon knowledge in the collective learning community. Still, more follow-up evaluation research needs to be conducted to verify this assumption. Nevertheless, our findings provide empirical evidence to support using *peer learning* as a pedagogical approach to research-based teacher education, potentially challenging the traditional focus on one-on-one supervision and the single relationship between supervisor and supervisee (Boud & Lee, 2005). It is worth noting that this study does not cast doubt on the necessity and significance of supervision; instead, it highlights the importance of innovative supervision, focusing on peer learning within the inclusive CAS framework.

4.2 | Promoting peer interactions and learning via online CAS

This study explored a case of online academic supervision that is constituted of a Moodle-based, collaborative learning model, which sustains ongoing creation of problem situations and the provision of timely intellectual feedback and resource support from peers and supervisors. This pedagogical design is consistent with Heron's (2019) analysis that material artefacts within pedagogical practices could support students' participation and structure their interaction in seminars. It is also supported by Bond and Bedenlier's (2019) conceptual framework illustrating how the technology-enhanced environment may support student engagement. In this online CAS model, students' projects served as the starting point of research sharing and discussion. Simultaneously, the problem-based and practice-based elements helped generate the interactions in the online forum. The project-based, practice-based and problem-based learning supported learner-centred supervision and peer learning, which, to some extent, transformed the traditional hierarchical model of one-on-one supervision into a collective co-constructing of research ideas and knowledge.

Based on the quantitative analysis, we found that most students actively engaged in the online discussion. However, the functions of interactions were restricted to proposing questions/problems and providing information/solutions. Analysing and comparing others' contributions which is the foundation of knowledge construction, occurred less frequently since our findings revealed that P3 (Comparing or discussing existing contributions, 12.67%) and P5 (Making a summary or conclusion, 8.40%) had the lowest percentage among all five categories of discussion behaviours. These findings are in line with previous research, which indicated that online discussions could help students explore certain research issues, but the level of knowledge construction could be improved (Hou et al., 2009; Huang et al., 2019). Meanwhile, providing feedback based on others' response and making a summary or conclusion rarely occurred during online discussion. It is not surprising since the research-related topics are complex, students may need more time to be involved in collaborative online discussion and to elaborate their research ideas before making conclusions (Dobber et al., 2012). To improve the cognitive process in the online learning community, we can employ concept map as a cognitive tool, as it can help with knowledge retention and guide students back to the problem under discussion. Wu (2020) applied the collaborative problem-solving approach for tutoring students and used the concept map to represent the structure of content knowledge. Higher cognitive behaviours that involve analysis, evaluation and creation are likely to occur as a result.

In our study, the online space seems to create a culture of giving and receiving feedback to overcome the cultural barrier of the 'face' issues for the Chinese students. As a co-author of this article, Peter reflected that the Chinese students in the study avoided being critical when commenting on others' works in the actual classroom, probably due to the lack of confidence and concern of 'face' in Chinese culture (Bond, 1996). In his observation, as non-native speakers of English, his students had difficulty using academic terminologies to provide immediate, fluent, and critical feedback. However, the Internet-medium environment seems to solve this problem and promote peer interactions and feedback. The finding demonstrates that in an online CAS space, students' willingness to give and receive feedback is enhanced (Hemer, 2012).

5 | CONCLUSION

With the goal of educating teacher-researchers for fast-changing needs in schools, the '3PBL' model of online CAS encouraged teacher candidates to share their academic ideas and refine their research design. This model embodied social processes facilitated by peers' and supervisors' feedback. Students and supervisors were the co-participants who generated mutual engagement and a shared repertoire (Nordentoft et al., 2013; Wisker et al., 2007). This in-depth case study successfully presents 'a more process-oriented account' (Dillenbourg et al., 1996, p. 189) of collaborative learning, focusing on the engagement of a class of taught postgraduate students in online CAS.

5.1 | Implications and limitations

The findings of this study have pedagogical implications for research-based teacher education and academic supervision. First, the featured Moodle-based collaborative learning space exemplifies an innovative technological and pedagogical design that can bring students and supervisors together to form a community of sharing and refining

research. Second, the findings have provided an exemplary case regarding the application of the online learning environment in supporting CAS and active research-based learning. Third, supervisors' facilitating role can be planned during the online CAS by setting up guidelines and pedagogical principles. Although more evidence is needed, this study suggests that collective, personalized and constructive feedback-giving enhanced by the online platform can enhance student engagement in the process of academic supervision. The productive online CAS seems to benefit both teacher candidates and their supervisors by promoting the co-construction of the knowledge and skills of educational research.

By focusing on the design and process of CAS in a specific online learning space, our study did not prove that the current form of CAS is more effective than otherwise. In addition, we did not analyse individual engagement in relation to their characteristics or personalities. This can be a focus in future research to examine the individual attributes and engagement in online CAS. Quasi-experiments or programme evaluations could provide more solid and robust evidence.

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ENDNOTES

[1] Utterance is defined as 'an independent clause, a non-restrictive dependent clause, an element of a compound predicate, or an address or an acknowledgement' in a message (Yeh et al., 2008, p. 2893).

[2] As the content and structure of interactive discussions seemed to replicate across the six weeks due to the same pedagogical design, we only selected the posts of week 1, week 3, and week 5 for qualitative analysis to keep the analysis manageable. It can be seen from Table 1 that a total of 263 posts were generated in the three weeks. A total of 13 students presented their project design in these weeks.

PEER REVIEW

The peer review history for this article is available at https://publons.com/publon/10.1111/jcal.12558.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

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