Summary

The focus of this dissertation is on student collaboration and outcomes in online project-based higher education in China. Project-based learning (PjBL) refers to a student-centered teaching-learning approach that engages learners in knowledge acquisition, application, and construction by accomplishing meaningful projects and creating real-world artifacts. Research has shown that PjBL is positively linked with different learning outcomes, such as content knowledge, skills, self-efficacy, and engagement. In this dissertation, four studies are described that were conducted to better understand the benefits of PjBL for Chinse higher education.

In **Chapter 1**, the context, aims, and conceptual frameworks adopted in the studies focusing on PjBL are described. In order to improve the teaching quality of Chinese higher education institutions, in 2018, the Ministry of Education of the People's Republic of China released its first national standard that requires the transition from traditional teacher-centered pedagogies to student-centered teaching-learning approaches. To this end, PjBL, as a promising pedagogy that benefits college students' learning, was introduced and implemented in the Chinese college curriculum in studies in this dissertation. All courses implemented in studies in this dissertation were online and the teaching and learning processes were also conducted online.

Three conceptual frameworks were adopted in the studies. PjBL is considered an alternative to teacher-centered direct instruction and can benefit both hard skills and soft skills that higher education requires. The development of artifacts distinguishes PjBL from other student-centered approaches. During PjBL, learners usually work in small groups and adopt ICT tools to facilitate the learning process. In general, teachers act as facilitators to support students' learning. Self-Determination Theory (SDT) can be used to examine "situational motivation" that exist in specific activities in a specific period, in this case PjBL. SDT contains three components of motivation, namely intrinsic motivation, extrinsic motivation, and amotivation. The Community of

Inquiry (CoI) framework is adopted to understand the learning and teaching processes in online PjBL. This framework contains three components with sub-components. More specifically, social presence consists of affectiveness, open communication, and group cohesion. Cognitive presence includes triggering event, exploration, integration, and resolution. Teaching presence involves the design and organization, facilitation, and direct instruction of teaching practice. These three presences together contribute to meaningful student outcomes.

To gain more insight into how PjBL benefits Chinse college students' learning, one review study and three empirical studies with these three conceptual frameworks were conducted. In study 1 (Chapter 2), different student outcomes and the corresponding measurement instruments in PjBL in higher education were investigated with a systematic literature review. In study 2 (Chapter 3), the influence of students' motivation for and strategies used in PjBL on their evaluations of PjBL was explored with a survey method. In study 3 (Chapter 4), to better understand how students' social and cognitive presences in online PjBL impacts their academic performance, an empirical study focusing on students' online discussions and artifacts was conducted. In study 4 (Chapter 5), another survey study was conducted to investigate how different roles of teachers in PjBL influence students' evaluations of PjBL.

In **Chapter 2**, a review study has been reported to reveal an overview of student outcomes of PjBL in higher education and how these outcomes were measured. Two research questions were answered in this study: (1) What student outcomes of PjBL are evaluated in higher education? (2) What instruments are adopted to measure these student outcomes?

Data collection was conducted in two steps. In the first step (i.e. search data bases), references were searched via a series of search terms or combinations of terms, such as "project-based", "higher education", and outcome. In total, 450 articles were found based on the combination of various Educational and Psychological Sciences databases, external resources, such as Google Scholar and Research Gate, and the snowballing method. In the second step (i.e. selection), the 450 articles found were further analyzed manually based on five

selection criteria, such as the studies had to be empirical and the studies had to focus on student learning. After the inter-rater reliability check, a total of 76 articles were selected for review.

Based on the clustering of learning outcomes, four categories and seven sub-categories of student outcomes were reported. These outcomes were cognitive outcomes (i.e. knowledge and cognitive strategies), affective outcomes (i.e. perceptions of the benefits of PjBL and perceptions of the experience of PjBL), behavioral outcomes (i.e. skills and engagement), and the outcome of artifact performance. Affective outcomes were most applied and learners' knowledge, strategies, and skills were also frequently measured. However, few studies have evaluated students' engagement and their artifacts. These are the direction for future research. Five categories of instruments were revealed, including questionnaires, rubrics and taxonomies, interviews, tests, and self-reflection journals. Although questionnaires were most frequently used, some studies did not provide information about the psychometric properties of these questionnaires and scales. Moreover, several studies reviewed lacked quality checks regarding the analysis of qualitative data. These limitations should be improved in future studies.

The findings highlighted the necessity to differentiate PjBL from similar pedagogies (e.g. problem-based learning) as PjBL can meet the needs of higher education that should provide innovative education for students. Therefore, it is necessary to encourage teachers in higher education to adopt PjBL.

In **Chapter 3**, a small-scale empirical study was reported that focused on the relation between students' motivation for and strategies used in online PjBL and their evaluations of online PjBL. This study was implemented based on an eight-week online PjBL course for first-year college students. During the first three weeks, students learned basic content knowledge via online videos, participated in a project-based activity, and created a project artifact (i.e. a film analysis report) in small groups on WeChat. For the other weeks, students took online lectures and the final exam. Two research questions were answered: (1) How is students' motivation related to their evaluations of online collaborative

PjBL? (2) How are students' strategies used related to their evaluations of online collaborative PjBL?

Data were collected via two surveys. Ninety-five students finished the first survey of their motivation for PjBL at the end of the second week. After each group of students submitted the project artifact at the end of the third week, 85 students completed the survey of their strategies used in PjBL and their evaluations. In total, 81 students completed all surveys.

Via partial least squares analyses, the findings showed that regarding students' motivation, autonomous motivation was positively related to students' evaluations. This result might be related to the authentic feature of the project, the use of WeChat in the project, and the improvement of students' personal development during the project. Students' amotivation was negatively related to students' evaluations. This might relate to students' disengagement for the project because they might not see the value of doing the project and their negative emotions during the project . In addition, no significant relationship between controlled motivation and students' evaluations was found. This result was different from previous studies and needs future exploration. As for students' strategies, the results showed that strategies of considering others' opinions and challenging others' opinions benefited students' sense of learning. This might because reflecting on others' opinions and learning from different perspectives encourage students to think deeply and extensively, which improves students' understanding and critical thinking skills. Besides, students were satisfied with PjBL even if they challenged peers' opinions. This might because students perceived safety during collaboration with peers and therefore expressed their feelings and opinions in an open way.

These results indicated that in order to motivate students in participating in online PjBL, the selection and design of projects and relevant educational activities should be authentic. The results also provided implications that teachers should create a safe environment for students' collaboration and encourage them to listen to and even challenge each other for a better learning experience.

In **Chapter 4**, an empirical study focusing on students' social and cognitive presences, based on the CoI framework, in online discussions during PjBL and their academic performance is reported. This study was implemented based on the same course in the study in Chapter 3. Four research questions were answered: (1) What components of social presence describe student groups' artifact creation in online discussions? (2) What components of cognitive presence describe student groups' artifact creation in online discussions? (3) How is student social presence in online discussions related to the artifact performance? (4) How is student cognitive presence in online discussions related to the artifact performance?

Since this study focused on students' group discussions during online PjBL, data of student social and cognitive presences were collected from the transcripts of 24 groups of students' discourse on WeChat and coded based on an adapted coding scheme. In total, 8469 units were coded for further analysis. The performance of students' artifacts (i.e. the film analysis report) was evaluated via a grading rubric.

Overall, descriptive results showed that for social presence, almost half of students' discussion posts were in the component of affectiveness, followed by open communication and group cohesion. For cognitive presence, almost all of the posts contributed to the level of exploration, followed by integration and triggering event. However, the number of posts in each group of these social and cognitive presences varied greatly. Stepwise regression analyses revealed that students' group academic performance was positively related to the social presence of affective expressions, humor use, and vocatives and the cognitive presence of exploration and offering opinions.

The results provided implications on the design and organization of projects. In short, the time and effort of the exploration phase should be shortened and students need to pre-review basic course materials before having online discussions. The results also highlighted the importance of teachers' assistance on students' discussions, such as providing students with the direction of the discussion and enlightening students with questions that they could debate.

In **Chapter 5**, a small-scale empirical study is reported, aiming to explore teachers' roles in online PjBL and how they are related to students' evaluations of online PjBL. This study was implemented based on a sixteen-week online PjBL course for mater students. During the course, students took online lectures and participated in two group PjBL activities in two course phases and collaboratively created two artifacts (i.e. a case analysis report and a course paper) in small WeChat groups. Three research questions were answered: (1) What is the relationship between students' perceptions of teaching presence and their evaluations of online PjBL in the first phase of the course? (2) What is the relationship between students' perceptions of teaching presence and their evaluations of online PjBL in the whole phase of the course? (3) Are these relationships mediated by students' perceptions of social presence and cognitive presence during the course?

Survey data were collected in two phases, namely after students completed the case analysis report (i.e. phase 1, weeks 1 to 4) and the course paper (i.e. the whole phase). In total, 38 and 41 students finished the survey in each phase, respectively.

Overall, results via partial least squares analyses showed that in the early phase of the course, the role of teachers' instructional design and organization and the role of directed facilitation had a positive and negative influence on student' perceived benefits, respectively. However, the influence of these two roles on perceived benefits was not found in the whole course phase and the influence on course satisfaction was not found in both course phases. Nevertheless, when social presence was added as the mediator, the effects of teachers' directed facilitation positively influenced perceived benefits and course satisfaction in both course phases.

The results indicated that when designing and organizing courses, teachers should pay more attention to the set-up of curriculum-related parameters in the early stage of the course. The results also implied that the most important role of teachers in online PjBL lies in learning facilitators who promote the social interaction among students.

In **Chapter 6**, the findings and limitations of the studies are discussed, and implications for future research and practice are provided. Regarding whether PjBL is suitable for Chinese higher education, the first study shows PjBL benefits diverse student outcomes. The other three empirical studies show that students are motivated for PjBL, actively engage in the learning process, and have positive evaluations of PjBL. This means that PjBL might be a suitable way for Chinese college curricula. In terms of the importance of WeChat, the findings of this dissertation show that WeChat is an ideal ICT tool for students' collaboration in online PjBL. Chinese college students are familiar with using WeChat as a communication tool for asking and receiving course-related information. WeChat is also easy to access and use on multiple platforms. More importantly, students can use a variety of communication ways to interact with peers in online discussions and therefore, a comprehensive image of student engagement, both socially and cognitively, could be depicted. With regard to the ideal role of teachers, the studies in this dissertation show that the role of teachers differs when it comes to different student groups. Teachers' instruction and facilitation seem more important if students have insufficient prior knowledge and limited understanding of content knowledge, especially when they face ill-structured and open projects. However, these roles of teachers might be less important if students have a deeper understanding of content knowledge and can reflect on their learning processes. In this case, students are likely to benefit from collaboration and interaction with group members.

The main limitations and future directions of the dissertation relate to the research design, the research method, and the generalizability of the findings of the studies. The correlational research design adopted in the three empirical studies could not reveal the effects of PjBL on student learning outcomes. Future studies are suggested to adopt experimental research designs to improve this limitation. For example, the effects of PjBL and other pedagogies and the effects of PjBL with different features can be compared. Regarding the research method, the three empirical studies were limited in the lack of sufficient qualitative information that might interpret the quantitative results in a deeper way. This can be improved in future studies via adopting explanatory sequential

designs that collect and analyze qualitative data after the collection and analysis of quantitative data. Moreover, because WeChat lacks the recording function, the data of students' online learning processes were not fully recorded. Future studies are suggested to adopt external recording functions to improve this limitation. In addition, the differences of student learning processes within each group were neglected. This can be improved by analyzing both the learning pattern and the dynamic development of students' engagement in each group in future studies. As for the generalizability of the findings, the studies of this dissertation are limited due to specific learning contexts and small sample size. This limitation can be improved in future studies via, for example, extending the range of learning contexts and the number of learners through the integration of PjBL with MOOCs.

The studies in this dissertation provide several suggestions for the design and organization of PjBL curricula and the improvement of teachers' role in PjBL. When organizing the course, teachers should clearly explain curriculum-related parameters (e.g. course schedules) to students, particularly in the early course phase. The project activities and artifacts should be designed authentically and close to students' real life in order to motivate students to engage in the learning process. Teachers should also make sure that students have some knowledge about the content before they participate in group discussions for projects. In order to encourage students to openly communicate and interact with each other, teachers need to create a safe and comfortable environment for discussions. Furthermore, for students who lack sufficient content knowledge and academic experience, teachers should join students' group discussions to provide guidance on their discussions during PjBL.

In **Chapter 7**, some reflections of the dissertation author after finishing this project are presented.