FACTORS INFLUENCING UNDERGRADUATES' ACCEPTANCE OF CHINESE DANMAKU VIDEO SITES FOR SELF-DIRECTED LEARNING USING INTEGRATION MODELS

LIN BIN

SULTAN IDRIS EDUCATION UNIVERSITY

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ABSTRAK

Kajian ini membentangkan model penerimaan teknologi lanjutan untuk meneroka faktor yang mempengaruhi penggunaan laman video Danmaku Cina untuk pembelajaran terarah kendiri (CDSDL) dalam kalangan pelajar sarjana muda jurusan pendidikan rendah, melalui pengintegrasian Model Penerimaan Teknologi (TAM) dengan rangka kerja *Task-Technology Fit* (TTF) serta nilai budaya peribadi (jarak kuasa, mengelakkan ketidakpastian, individualisme dan kolektivisme). Kajian kuantitatif ini dilaksanakan melalui melalui tinjauan soal selidik yang diadaptasi dari kajian Venkatesh, Kamal and Sumak et al kepada 312 pelajar dari tiga buah universiti di China bertujuan menilai kelestarian CDSDL dalam pendidikan tinggi. Analisis data secara deskriptif untuk membandingkan nilai min persepsi pelajar terhadap penggunaan CDSDL dilakukan menggunakan perisian SPSS 22 dan AMOS 22. Analisis menunjukkan pandangan yang ketara tentang faktor-faktor yang mendorong penerimaan CDSDL di China untuk kemampanan. Dapatan juga menunjukkan bahawa tanggapan kebergunaan, keadaan memudahkan, pengaruh sosial, dan kepuasan pelajar memberi pengaruh positif terhadap penerimaan CDSDL di China. Selain itu, pengelakan ketidakpastian, jarak kuasa dan kolektivisme secara tidak langsung memberi kesan kepada penerimaan dengan mempengaruhi persepsi kebergunaan dan persepsi kemudahan penggunaan. Walaupun persepsi kebergunaan dan persepsi kemudahan penggunaan muncul sebagai penentu utama penerimaan teknologi. Kajian menunjukkan kepentingan faktor tambahan untuk penggunaan mampan dalam konteks pendidikan tinggi. Dengan menekankan aspek persekitaran dan pengalaman, menyerlahkan keperluan untuk mewujudkan keadaan yang kondusif di mana pelajar berasa diberi kuasa dan disokong untuk terus melibatkan diri dengan sumber yang menawarkan pengalaman pembelajaran yang bermakna. Secara keseluruhannya, penyelidikan ini menyumbang kepada kemajuan teori penerimaan teknologi dengan memberi penerangan tentang dinamik pelbagai rupa yang mempengaruhi penerimaan pelajar terhadap platform baharu untuk pembelajaran terarah kendiri. Dengan mengenal pasti faktor utama dan interaksi mereka. Kajian juga memberikan pandangan yang bernilai untuk pendidik, penggubal dasar dan pembangun platform yang ingin meningkatkan kemampanan dan keberkesanan inisiatif pembelajaran kendiri dalam persekitaran pendidikan tinggi.

FACTORS INFLUENCING UNDERGRADUATES' ACCEPTANCE OF CHINESE DANMAKU VIDEO SITES FOR SELF-DIRECTED LEARNING USING INTEGRATION MODELS

ABSTRACT

This study presents an extended technology acceptance model to explore the factors influencing the adoption of Chinese Danmaku video sites for self-directed learning (CDSDL) among undergraduate students majoring in primary education. Integrating the Technology Acceptance Model (TAM) with the Task-Technology Fit (TTF) framework and personal cultural values (power distance, uncertainty avoidance, masculinity, and collectivism), the research investigates the sustainability of Chinese CDSDL in higher education through quantitative methods. For this instrument, the questionnaire was adapted from the study by Venkatesh, Kamal and Sumak et al.. A sample of 340 students from three Chinese universities participated in the survey, yielding 312 valid responses. The study used a descriptive analysis through SPSS 22 and AMOS 22 to discover current students' views using CDSDL by comparing them with the mean value. The study reveals significant insights into the factors driving the acceptance of Chinese CDSDL for sustainability. Results demonstrate that perceived usefulness, facilitating conditions, social influence, and student satisfaction exert positive influences on the acceptance of Chinese CDSDL. Moreover, uncertainty avoidance, power distance, and collectivism indirectly impact acceptance by influencing perceived usefulness and perceived ease of use. While perceived usefulness and perceived ease of use emerge as primary determinants of technology acceptance, the research underscores the importance of additional factors for sustainable adoption in higher education contexts. By emphasizing environmental and experiential aspects, the study highlights the need to create conducive conditions where students feel empowered and supported to continually engage with resources that offer meaningful learning experiences. Overall, this research contributes to the advancement of technology acceptance theories by shedding light on the multifaceted dynamics influencing students' acceptance of new platforms for self-directed learning. By identifying key factors and their interplay, the study provides valuable insights for educators, policymakers, and platform developers seeking to enhance the sustainability and effectiveness of self-directed learning initiatives in higher education settings.

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LIST OF ABBREVIATION

CDSDL	Chinese Danmaku video sites of self-directed learning strategies
COL	Collectivism
FC	Facilitating Conditions
MASC	Masculinity
PD	Power Distance
PEOU	Perceived Ease of Use
PU	Perceived Usefulness
SDL	Self-Directed learning
SI	Social Influence
SS	Student Satisfaction
TAM	Technology Acceptance Model
TTF	Task-Technology Fit
UA	Uncertainty Avoidance

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CHAPTER 1

INTRODUCTION

1.1 Introduction

In the twenty-first century, colleges and universities have fully integrated modern information technologies, such as computer and multimedia network technologies, into their educational frameworks. These advancements emphasize a student-centered teaching model, with teachers guiding instruction (Alam et al., 2021). To enhance students' engagement in active learning and promote their capacity for knowledge creation and application, educators are increasingly leveraging network technologies to individualize and enrich the teaching and learning process (Buch, Rathod, & Naik, 2021). Many students have started using Danmaku video sites for self-directed learning (SDL), where teachers upload course content, and students actively engage with it at their own pace.

The number of Chinese universities and university students has grown rapidly in recent years. As of 2022, there were 41.83 million university students and 3,013 universities in China. In 2017, there were 26.95 million university students and 2,759 universities (Chen et al., 2023). Educators from various fields struggle to keep up with the rapidly evolving demands of the real world, which makes large-class formal education less effective for meeting students' individual needs. Students increasingly seek growth and diversification in their education (Toh & Kirschner, 2020). The swift advancement of information technology and the widespread use of smart devices have created a ubiquitous learning environment that offers seamless connectivity and accessibility anywhere, anytime. This environment supports self-directed learning, which can accommodate learner differences, as well as space and time constraints (Zhu, Bonk & Doo, 2020). Alvin Toffler (1996) emphasized that "the future illiterate will not be those who cannot read, but those who have not learned how to learn autonomously." Self-directed learning allows students to customize their learning venues and materials to suit their individual needs and schedules for acquiring both material and procedural knowledge. In essence, self-directed learning meets the needs of college students across different stages of study, enabling them to adapt to future employment opportunities and increased mobility (Bergamin et al., 2019).

Numerous researchers (Ferdinand & Zuhroh, 2021; Van Zyl, 2020; Lasfeto, 2020) have extensively explored self-directed learning (SDL) and its applications in network contexts. These studies frequently discuss the meanings, models, features, constituent aspects, and scale of SDL (Ferdinand & Zuhroh, 2021). Researchers have also examined methods to measure, improve, and cultivate student autonomy (Van Zyl, 2020). However, the current state of research on SDL within networked learning

environments remains limited, and there is insufficient understanding of the factors that influence university students' intentions and strategies for adopting SDL. Given this context, this study aims to investigate the factors influencing college students' use of Danmaku video websites and the sustainability of their usage based on the Technology Acceptance Model (TAM) and Task-Technology Fit (TTF) models in SDL. The findings of this research will contribute to the further development of self-directed learning studies and offer insights for enhancing SDL practices (Lasfeto, 2020).

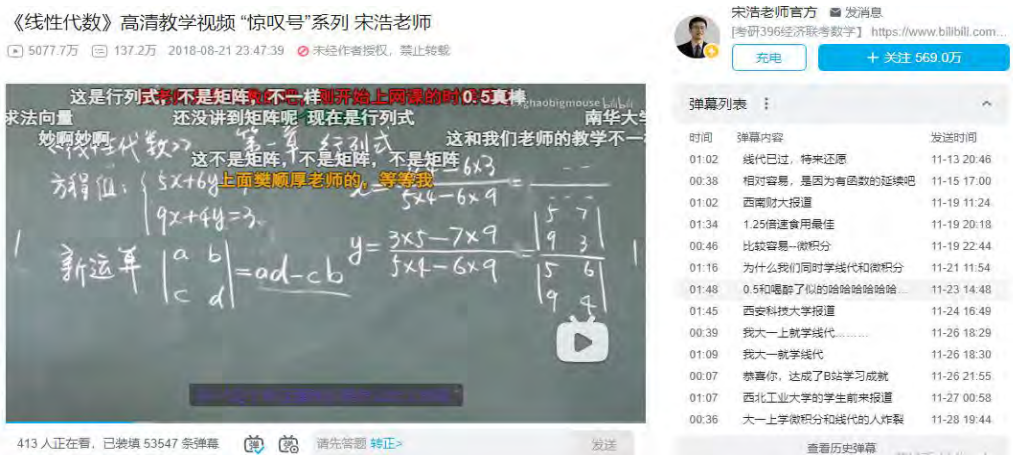
1.2 Backgrounds

Human learning methods have evolved significantly with the advancement of technology. Unlike traditional video sites such as YouTube, where videos and comments are displayed in separate sections (Lin, Huang & Cordie, 2018), the Danmaku system drop overlays comments directly onto the video as text, allowing all current and future viewers to see them while watching. As a result, viewers experience a sense of high parallelism, where they can watch the video and read comments simultaneously, giving the impression of interacting with other viewers in real-time (Ferdinand & Zuhroh, 2021). Additionally, the remarks appear as a "stream of consciousness" and are synchronized with the video timeline, enabling rapid comment transmission (Stuss et al., 2019; Alhussain et al., 2020). In recent years, Danmaku has gradually transcended its roots in two-dimensional culture and entered the public's awareness, becoming more mainstream. In this context, BILIBILI has

consistently updated its Danmaku features and embraced Danmaku as a key communication tool for self-directed learning.

Figure 1.1

Screenshot of a sample video on Bilibili with default settings



(a)

(b)

In simple terms, the Danmaku interface offers a unique feature that allows viewers of online videos to make "live" comments that are immediately displayed on the video. When the total number of comments reaches a certain threshold, the visual

effect known as Danmaku,translated as "barrage" or "bullet curtain" from Japanese,is produced, as shown in Figure 1.1(a) and Figure 1.1(b). According to Yang (2020), this feature creates a viewing experience that is more dynamic, interactive, and socially engaging than other commentary systems.

As the internet continues to evolve, the Danmaku video feature, allowing time-synchronized comments during video playback, is becoming a significant part of online learning. With the internet, transferring videos, images, and documents through social networking sites is easier than ever (Ferdinand & Zuhroh, 2021). Students gain expertise in using digital devices, digital skills, and social media, preparing them for a digital future (Grand-Clement, 2017). Danmaku video sites integrate online learning gateways and time-synced comments with social media-like functionality, enriching the learning experience.

Danmaku video sites have integrated online learning gateways with time-synchronized comments that function similarly to social media (Xi et al., 2021). These platforms offer students digital skills and keep them connected to the world and other students, providing access to information anytime, anywhere. Danmaku video sites facilitate interactive, independent exploration and study under the supervision of lecturers, promoting lifelong and self-directed learning. Additionally, these platforms support peer learning and improve communication between instructors and students. They encourage creative teaching and learning across content, collaboration, connection, and creativity (Luo, Freeman & Stefaniak, 2020). Online learning, also known as e-learning, is a form of distance education that relies on internet technologies to mediate the learning process. E-learning aims to enhance teaching

methods and academic performance (Islam, 2016). Numerous studies have explored the adoption of e-learning and its impact on student academic achievement (Alyoussef, Alamri & Al-Rahmi, 2019; Alalwan et al., 2019). Alqahtani and Rajkhan (2020) define e-learning as "any learning conducted online." This technology-driven e-learning model creates an extended environment for learning anytime and anywhere (Verdugo & Villarroel, 2021). Depending on their educational institutions and instructors, students may be required to participate in regular online lectures, presentations, and discussions. They often use the provided platform to access learning materials such as recorded lectures, reading lists, activities, and assignments (Heng & Sol, 2021).

The development of Danmaku technology enables students to interact with one another while utilizing online educational resources. The Danmaku video comment function allows users to overlay comments onto videos, with the comments flowing from right to left across the screen. Despite the Chinese language being written and read from left to right, viewers in China do not find this orientation challenging for watching Danmaku comments. Unlike traditional commentaries displayed below videos, Danmaku comments appear directly on the video screen, creating a more synchronized experience (Wu et al., 2020). The timing of Danmaku comments is linked to the video lecture's timeline, enhancing the connection between the content of the video and the comments and providing a sense of synchrony. Danmaku features are prevalent on various Chinese websites, with http://bilibili.com being particularly popular among younger users (Ning & Dong, 2021). In addition to offering entertainment videos, Bilibili also hosts numerous video lectures. For instance, Figure 1.1 shows a screenshot from a video lecture on Bilibili that covers the

Algebra and Psychology portion of the national university entrance test (Yang, 2020). The video includes numerous Danmaku comments, which vary in color and size. Users can choose whether to display the Danmaku feature, allowing them to add their own contributions (Figure 1.1(a)). To submit comments on Danmaku, viewers must be registered members of Bilibili.com. Non-members can watch videos on the site but cannot leave comments. The use of Danmaku has significantly increased interaction between students and instructors in online video courses. Compared to other interactive approaches like comments or messages at the bottom of videos, Danmaku displays viewers' remarks directly on the video, providing a co-viewing experience that may enhance learners' sense of presence and reduce feelings of loneliness (Cheng et al., 2021). As shown in Figure 1, Danmaku offers the advantages of both relevance and variety (Wu et al., 2019). Research suggests that Danmaku may improve both the performance and efficiency of learners (Tian, 2020).

Danmaku Video Sites, such as Bilibili, have gained prominence as popular online platforms for educational content consumption, particularly in China (Liu & Liao, 2022; Zheng et al., 2023). While traditional video-sharing websites primarily offer passive viewing experiences, Danmaku Video Sites enhance user engagement and interaction through the integration of time-synchronized comments, or "danmaku bullets," overlaid on videos. These platforms have become increasingly recognized for their potential to facilitate self-directed learning by providing learners with access to a diverse range of educational materials, fostering active participation and collaboration, and creating supportive learning communities (Huang & Li, 2023).

Numerous studies have explored the role of Danmaku Video Sites in promoting self-directed learning among users, highlighting their unique features and their impact on learning outcomes. Research has shown that the interactive nature of danmaku bullets encourages learners to actively engage with video content, ask questions, share insights, and participate in discussions in real-time (Qi & Xue, 2022). This active participation promotes deeper comprehension, critical thinking, and knowledge retention, thereby enhancing the effectiveness of self-directed learning experiences (Zhao & Wang, 2023).

Furthermore, Danmaku Video Sites have been found to facilitate peer-to-peer learning and knowledge sharing through their community-driven content curation and recommendation systems. Users can contribute to the selection and organization of educational materials, share resources, and collaborate on learning projects, creating a collaborative and interactive learning environment (Luo & Zhang, 2022). Studies have demonstrated that this collaborative approach to learning fosters a sense of ownership, belonging, and motivation among users, leading to increased engagement and satisfaction with the learning process (Chen & Wei, 2022).

Additionally, research has explored the impact of gamification elements integrated into Danmaku Video Sites on user motivation and engagement in self-directed learning activities. Gamified features such as achievement badges, leaderboards, and rewards for active participation incentivize learners to set goals, track their progress, and compete with peers, making the learning experience more enjoyable and rewarding (Wang & Jiang, 2022). Studies have shown that gamification

can enhance learner motivation, persistence, and achievement, leading to improved learning outcomes and reduced dropout rates (Zhang & Wang, 2022).

Moreover, Danmaku Video Sites have been recognized for their flexibility and accessibility, allowing learners to access educational content anytime, anywhere, and at their own pace. This flexibility accommodates diverse learning styles, preferences, and schedules, enabling learners to engage in self-directed learning activities that fit their individual needs and lifestyles (Li & Sun, 2023). Research has highlighted the importance of flexibility in online learning environments for promoting learner autonomy, independence, and self-regulated learning strategies (Zhao & Wang, 2023).

Overall, the existing literature provides substantial evidence supporting the contribution of Danmaku Video Sites to the field of self-directed learning. By offering interactive and collaborative learning experiences, fostering peer-to-peer interaction and knowledge sharing, integrating gamification elements, and providing flexibility and accessibility, these platforms empower learners to take control of their learning process and achieve their educational goals (Zheng et al., 2023; Liu & Liao, 2022). Additional research is needed to further explore the effectiveness of Danmaku Video Sites in supporting self-directed learning and to identify strategies for optimizing their use in educational settings.

Malcolm Shepherd Knowles is known for providing a foundational description of self-directed learning (SDL). According to Knowles, SDL is a process where individuals take the initiative in assessing their own learning needs, setting learning goals, and identifying human and material resources for learning, with or without

assistance. Learners select and apply appropriate learning strategies and evaluate their own learning outcomes (Brandt, 2021). This approach allows learners to plan, manage, and evaluate their learning activities independently, at any time and in any location. Integrating SDL into the teaching and learning process can enhance learners' competencies and motivate them to engage in learning activities both inside and outside the classroom. This is because SDL empowers learners to take responsibility for what lessons to learn and which real-life problems to solve (Siahaan, 2022). Consequently, SDL gives learners a more active role in their own education. Despite the importance of SDL in developing university students' skills, there is a need to shift the educational paradigm from focusing on teachability to emphasizing learnability. This transition also involves moving from a transmission perspective of learning to a transactional view (Brandt, 2021). For SDL to be effective, there must be a reciprocal relationship between the student and the instructor. This means the learner must actively initiate and lead their own learning process, while the teacher acts as a facilitator and guide (Charokar & Dulloo, 2022).

The advantages of self-directed learning (SDL) are most evident in the learners it shapes (Ferdinand, 2021; Ferdinand & Zuhroh, 2021; Buch, Rathod, & Naik, 2021; Nasri, Halim & Talib, 2021). University students benefit from learning independently and enjoy utilizing new methods and tools to acquire knowledge (Alsufyani, Aboshaiqah, Moussa, Baker, Aljuaid, & Alshehri, 2020). SDL fosters qualities such as determination, self-discipline, self-confidence, and goal orientation. It also helps students become more proficient learners and socially engaged individuals (Kumar, Singh & Buyya, 2020). Self-directed learners can research information across multiple sources and employ various strategies to achieve their

goals, such as expressing concepts through drawing or writing. Additionally, SDL allows students to develop their own learning norms and leadership styles (Loeng, 2020).

1.3 Problem Statement

Proponents of Danmaku video sites argue that watching instructional videos can become a communal experience where videos facilitate a shared experience that serves as the basis for socialization (Xiang & Chae, 2021). Chinese Danmaku video sites, such as Bilibili, Youku, and Zhihuishu, enhance this social experience by providing an aggregated view of other viewers' comments in real-time while the video is being watched. This technology may transform students' video-watching experiences from passive and solitary activities to active and socially engaged experiences, where students learn online videos within a community of viewers through self-directed learning strategies (SDL). In SDL, learning environments and materials can be customized to meet the needs of individual students and their time constraints for developing content and procedural knowledge. This raises questions about whether users perceive Danmaku as more useful or easier to use compared to traditional video sites and whether these perceptions influence their continued use of Danmaku video sites. The existing literature on the technology acceptance model identifies perceived characteristics as key determinants of perceived ease of use and perceived usefulness (Huang, 2021). However, the availability of perceived features does not automatically translate to an increase in the use of self-directed learning strategies on Chinese Danmaku video sites. Further research is needed to understand

the complex interplay between user perceptions and the adoption and sustained use of Danmaku video sites for SDL.

Currently, there is no ideal model for studying and describing students' choices to incorporate Chinese Danmaku video websites into their learning environments. The technology acceptance model (TAM) is commonly employed to study students' acceptance of new technologies (Al-Nuaimi & Al-Emran, 2021). However, TAM focuses solely on users' attitudes toward a particular information technology tool, which are influenced by the perceived usefulness and ease of use of the tool (Rafique et al., 2019). To gain a deeper understanding of students' acceptance and usage of online learning materials (e-learning, mobile learning, and Danmaku video sites), some researchers have augmented TAM with various external factors. For instance, one study presented a model based on the information systems continuation expectation-confirmation model to explore learning through Danmaku video sites (Xiang & Chae, 2021). Another study combined the theories of planned behavior (TPB) and self-determination theory (SDT) as a research framework to investigate the factors influencing students' decisions to use Danmaku video sites for self-directed learning strategies (Xu et al., 2022). These expanded models aim to provide a more comprehensive understanding of the factors driving students' adoption and continued use of Danmaku video sites in the context of self-directed learning.

The task-technology fit (TTF) model is a widely used theoretical framework for evaluating how information technology contributes to performance, analyzing the implications of technology use, and determining whether task and technology features align. The model posits that the fit between the characteristics of the task and the

attributes of the technology can affect task-technology fit, which in turn influences performance and technology usage.TTF suggests that the compatibility between task requirements and technology capabilities is a key determinant of user satisfaction and productivity. When there is a good fit between the tasks and the technology, users are more likely to use the technology effectively and experience improved performance. Since its introduction, the TTF model has been extensively researched and applied across a wide range of information systems (Alyoussef, 2021). This model provides valuable insights into how technology can best be utilized to support various tasks and achieve optimal outcomes.

The technology acceptance model (TAM) focuses on short-term beliefs and attitudes regarding technology acceptance, such as users' perceived usefulness and ease of use of Danmaku video sites for self-directed learning strategies. However, TAM does not thoroughly address long-term beliefs and attitudes that occur before or after the acceptance of these sites. In contrast, the task-technology fit (TTF) model emphasizes the match between task requirements and technology attributes, suggesting that when a good fit is achieved, such as with Danmaku video sites, a positive outcome is anticipated. TTF highlights the potential for task-technology adaptation theory to overcome some limitations of TAM in this context. Although TTF has been extensively studied in various scenarios, there is limited research on its application to Danmaku video sites for self-directed learning strategies in China. The impact of task-technology fit on the adoption of Chinese Danmaku video sites for self-directed learning strategies and its influence on student adoption remains an open question. Further investigation is needed to understand the relationship between task-

technology fit and user adoption in this area, as well as its potential effects on students' engagement and performance.

The task-technology fit (TTF) model is based on maintaining an optimal match between capabilities and task circumstances, leading to improved system performance. Combining TTF with the technology acceptance model (TAM) provides a more comprehensive understanding of Chinese Danmaku video sites for self-directed learning strategies by addressing the limitations of each model. According to Elçi and Abubakar (2021), integrating TAM and TTF models explains more variation in information technology use than either model alone. However, the TTF model does not account for facilitating conditions (FC), social influence (SI), and individual cultural characteristics in the context of Chinese Danmaku video sites for self-directed learning strategies. This limitation may hinder its predictive capability when considering Danmaku video sites with social networking technologies in China. To overcome this constraint, it is important to incorporate facilitating conditions, social influence, and other individual cultural characteristics such as power distance, uncertainty avoidance, collectivism, and masculinity. By integrating these factors into the TTF model, a more nuanced analysis of Chinese Danmaku video sites can be achieved, providing insights into how these variables influence students' adoption and use of self-directed learning strategies in this context. This approach offers a more holistic perspective on the factors impacting users' engagement with Danmaku video sites and can guide the design and implementation of more effective learning environments.

The persistently high dropout rate is a major challenge in current online self-directed learning (Ding & Shen, 2022; Ma & Lee, 2018). The dropout rate refers to the proportion of students who do not complete a certain educational program or online course (Tan & Shao, 2015). This study aims to explore the factors influencing Chinese undergraduate students' use of Danmaku video websites for self-directed learning. Online learning environments often suffer from spatiotemporal separation between teachers and students and asynchronous communication, making it difficult for learners to receive timely guidance and assistance during self-directed learning (Huang et al., 2020). Additionally, students may lack self-directed learning methods and skills (Rasheed et al., 2020) or face insufficient support from the learning environment (Mishra et al., 2020), resulting in weak learning motivation, low initiative, and poor participation. These issues hinder learners' cognitive development and the progression of self-directed learning (Zhou et al., 2020). While thousands of people enroll in online classes, many students drop out because the courses do not align with their interests or due to feelings of isolation (Wang et al., 2019). Despite the popularity of Chinese Danmaku video sites for self-directed learning strategies, these resources experience very high dropout rates (Karatas & Arpaci, 2021). On average, only around ten percent of students enrolled in these online learning resources complete their course requirements (Ofei-Manu & Didham, 2018). Numerous online programs continue to face significant student attrition, which may stem from a variety of causes. Identifying and addressing these factors is crucial to improve the effectiveness and retention rates of online self-directed learning programs.

In the context of online education, students' decisions are heavily influenced by social media platforms (Huang et al., 2020). Learners often choose classes that

their peers have previously completed due to the herding effect (Wang et al., 2023). This tendency to follow the crowd can lead to illogical herding behavior, which is one of the factors contributing to high dropout rates. High dropout rates in online education represent a significant loss of resources that could have been avoided (Ma & Lee, 2018). The persistent issue of high dropout rates is a major challenge frequently discussed by both academics and industry professionals in the realm of online learning (Ding & Shen, 2019). Reducing dropout rates and improving student retention are essential to enhancing the quality and effectiveness of online learning programs.

Learners on Chinese Danmaku video websites can engage with other learners in real time about learning content, share their learning progress, and encourage each other through Danmaku comments. This interactive environment supports self-directed learning by helping learners perceive their own learning process while fostering meaningful interactions with external support in the learning environment. As a result, this dynamic communication can improve learning efficiency and outcomes while reducing dropout rates. Danmaku feedback during learning provides learners with immediate insights into their status, allowing them to adjust their learning behaviors and strategies promptly. Additionally, Danmaku video sites serve as communities of students who post time-synchronized comments, functioning similarly to social media sites (Van Mierlo & Beers, 2018). This interactive and collaborative approach creates a supportive learning community, which can be found on platforms like Bilibili and other Danmaku video sites in China. To encourage pedagogical research on these platforms, leading universities in China have launched initiatives to develop online learning resources and promote educational research.

These efforts aim to enhance learners' interest and reduce online learning dropout rates by providing more engaging and effective self-directed learning environments. By leveraging the collaborative and interactive aspects of Danmaku video sites, these initiatives strive to create more supportive and successful online learning experiences.

Several studies have highlighted the prevalence of high dropout rates in online self-directed learning environments. For example, research by Ding and Shen (2022) and Ma and Lee (2019) underscores the persistent issue of dropout rates in online education settings. These studies have found that a substantial proportion of students enrolled in online programs fail to complete their courses, with dropout rates often exceeding those of traditional face-to-face courses. Furthermore, empirical evidence from Wang et al. (2020) and Ofei-Manu & Didham (2018) supports the notion that online learning resources, including Chinese Danmaku video sites for self-directed learning (CDSDL), experience high dropout rates. Wang et al. (2020) observed that approximately ten percent of students enrolled in online learning resources fulfill their course requirements on average, indicating a significant dropout problem in these platforms. Moreover, research has identified various factors contributing to high dropout rates in online self-directed learning environments. Spatiotemporal separation between teachers and students, asynchronous communication, and lack of timely guidance and assistance during self-directed learning are among the factors identified by Huang et al. (2020) and Wang et al. (2020). Additionally, students' own lack of self-directed learning methods and skills, as highlighted by Rasheed et al. (2020), and insufficient support from the learning environment, as noted by Nguyen et al. (2020), can further exacerbate dropout rates. The impact of social media platforms on student decision-making and course selection in online education settings has also been

documented. Studies by Huang et al. (2020) and Wang et al. (2020) suggest that learners are influenced by their peers' choices and may be more likely to enroll in courses that their contemporaries have completed, contributing to the herding effect and potentially leading to higher dropout rates. Furthermore, research has shown that the availability of supportive learning communities and effective interactions among learners can mitigate dropout rates in online self-directed learning environments. Danmaku video sites, such as Bilibili, facilitate communication among learners through synchronized remarks, providing opportunities for collaboration, knowledge sharing, and mutual support (Van Mierlo & Beers, 2020). These platforms create a sense of community among users and foster engagement, which can help reduce dropout rates by promoting a supportive learning environment. In summary, the issue of high dropout rates in online self-directed learning is well-documented in the literature, with empirical evidence supporting its significance. By providing supporting data and studies, the thesis can underscore the importance of addressing this challenge and highlight the potential impact on student outcomes and the effectiveness of online learning platforms like CDSDL.

At the heart of this research lies the need to understand the factors influencing the adoption and sustained use of CDSDL platforms for self-directed learning among undergraduate students in China. While the problem statement touches upon several relevant factors, it does not clearly articulate how these factors collectively contribute to addressing the central research problem.

One of the main issues discussed in the problem statement is the persistently high dropout rate in online self-directed learning environments, including CDSDL

platforms. The problem statement cites empirical evidence from various studies (e.g., Ding & Shen, 2022; Ma & Lee, 2018; Wang et al., 2020; Ofei-Manu & Didham, 2018) to underscore the significance of this challenge. However, it does not explicitly link this issue to the core research problem or explain how addressing dropout rates relates to the broader goal of understanding CDSDL adoption and sustained use.

The problem statement also discusses the potential influence of social influence and individual cultural values on technology adoption and usage within the context of CDSDL. While these factors are undoubtedly relevant, their connection to the central research problem remains unclear. The problem statement should clarify how understanding the role of social influence and cultural values can contribute to the broader goal of enhancing CDSDL adoption and sustained use among undergraduate students.

Similarly, the problem statement highlights the limitations of existing models, such as the Technology Acceptance Model (TAM) and the Task-Technology Fit (TTF) model, in capturing the nuances of user behavior within CDSDL platforms. It suggests the need to integrate multiple models to address these limitations. However, the rationale for pursuing such an integrated model and its relevance to the core research problem is not explicitly stated.

To strengthen the problem statement and provide clarity, it is crucial to establish a clear central research problem that serves as the focal point. In this case, the central research problem could be formulated as follows:

"Despite the growing popularity of Chinese Danmaku Video Sites for Self-Directed Learning (CDSDL) among undergraduate students in China, a significant proportion of users fail to adopt and sustain their usage of these platforms for self-directed learning purposes. This raises the need to understand the multifaceted factors influencing CDSDL adoption and sustained use, including individual perceptions, social influences, cultural values, task-technology fit, and the unique features of these platforms."

By articulating this central research problem, the problem statement can then effectively tie together the various factors and issues discussed, explaining how they collectively contribute to addressing the core challenge of enhancing CDSDL adoption and sustained use among undergraduate students.

For instance, the problem statement could explain how understanding the role of social influence and individual cultural values can shed light on the motivations and barriers to CDSDL adoption and sustained use. It could also highlight the importance of considering the task-technology fit between CDSDL platforms and the self-directed learning tasks they support, as well as the potential impact of sustainability education and student satisfaction on the long-term viability of these platforms.

Furthermore, the problem statement could justify the need for an integrated model by emphasizing the limitations of existing models in capturing the complex interplay of factors influencing CDSDL adoption and sustained use. By integrating multiple models, such as TAM, TTF, and cultural values, the research can provide a more comprehensive understanding of user behavior and motivations within the context of CDSDL platforms.

In summary, while the problem statement covers a wide range of relevant issues and factors, it lacks a clear central research problem that ties these elements together. By establishing a well-defined central research problem focused on understanding the factors influencing CDSDL adoption and sustained use among undergraduate students in China, the problem statement can effectively contextualize and justify the various factors and issues discussed, leading to a more coherent and focused research agenda.

When considering the challenges of dropout rates and sustainable learning development in Chinese Danmaku video sites for self-directed learning strategies, the quality of learning and teaching is a key concern (Van Mierlo & Beers, 2018). Education is recognized as a crucial element in achieving sustainable development on a global scale (Calvo et al., 2020; Adenle et al., 2021). The increase in Danmaku video sites has prompted sustainability educators to adjust their teaching methods, particularly in areas such as energy, wealth, ethics, the environment, and management (Hueske et al., 2021). Prior research (Zint et al., 2022) highlights ethics as one of the most vital components of sustainability education. A study by Fang et al. (2018) revealed that the impact of Danmaku video sites for self-directed learning strategies is heightened when developers integrate sustainability concerns into the content and encourage students to engage with them. There are significant gaps in understanding the causes of self-directed learning and the long-term viability of sustainability in the context of Chinese Danmaku video sites. Additionally, student satisfaction is a critical measure of successful studies and overall learning experience (Abuhassna et al., 2020). The effect of sustainability use in Chinese Danmaku video sites for self-directed learning strategies on student satisfaction remains unclear. Further research is

needed to explore the relationship between sustainability and Danmaku video sites for self-directed learning strategies, particularly regarding its influence on student satisfaction and the long-term viability of sustainable practices. By bridging these gaps, educators and developers can optimize the use of Danmaku video sites for enhancing student satisfaction and promoting sustainable learning.

Therefore, the current models may inadequately capture the nuances of user behavior within Chinese Danmaku video sites for self-directed learning (CDSDL). Integrating multiple models can effectively address these limitations.

Individual-Centric Focus: Existing models like the Technology Acceptance Model (TAM) predominantly focus on individual-level factors such as perceived usefulness and perceived ease of use. While these factors are undoubtedly important, they might not fully account for the social and cultural dynamics at play in CDSDL platforms. In the case of CDSDL, where users engage in collaborative learning experiences facilitated by real-time comments, individual-centric models might overlook the influence of social interactions and group dynamics on technology adoption.

Neglect of Social Influence and Cultural Values: TAM, in particular, does not explicitly consider the role of social influence or cultural values in shaping users' attitudes towards technology. However, in the context of CDSDL, where users actively engage with a community of learners through danmaku comments, social influence and cultural values play a significant role in shaping user behavior. For instance, users may be more inclined to adopt CDSDL platforms if they perceive them

as socially endorsed by their peers or if the platforms align with their cultural values regarding collaborative learning and knowledge sharing.

Inadequate Consideration of Platform-Specific Features: Existing models may not adequately account for the unique features of CDSDL platforms, such as the real-time commenting system and the sense of community fostered by these platforms. Traditional models like TAM might overlook how these platform-specific features influence users' perceptions of usefulness and ease of use. For example, users might find CDSDL platforms more useful and easier to use than traditional video sites because of the added interactivity and social engagement facilitated by features like danmaku comments.

Limited Scope for Interaction Effects: Existing models often examine individual factors in isolation, without considering how these factors interact with each other or with contextual variables. However, in the context of CDSDL, where multiple factors—such as individual perceptions, platform features, social interactions, and cultural values—interact to shape user behavior, a more nuanced approach is needed. Integrating multiple models allows for the examination of complex interaction effects, providing a more comprehensive understanding of the factors driving technology adoption in CDSDL platforms.

By integrating multiple models such as TAM, the Task-Technology Fit (TTF) model, and cultural values, we can address these limitations and develop a more comprehensive framework for understanding technology adoption and usage in CDSDL platforms. TAM provides insights into individual perceptions of technology,

TTF examines the fit between technology and tasks, and cultural values shed light on the social and cultural influences on user behavior. Together, these models offer a more nuanced understanding of the factors driving technology adoption in CDSDL platforms, allowing for a richer analysis of user behavior and motivations.

The problem statement introduces several theoretical models, including the Technology Acceptance Model (TAM), Task-Technology Fit (TTF), Theory of Planned Behaviour (TPB), and Self-Determination Theory (SDT), as well as concepts like perceived usefulness, task-technology fit, and social influence. While these models and concepts are relevant to the broader domain of technology adoption and usage, their specific relevance and integration with the study's central research question need to be clearly established.

The central research question of this study is to understand the factors influencing the adoption and sustained use of Chinese Danmaku Video Sites for Self-Directed Learning (CDSDL) among undergraduate students in China. To address this question, a coherent and well-integrated theoretical framework is essential.

The TAM is a widely adopted model that provides a solid foundation for understanding individual perceptions and attitudes towards technology adoption. Within the context of this study, TAM can be utilized to investigate students' perceptions of the usefulness and ease of use of CDSDL platforms, as these perceptions are known to influence technology acceptance and usage intentions.

However, TAM primarily focuses on individual beliefs and attitudes, and may not fully capture the broader contextual factors and task-related considerations that can influence the adoption and sustained use of CDSDL platforms for self-directed learning. To address this limitation, the TTF model can be integrated to examine the fit between the features and capabilities of CDSDL platforms and the specific tasks and requirements of self-directed learning.

The TTF model posits that when there is a good fit between the technology and the task at hand, users are more likely to adopt and effectively utilize the technology, leading to improved performance and outcomes. By incorporating the TTF model into the theoretical framework, the study can explore whether the unique features of CDSDL platforms, such as real-time commenting and collaborative learning environments, align with the needs and preferences of undergraduate students engaged in self-directed learning.

Furthermore, the problem statement highlights the potential influence of social factors and cultural values on technology adoption and usage within the CDSDL context. To account for these influences, the TPB and SDT can be integrated into the theoretical framework.

The TPB considers the role of subjective norms and social influence in shaping an individual's behavioural intentions and actions. Within the context of CDSDL adoption and use, the TPB can shed light on how the perceptions and behaviours of peers, instructors, or other social groups influence students' intentions to adopt and sustain the use of these platforms for self-directed learning.

Additionally, SDT emphasizes the importance of self-determination and autonomous motivation in driving behaviour. As self-directed learning inherently involves a high degree of autonomy and self-regulation, SDT can provide insights into how students' intrinsic motivations and perceived autonomy impact their adoption and sustained engagement with CDSDL platforms.

By integrating TAM, TTF, TPB, and SDT into a comprehensive theoretical framework, the study can offer a holistic and nuanced understanding of the factors influencing CDSDL adoption and sustained use among undergraduate students in China. This integrated framework accounts for individual perceptions (TAM), task-technology fit considerations (TTF), social influences (TPB), and motivational factors (SDT), providing a robust and well-rounded approach to addressing the central research question.

To further strengthen the theoretical framework and enhance its coherence, potential overlaps and intersections among these models and concepts should be acknowledged and addressed. For instance, the TPB's concept of subjective norms may overlap with the social influence constructs in SDT, necessitating a clear delineation or integration of these constructs within the study's theoretical framework.

Moreover, the study hypotheses and primary arguments should be derived from and clearly linked to this integrated theoretical framework. By explicitly connecting each hypothesis or argument to the relevant theoretical models and concepts, the study can demonstrate a coherent and consistent approach, facilitating readers' understanding of the underlying rationale and assumptions.

For example, hypotheses related to the influence of perceived usefulness and perceived ease of use on CDSDL adoption and sustained use can be directly derived from TAM, while hypotheses concerning the impact of task-technology fit can be grounded in the TTF model. Similarly, hypotheses exploring the role of social influence and intrinsic motivation can be rooted in TPB and SDT, respectively.

By explicitly establishing these connections between the study hypotheses and the integrated theoretical framework, the problem statement can provide a clear and coherent narrative, guiding readers through the rationale and justification for the chosen approach.

In summary, to address the concern about the lack of integration and clear connection between the various theoretical models, concepts, and the study question, a comprehensive revision and explanation are provided. The revision establishes the central research question and articulates the relevance and integration of each theoretical model (TAM, TTF, TPB, SDT) and concept (perceived usefulness, task-technology fit, social influence) within the study's theoretical framework. Additionally, potential overlaps and intersections among these models and concepts are acknowledged, and the importance of deriving and clearly linking the study hypotheses and primary arguments to this integrated theoretical framework is emphasized. By providing this coherent and well-integrated theoretical foundation, the problem statement can effectively guide readers' understanding of the study's rationale and approach, enhancing the overall clarity and comprehensibility of the research.

1.4 Research Objectives

Therefore, it is necessary to achieve the following objectives:

1. To identify the needs of the development of the CDSDL model for the undergraduate level based on students' views.
2. To develop an integrated model for understanding the adoption and sustained use of Chinese Danmaku Video Sites for Self-Directed Learning (CDSDL) among undergraduate students, by synthesizing the Technology Acceptance Model (TAM), Task-Technology Fit (TTF) model, and relevant cultural factors.
3. To validate the acceptance and intention to use the CDSDL model among undergraduate students.

1.5 Research Questions

Concerning the problem statement, this research intends to answer the following research questions:

1. What are the existing influence factors of the development of the CDSDL model for the undergraduate level based on students' views?
2. Are there any relationships between perceived usefulness (PU), perceived ease of use (PEOU), Facilitating conditions (FC), Social Influence (SI), and individual cultural characteristics, adoption as sustainability, task-technology fit (TTF), and student satisfaction (SS) towards Chinese CDSDL?

3. What is the level of acceptance and intention to use the CDSDL model among undergraduate students, and how are these factors influenced by the integrated TAM strategies?

1.6 Hypotheses

In order to reply research questions, the following hypotheses are constructed.

H1: Perceived usefulness will positively influence students' intention to sustainability adoption for Chinese CDSDL in Chinese higher education universities.

Justification: According to the Technology Acceptance Model (TAM), perceived usefulness is a crucial determinant of an individual's intention to adopt a technology (Davis, 1989). In the context of CDSDL, students who perceive these platforms as useful for their learning and personal development are more likely to have a positive intention to adopt them for sustainability.

H2a: Perceived ease of use will positively influence perceived usefulness of sustainability adoption for Chinese CDSDL in Chinese universities.

H2b: Perceived ease of use will positively influence students' intention to sustainability adoption for Chinese CDSDL in Chinese universities.

Justification: The TAM posits that perceived ease of use not only directly influences an individual's intention to adopt a technology but also indirectly affects intention through its impact on perceived usefulness (Davis, 1989). If students find CDSDL platforms easy to use and navigate, they are more likely to perceive them as useful and have a higher intention to adopt them for sustainability purposes.

H3a: Facilitating conditions will positively influence perceived usefulness of sustainability adoption for Chinese CDSDL.

H3b: Facilitating conditions will positively influence perceived ease of use of sustainability adoption for Chinese CDSDL.

Justification: Facilitating conditions refer to the degree to which an individual believes that organizational and technical infrastructure exists to support the use of a system (Venkatesh et al., 2003). In the context of CDSDL, facilitating conditions (e.g., institutional support, technical resources) may enhance the task-technology fit (TTF) between the platforms and self-directed learning needs, thereby positively influencing students' perceptions of usefulness and ease of use for sustainability purposes.

H4a: Social influence will positively influence perceived usefulness of sustainability adoption for Chinese CDSDL.

H4b: Social influence will positively influence perceived ease of use of sustainability adoption for Chinese CDSDL.

Justification: Social influence refers to the extent to which an individual perceives that important others believe they should use a particular system (Venkatesh et al., 2003). In a collectivistic culture like China, social influence may play a significant role in shaping students' intentions to adopt CDSDL for sustainability purposes. The impact of perceived usefulness and ease of use on intention may be moderated by the presence or absence of social influences from peers, instructors, or institutions.

H5a: Power distance will positively influence perceived usefulness of sustainability adoption for Chinese CDSDL.

H5b: Power distance will positively influence perceived ease of use of sustainability adoption for Chinese CDSDL.

Justification: Power distance refers to the extent to which individuals accept and expect unequal distributions of power within a society or organization (Hofstede, 2001). In the context of Chinese Danmaku Video Sites for Self-Directed Learning (CDSDL), power distance may influence students' perceptions of the usefulness and ease of use of these platforms. For instance, students with a higher power distance orientation may perceive CDSDL platforms as more useful and easier to use if they perceive these platforms as endorsed or recommended by authoritative figures or institutions.

H6a: Uncertainty avoidance will positively influence perceived usefulness of sustainability adoption for Chinese CDSDL.

H6b: Uncertainty avoidance will positively influence perceived ease of use of sustainability adoption for Chinese CDSDL.

Justification: Uncertainty avoidance refers to the extent to which individuals within a culture feel threatened by ambiguous or unknown situations (Hofstede, 2001). In the context of CDSDL adoption, students with a higher level of uncertainty avoidance may place greater emphasis on the perceived usefulness and ease of use of these platforms as a means of reducing uncertainty and ambiguity in their learning experiences. The influence of perceived usefulness and ease of use on intention may be moderated by students' level of uncertainty avoidance.

H7a: Collectivism will negatively influence perceived usefulness of sustainability adoption for Chinese CDSDL.

H7b: Collectivism will negatively influence perceived ease of use of sustainability adoption for Chinese CDSDL.

Justification: Collectivism refers to the degree to which individuals prioritize group goals and collective interests over individual interests (Hofstede, 2001). In the context of CDSDL, collectivism may influence students' perceptions of usefulness and ease of use. Students with a higher collectivistic orientation may perceive CDSDL platforms as less useful or more difficult to use if they perceive these platforms as

promoting individualistic learning approaches that conflict with their cultural values of group harmony and conformity.

H8a: Masculinity will positively influence perceived usefulness of sustainability adoption for Chinese CDSDL.

H8b: Masculinity will positively influence perceived ease of use of sustainability adoption for Chinese CDSDL.

Justification: Masculinity refers to the extent to which a culture values assertiveness, achievement, and material success (Hofstede, 2001). In a more masculine culture, students may be more inclined to adopt CDSDL platforms if they perceive them as useful for achieving their learning goals and enhancing their academic performance. The influence of perceived usefulness and ease of use on intention may be moderated by students' level of masculinity orientation.

H9a: The TTF has a positive effect on the perceived usefulness of sustainability adoption for Chinese CDSDL.

H9b: The TTF has a positive effect on the perceived ease of use of sustainability adoption for Chinese CDSDL.

Justification: The Task-Technology Fit (TTF) model suggests that a good fit between the capabilities of a technology and the requirements of a task will positively influence the user's perceptions of that technology's usefulness and ease of use

(Goodhue & Thompson, 1995). In the context of CDSDL adoption for sustainability purposes, if the features and functionalities of these platforms align well with the needs of self-directed learning, students are more likely to perceive them as useful and easy to use.

H10: Chinese CDSDL adoption as sustainability has a positive influence on student satisfaction.

Justification: Student satisfaction is a crucial indicator of the effectiveness and success of educational initiatives and practices (Abuhassna et al., 2020). If students perceive CDSDL platforms as sustainable and aligned with their learning needs, they are more likely to adopt and engage with these platforms, leading to increased satisfaction with their overall learning experience.

By incorporating cultural dimensions such as power distance and collectivism etc., the study acknowledges the potential influence of cultural values on technology acceptance and adoption within the Chinese context. These dimensions are particularly relevant given the emphasis on self-directed learning, which may contrast with traditional educational practices and cultural norms in China.

Furthermore, the inclusion of these hypotheses aligns with the research objective of developing an integrated model that considers cultural factors in understanding CDSDL adoption and sustained use among undergraduate students in China.

It is important to note that while these hypotheses propose specific relationships between cultural dimensions and perceived usefulness/ease of use, the study should also explore and remain open to alternative perspectives or nuanced effects. Cultural dimensions are complex constructs, and their influence on technology adoption may vary across different contexts and individual characteristics. By providing clear justifications and explanations for the inclusion of cultural dimensions in the hypotheses, the revised version enhances the coherence and relevance of the hypotheses within the research context, addressing the concern raised in the comment.

1.7 Importance of Research

Students may use Chinese Danmaku video sites as learning resources for self-directed learning (Al-Qaysi et al., 2020). Evaluations of students' perceptions of these sites involve two stages: first, assessing their attitudes, adoption, and usage habits; second, evaluating how well the sites meet students' needs, emphasizing the utility of the sites for self-directed learning. The two stages are interconnected, as students must embrace these sites for self-directed learning before their utility can be properly assessed. However, current studies examining students' engagement with these sites often oversimplify both viewpoints and adoption's long-term sustainability. Expecting a basic model to remain effective in ever-evolving information technology settings without modification may not provide an accurate depiction of behavior across various technologies and adoption scenarios.

During the ongoing COVID-19 pandemic, Chinese Danmaku video sites and self-directed learning methodologies have largely replaced traditional face-to-face education (Lin et al., 2018; Zhang and Cassany, 2019). Integrating Danmaku video sites with self-directed learning methods enhances teaching and learning. These strategies enable lecturers to reach a global student audience (Van Mierlo & Beers, 2018). This research offers guidance for Chinese educational practices, emphasizing the importance of recognizing students' roles and enhancing their self-directed learning skills according to new lesson standards. It explores the relationship between self-directed learning and research in elementary education among university students using Chinese Danmaku video sites in a network learning environment, considering factors such as students' grades, gender, duration, and frequency of use. The findings contribute to understanding differences in self-directed learning, supporting skill development, and improving academic performance. Encouraging students to build a comprehensive understanding of the world is essential. Additionally, examining the current state of students' self-directed learning in a network learning environment helps students, teachers, and universities understand learning processes and address existing issues. Implementing targeted improvements can enhance self-directed learning skills among diverse college students through the use of Chinese Danmaku video sites.

For policymakers, the implementation of self-directed learning technologies such as Danmaku video sites can lead to significant cost savings by employing instructional designers (Zhang et al., 2019). These potential cost reductions may appeal to educational authorities in higher education institutions (Bo, 2020). Exploring faculty members' experiences with adopting these changes could support

the effective deployment of Danmaku video site technology for self-directed learning across university courses. This could, in turn, potentially enhance student learning outcomes.

1.8 Research Scope

This study integrates the unique features of Chinese Danmaku video sites as network learning environments with an investigation into the self-directed learning status of university students. The platform Bilibili is used as a self-directed learning strategy. This research can expand the scope of self-directed learning research while also demonstrating the depth and practical applicability of self-directed learning theories. Researchers recruited participants for this study using WeChat advertising. Purposeful sampling, rather than random sampling, is a common practice in social research because it is more cost-effective and saves time. The survey was self-administered, and participants were drawn from three Chinese universities. Since these universities recruit students from all 31 provinces in China, the participants are considered representative of Chinese university students. The study targets Chinese higher education students involved in CDSDL. The next section describes the data collection method using WeChat advertising in detail. The three universities were selected for sampling because they cover the entire country through different entry points in the Gaokao examination.

1.9 Research Limitation

These limitations offer recommendations for future research. First, this study used a cross-sectional research design to investigate factors influencing university students' intention to adopt Chinese Danmaku video sites. Cross-sectional data collection captures data at a single point in time, allowing researchers to explore associations but not causation or changes over time. University students' attitudes and behaviors may evolve as they gain experience, making a longitudinal study more appropriate to understand how the duration of use affects students' intention and adoption of Chinese Danmaku video sites for self-directed learning. Longitudinal studies track the same sample over time, enabling researchers to analyze changes in learning attitudes, behaviors, and outcomes with increasing experience. This approach contrasts with cross-sectional studies, which examine different samples at a single time point.

In recent years, smartphones have elevated the network learning environment, and new technological advances such as mobile apps have significantly changed the way online learning is conducted. Examining the impact of various factors in the network learning environment can help improve online learning experiences for university students.

The study's sample size was limited by the research requirements, but a larger sample of university students using the network learning environment in China might yield different findings. This research explores the relationship between self-directed learning among university students in Chinese Danmaku video sites as a network learning environment. However, the findings may not represent network learning environments worldwide. Researchers from other countries are encouraged to conduct

similar studies. A cross-cultural study could provide valuable insights by comparing information from different countries.

1.10 Operational Definition

Self-Directed learning (SDL) (Beckers et al., 2018)

Self-directed learning (SDL) is the process of independent and autonomous learning, where individuals take charge of their own educational journey. Bilibili, a major Chinese Danmaku video site, offers a platform that supports SDL experiences. On Bilibili, SDL involves learners actively engaging with the platform's content and resources to pursue their learning goals and interests. Students can explore a wide range of educational videos, tutorials, lectures, and other learning materials available on the platform, selecting topics, subjects, or creators based on their preferences and needs. Bilibili supports SDL through its interactive features, such as Danmaku, which allows users to leave real-time comments on videos. This functionality enables learners to share their thoughts, ask questions, and engage in discussions with other users, fostering active participation and collaborative learning. Learners can benefit from the diverse perspectives and knowledge shared by the Bilibili community. Teachers play a key role in SDL by providing students with learning resources such as textbooks, reference materials, case studies, and online resources to support their self-directed learning. Additionally, teachers should offer timely feedback to help students understand their academic performance and guide them towards improvement.

Chinese Danmaku video sites of self-directed learning strategies (CDSDL)

Chinese Danmaku Video Sites for Self-Directed Learning (CDSDL) refer to online platforms in China that integrate user-generated comments (known as "danmaku") overlaid on video content, creating an interactive and collaborative learning environment. These sites have gained popularity as a medium for self-directed learning, where users can access a wide range of educational content, including instructional videos, lectures, and tutorials, while engaging in real-time discussions and knowledge sharing. The term "danmaku" originates from the Japanese word "barrage," referring to the streams of comments that appear on the video screen, scrolling across in a synchronized manner. This feature allows viewers to contribute their thoughts, questions, and insights while watching the video, fostering a sense of community and enabling dynamic interactions among learners. CDSDL platforms typically offer a vast library of educational content spanning various subjects and disciplines, catering to diverse learning interests and needs. Users can browse and select videos based on their preferences, engage with the content at their own pace, and participate in discussions through the danmaku comment stream. One of the key advantages of CDSDL is the opportunity for peer learning and support. As users watch videos and contribute comments, they can benefit from the collective knowledge and perspectives of the community. Experienced learners can share their insights, while newcomers can seek clarification or feedback, creating a collaborative and supportive learning environment. These platforms have gained traction in China, where self-directed learning and informal educational opportunities are highly valued. CDSDL sites provide an alternative to traditional classroom settings, offering learners

flexibility, autonomy, and the ability to engage with educational content in an interactive and engaging manner.

Within the scope of this study, Chinese Danmaku Video Sites for Self-Directed Learning (CDSDL) refer to online platforms such as Bilibili and Youku that integrate the danmaku feature to facilitate interactive and collaborative learning experiences among undergraduate students majoring in primary education. The danmaku feature allows users to overlay comments on videos that flow from right to left across the screen, enabling real-time communication and knowledge sharing among learners. CDSDL emphasizes the learner's motivation, autonomy, and desire for self-directed learning (SDL), assuming that individuals possess autonomy influenced by factors such as age, experience, and intrinsic learning needs. Autonomy is closely linked to SDL, and understanding this connection can help identify factors that aid or impede individuals' efforts in self-directed learning. On CDSDL platforms like Bilibili, students can watch video content while posting comments in real-time, creating an interactive learning community. This feature allows students to communicate with other learners, share ideas, ask questions, and receive timely feedback from teachers, enhancing their learning experience. Despite China's conventional reading orientation from left to right, viewers can easily follow the danmaku comments. CDSDL enables students to independently choose their own learning paths, deciding what and when to learn without the constraints of traditional educational curricula. Bilibili, as a popular CDSDL platform among Chinese university students, serves as a key example for exploring the concept of danmaku video sites for self-directed learning. In this study, CDSDL will be operationalized by assessing participants' frequency and duration of engagement with danmaku-enhanced learning materials on platforms like Bilibili, as

well as their perceived benefits and challenges associated with CDSDL usage. The study aims to understand the factors influencing SDL on these platforms and how CDSDL can support or hinder self-directed learning efforts among undergraduate students majoring in primary education.

Technology Acceptance Model (TAM)

The Technology Acceptance Model (TAM) is a highly influential and widely adopted theoretical framework in the field of information systems. Developed by Fred Davis in 1989, TAM aims to explain and predict user acceptance and adoption of new technologies by examining the motivational factors that shape individuals' attitudes and behaviors toward using a particular system or technology. At the core of TAM are two key determinants: perceived usefulness and perceived ease of use. Perceived usefulness refers to the degree to which an individual believes that using a specific technology will enhance their job performance or productivity. It captures the user's perception of the potential benefits and advantages associated with the technology's application. Perceived ease of use, on the other hand, relates to the degree to which an individual believes that using the technology will be free of effort. It reflects the user's assessment of the system's ease of learning, comprehension, and operation. According to TAM, these two factors – perceived usefulness and perceived ease of use – directly influence an individual's attitude toward using the technology, which in turn shapes their behavioral intention to use it. Behavioral intention, as postulated by the model, is a strong predictor of actual technology use and adoption. TAM also suggests that perceived ease of use can indirectly influence behavioral intention through its effect

on perceived usefulness, as technologies that are easier to use are often perceived as more useful. TAM has proven to be a robust and parsimonious model, widely employed in various domains to understand and predict user acceptance of various technologies, including software applications, mobile devices, e-learning systems, and emerging technologies. Its simplicity and adaptability have contributed to its widespread adoption, and numerous extensions and modifications have been proposed to enhance its explanatory power and applicability in different contexts.

The Technology Acceptance Model (TAM) is a theoretical framework utilized in this study to assess the extent to which undergraduate students majoring in primary education perceive Chinese Danmaku Video Sites for Self-Directed Learning (CDSDL) as useful and easy to use. Perceived usefulness will be measured by participants' ratings of how CDSDL enhances their learning outcomes and experiences, while perceived ease of use will be assessed based on participants' perceptions of the usability and accessibility of CDSDL features.

Perceived Usefulness (PU)

Perceived usefulness refers to an individual's belief that adopting a particular system will enhance their performance (Kamal et al., 2020). In the context of Chinese Danmaku video sites for self-directed learning (CDSDL), learners view Bilibili and its features as useful for achieving their learning goals. In CDSDL, students' perceived usefulness encompasses their perceptions of the site's actual or subjective value and

benefits. This perceived usefulness can impact students' satisfaction with a Chinese Danmaku site for self-directed learning by influencing their willingness to engage in self-directed learning, participate in interactions, and see the site as a valuable resource for their academic or personal interests.

Perceived Ease of Use (PEOU)

Perceived ease of use refers to the belief that using a particular system requires minimal effort (Kamal et al., 2020). In CDSDL, learners find Bilibili's interface and functionalities easy to navigate and use in their self-directed learning. Students can adjust parameters such as Danmaku playback speed, font color, and masked words on Bilibili's page to suit their preferred learning style, making the platform easy to operate. In CDSDL, students' perceived ease of use relates to whether they find the site's interface and functionality easy to understand, navigate, and operate. This perception influences whether the site meets their needs and provides a seamless learning and interactive experience. Perceived ease of use is crucial to the student learning experience. If students find self-directed learning lessons on the website challenging to use or the interface confusing, their learning outcomes and motivation may be negatively affected. Therefore, the design and functionality of Danmaku video sites should be optimized to ensure that students can easily access, discover, and engage with valuable video content and interactions. This contributes to student satisfaction and supports effective self-directed learning.

Facilitating Conditions (FC)

Facilitating conditions refer to an individual's perception of available resources and support for performing a behavior (Venkatesh et al., 2012). In the context of CDSDL, learners view the availability of resources and support on Bilibili, such as educational content and interactive features, as facilitating conditions for their self-directed learning experiences. In this study, facilitating conditions directly impact students' usage behavior. On Chinese Danmaku video sites, facilitating conditions for students include factors and environments that encourage and support their active participation in learning and interaction. Teachers can post high-quality course content aligned with the course syllabus on Danmaku video sites and respond promptly to students' questions in pop-up comments. Students can engage with course materials according to their own learning needs and schedules, and these facilitating conditions can help students participate more actively in their learning, enhancing their satisfaction with their self-directed learning.

Social Influence (SI)

Social influence refers to the extent to which individuals are swayed by others' opinions regarding a particular technology (Venkatesh et al., 2012). In the context of CDSDL, learners' decisions to engage with Bilibili for self-directed learning can be shaped by their peers' opinions and recommendations or the views of online community members. In CDSDL, students' social influence also encompasses the impact of their interactions with other students. Sharing academic, curricular, or

cultural perspectives can have positive, negative, or neutral effects on learners. This dynamic can play a significant role in shaping students' engagement and experiences on the platform.

Personal Cultural Values

Personal cultural values refer to the deeply ingrained beliefs, attitudes, norms, and preferences that individuals acquire through socialization within a particular cultural context. These values shape an individual's worldview, behaviors, and decision-making processes, acting as guiding principles that influence various aspects of their lives, including their interactions with technology. Cultural values can be conceptualized along several dimensions, such as power distance (the extent to which individuals accept and expect unequal distributions of power), uncertainty avoidance (the degree of tolerance for ambiguity and uncertainty), individualism/collectivism (the prioritization of individual or group interests), masculinity/femininity (the emphasis on traditionally masculine or feminine values), long-term orientation (the degree of future-oriented pragmatism), and indulgence/restraint (the extent to which individuals indulge or restrain their desires). These cultural dimensions can manifest in various ways, influencing individuals' perceptions, attitudes, and behaviors toward technology adoption and use. For example, individuals from cultures with high uncertainty avoidance tendencies may be more hesitant to adopt new technologies due to a preference for established norms and aversion to ambiguity. Conversely, those from individualistic cultures may place greater emphasis on personal achievement and be more inclined to adopt technologies that enhance individual productivity and

performance. Understanding the influence of personal cultural values on technology acceptance and use is crucial, as it can help organizations and researchers tailor their approaches to technology implementation, training, and communication to better align with the cultural contexts of their target users. This consideration can lead to more effective technology adoption, increased user satisfaction, and ultimately, improved organizational performance.

Personal cultural values, including power distance, uncertainty avoidance, masculinity, and collectivism, are key factors examined in this study to understand how cultural dimensions influence undergraduate students' perceptions and behaviors related to CDSDL adoption. These cultural values will be measured using validated scales and instruments adapted to the cultural context of the participants, allowing for a nuanced exploration of their impact on technology acceptance and usage.

Power Distance (PD)

Power distance reflects an individual's acceptance of power disparities and inequality as a societal norm (Srite & Karahanna, 2006). In the context of CDSDL, learners' power distance orientations may influence their engagement with Bilibili, as they may value or perceive hierarchical structures and authority within the platform. In CDSDL, students' power distance stems from three main sources: First, the level of student management and control over the site. If the site is managed and maintained by the students themselves or by teachers, they may have more power and autonomy to decide on content, rules, and community guidelines. Second, the degree of student

control over educational content. If students can choose their own learning paths and select from multiple content providers, they may experience greater autonomy and power.

Lastly, power distance between students and other users can be seen in social interactions and pop-up comments. Students may feel more empowered in social interactions if they are free to express their views, ask questions, and engage with others. Less power distance may encourage more active learning and engagement, as students feel a greater sense of autonomy and influence. However, a balance in power distance is important to maintain an organized and high-quality learning community and content.

Uncertainty Avoidance (UA)

Uncertainty avoidance refers to an individual's tolerance for ambiguity and willingness to take risks (Srite & Karahanna, 2006). In the context of CDSDL, learners' levels of uncertainty avoidance may influence their exploration and openness to trying new learning approaches or resources on Bilibili. Students' uncertainty avoidance can impact their willingness to engage in self-directed learning, post comments, or interact with others on Danmaku video sites. For instance, some students may hesitate to voice their opinions or questions in Danmaku comments, fearing criticism or opposition from peers or teachers. This fear may lead them to remain silent due to uncertainty about the potential outcome. Additionally, students may prefer sticking to familiar traditional learning methods instead of experimenting

with new self-directed learning approaches on Danmaku video sites, fearing that these methods may result in failure or uncertain outcomes. Uncertainty avoidance can hinder student learning and engagement by limiting their willingness to explore new learning opportunities.

Collectivism (COL)

Collectivism refers to the degree to which individuals prioritize group needs over personal ones and view themselves as part of a collective rather than as individuals (Srite & Karahanna, 2006). In CDSDL, learners' collectivist orientations may shape their engagement with Bilibili's community-based learning and collaborative features. Students with collectivist orientations tend to emphasize teamwork, social interaction, and knowledge sharing over individual learning and achievement. This focus on collaboration and group success can enhance their experience on Bilibili, as they engage in community-based learning and benefit from the collective knowledge and perspectives of others.

Masculinity (MASC)

Masculinity represents the extent to which individuals endorse values associated with assertiveness and competitiveness (masculine) or warmth and cooperation (feminine) (Srite & Karahanna, 2006). In CDSDL, learners' masculinity orientations may influence their preferences for content and interactions on Bilibili. Students in

CDSDL may exhibit confidence in their own opinions and decision-making, displaying a willingness to think and act independently without relying on others. They may also display a certain degree of assertiveness in social interactions, attempting to dominate discussions, steer the direction of conversations, or present their views as authoritative.

Task-Technology Fit (TTF)

The Task-Technology Fit (TTF) framework, introduced by Dale L. Goodhue and Ronald L. Thompson in 1995, emphasizes the importance of aligning technology characteristics with the requirements of the tasks it is intended to support. The central premise of TTF is that the degree of fit between the functionality and capabilities of a technology and the demands of the tasks it is designed to facilitate will influence the extent to which that technology is effectively utilized and its potential benefits are realized. TTF framework suggests that a high degree of task-technology fit leads to better performance outcomes and increased utilization of the technology. Conversely, a poor fit between the technology and the tasks it supports can result in inefficiencies, underutilization, and a failure to achieve the desired outcomes. The framework considers various aspects of both the technology and the tasks it supports, such as data quality, system reliability, ease of use, and functionality, as well as task characteristics like complexity, interdependence, and time criticality. By evaluating the alignment between these factors, TTF provides a lens through which to assess the suitability and effectiveness of a given technology for specific tasks or job roles. TTF has been widely applied in various contexts, including the adoption and utilization of enterprise

systems, mobile technologies, and e-commerce platforms. It offers a valuable perspective on the importance of considering the task-technology fit as a critical factor in ensuring the successful implementation and effective use of technologies within organizations and other settings.

The Task-Technology Fit (TTF) framework, as applied in this study, examines the degree to which CDSDL aligns with the learning tasks and objectives of undergraduate students majoring in primary education. TTF will be operationalized by assessing the compatibility between CDSDL features and the specific learning needs and preferences of participants, as measured through surveys and interviews. Task-Technology Fit (TTF) is essential for evaluating user performance. The TTF model assesses the alignment between technology utility, task requirements, and users' skills in utilizing technology (Wu & Chen, 2017). In CDSDL, the fit between Bilibili's features and learners' self-directed learning tasks affects their satisfaction and engagement with the platform.

Student Satisfaction (SS)

Student satisfaction (SS) refers to students' contentment and overall positive experience with their studies (Abuhassna et al., 2020). In CDSDL, learners' satisfaction with Bilibili's learning resources, interactive features, and community engagement plays a crucial role in their sustained use and continued adoption of the platform.

Sustainability in Higher Education

Sustainability in higher education refers to the integration of environmentally responsible, socially equitable, and economically viable practices within educational institutions and initiatives. It encompasses a holistic approach to ensuring the long-term viability and positive impact of educational programs and activities on students, faculty, local communities, and society at large. Environmental sustainability in higher education involves minimizing the ecological footprint of educational institutions through initiatives such as energy efficiency measures, waste reduction, sustainable procurement practices, and the promotion of environmentally conscious behaviors among students and staff. Social sustainability focuses on promoting diversity, inclusion, and equal access to educational opportunities, fostering a sense of community, and contributing to the overall well-being and empowerment of individuals and communities. Economic sustainability involves the efficient and responsible management of financial resources, ensuring the long-term financial viability of educational institutions and programs while considering the broader economic impacts on stakeholders, such as students, faculty, and local communities. Sustainable practices in higher education are often guided by principles of environmental stewardship, social justice, and ethical decision-making. They may include initiatives such as green campus initiatives, community outreach programs, curriculum redesign to incorporate sustainability concepts, research on sustainable technologies and practices, and collaboration with local and global partners to address pressing sustainability challenges. By embracing sustainability in higher education, institutions can not only reduce their environmental impact and foster social equity but also equip students with the knowledge, skills, and values necessary to address

complex sustainability issues in their future careers and lives. Ultimately, sustainable higher education aims to prepare future generations to be responsible global citizens and contribute to the creation of a more sustainable and equitable world.

Sustainability in the context of higher education, as explored in this study, pertains to the long-term viability and effectiveness of CDSDL initiatives in promoting positive learning outcomes and experiences among undergraduate students majoring in primary education. Sustainability will be evaluated based on indicators such as the persistence of CDSDL usage over time, its impact on students' academic performance and satisfaction, and its alignment with institutional goals and objectives for educational innovation and quality improvement.

1.11 Thesis Organizations

The study is divided into five chapters, each covering a specific theme and key content related to the study strategy outlined above.

Chapter 1 addresses the research background, research problems, research questions, research hypotheses, and the research conceptual framework.

Chapter 2 analyses relevant educational learning theories, provides an overview of Danmaku learning strategies and self-directed learning, and integrates the analysis of TTF and TAM theoretical research variables. It introduces new research variables such as facilitating conditions, social influence, and individually espoused

cultural values based on learners' individual characteristics. The chapter reviews these variables and constructs a theoretical model for the research.

Chapter 3 presents and analyses the research methodology, research design, research sample, research instrument, sample recovery, and data analysis techniques. The thesis used SPSS version 22 and AMOS version 22 to analyze the sample data, conduct reliability and validity analyses, and perform confirmatory factor analysis (CFA).

Chapter 4 covers a preliminary exploration of relationships between various research variables, research model factor analysis, path analysis, and research model verification. It also answers the research questions of the study based on survey data, offering initial findings on students' self-directed learning technology adoption behavior using Chinese Danmaku video sites.

Chapter 5 includes a research summary, research innovations, research limitations, and discussions on future research directions.

This research examines the adoption of Chinese Danmaku Video Sites for Self-Directed Learning (CDSDL) among undergraduate students in China. The study integrates the Technology Acceptance Model (TAM), Task-Technology Fit (TTF) model, and cultural factors to develop a comprehensive framework for understanding CDSDL adoption and sustained use.

Key research objectives include identifying factors influencing CDSDL adoption, developing an integrated model, and validating acceptance and intention to use CDSDL among undergraduate students. The study proposes several hypotheses exploring relationships between perceived usefulness, perceived ease of use, facilitating conditions, social influence, cultural characteristics, task-technology fit, and student satisfaction.

The research emphasizes the importance of understanding CDSDL adoption in the context of China's higher education system, particularly during the COVID-19 pandemic. It aims to provide insights for educational practices, policymakers, and institutions to enhance self-directed learning experiences and outcomes.

The study acknowledges limitations such as its cross-sectional design and sample size constraints. It suggests future research directions, including longitudinal studies and cross-cultural comparisons. The findings are expected to contribute to the development of self-directed learning theories and practices, particularly in the context of Chinese higher education and online learning environments.