A Grounded Theory Study of the Psychological Distance in Online Education

Ling Zhang[1], Jiang Ye[2*] and Jing-xuan Wang[1]
[1]College of Management Science, Chengdu University of Technology, China // [2]College of Earth Sciences, Chengdu University of Technology, China // zhangling@cdut.edu.cn // yejiang@cdut.edu.cn // wjx7828@163.com
[*]Corresponding author

ABSTRACT: In educational reform, people actively promote educational innovation by applying intelligent technology. As the main participants in education, people experience a series of psychological and cognitive changes in the teaching process. This autonomy and uncertainty will directly affect the effect of network teaching. Due to the variability in the characteristics of individuals, following the psychological perception and subjective value of people and optimizing the development of wisdom education with a reasonable technical cognitive attitude have become a focus. This study uses the grounded theory method to conduct in-depth interviews and questionnaire surveys on 330 e-learners and extracts 400 codes, 38 concepts, 9 categories and 4 core categories. This paper reconstructs the theoretical model of psychological distance in the network education process and identifies four new dimensions: cost distance, initiative distance, control distance and interaction distance. In addition, the four dimensions reflect four core value needs of learners for online education: convenience, self-efficacy, self-identity and binding force. The paper provides a good theoretical basis to improve the user experience and satisfaction in online education and optimize the level of intelligent education.

Keywords: Online education, Psychological distance, Grounded theory

1. Introduction

The sudden onset of COVID-19 has challenged education systems, and education reform, which has been pushed to the forefront, cannot be delayed. All courses have been transferred to online, which is a real and thorough internet + teaching practice for all universities. How to better apply smarter technology in education and provide informative and intelligent education has become a new focus of scholars. Overall, the development and progress of online education practices have occurred with the progress and use of educational technology. Technology enables educators to overcome common learning barriers in online education. For example, Cantabella et al. (2020) proposed a new tool to evaluate students' satisfaction using smileys, and Villagrá-Arnedo et al. (2020) proposed the construction of an achievement prediction system to help teachers gain insight into students' learning trends. However, although technology has done its best to bring online learners "closer" to schools and courses, the impact of "distance" in online education is still far-reaching. This is because as the main participants in education, the psychological perception of people is changing and uncertain. In the distance learning process, what types of participation in relevant cognitive and psychological processes are best (Breves & Schramm, 2021)? How can we highlight the proximity of learning (Afrouz & Crisp, 2021)? We need to put forward the right cognitive attitude toward technology. We must pay attention to learners' user experience from people's psychological perception and subjective value and improve the effect of network teaching through user satisfaction to optimize the development of intelligent education.

1.1. Literature review

1.1.1. Research on the user experience of online education

Some scholars have used the theory of "sense of social presence" to analyze user experience problems and sought to enhance the effect of online education. For example, Kwon (2011) explored the impact of social presence on learning outcomes and the relationship between social presence and learners' characteristics. Kožuh et al. (2015) analyzed the influence of social presence and interaction on the success of students in the learning environment. However, teaching scene simulation is only one form, and not every learner can actively participate in consciousness and achieve good learning results. Many scholars have also researched the influence of other factors. By testing a model of online learner participation, Vayre and Vonthron (2017) demonstrated that self-efficacy only mediates between the sense of community and the sense of participation. Bellotti et al. (2013) and Orlando (2015) discussed using game design in online education to keep students interested. Warren and Nash (2019) explained how online consulting education used the art of expression to increase people's awareness.

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Farrell et al. (2016) mentioned that the interaction between learners and online interfaces, content, and other learners was an important consideration in designing online education courses. Matcha et al. (2019) created a model for user-centered learning analytics systems.

In the research on online education user experience, scholars observe different perspectives (such as self-efficacy, transaction distance and satisfaction, interest stimulation, perceived service quality, and emotional interaction), which resulted in different attribution analyses of online education user experience. Both quality of user experience and satisfaction are the results of multiple psychological perceptions of the learners. Can we explore the advantages and disadvantages of user experience and identify the factors that affect the user satisfaction from multiple angles and distances of learners' psychological perception?

1.1.2. Research on psychological distance

The concept of psychological distance was proposed by Bullough (1912) in the field of philosophy and aesthetics in 1912. He pointed out that the generation of beauty arises from the psychological distance between the subjective perception of the observer and the artwork. Liberman and Trope (1998) first introduced psychological distance into the field of social psychology in 1998. They suggested that psychological distance refers to people's subjective experience of approaching or moving away from the reference point of a certain thing and that they make judgments based on how they feel in the moment (Trope & Liberman, 2003). Dhar and Kim (2007) asserted that psychological distance is the subjective distance between the parties and the event in the psychological space of the parties. Therefore, the definition of psychological distance mainly involves three points: first, an individual has a subjective experience of the target; second, the experience has different psychological dimensions; and third, the origin of the distance is the observer itself. Integrating the thoughts of several researchers, this study summarizes the concept of psychological distance as follows: psychological distance constitutes the subjective distance between the self and the event in the psychological space of the self when the self is taken as the origin of the distance.

Tolman (1932) was the first to define the dimension of psychological distance. Later, Bar-Anan et al. (2006) explored the correlation between construal level theory (CLT) (people's mental representation of cognitive objects or events shows different degrees of abstraction (Liberman & Trope, 1998; Trope & Liberman, 2003) and psychological distance. Amit et al. (2009) and Bar-Anan et al. (2006) asserted that there is a potential, automatic and regular relationship between psychological distance and CLT. Bar-Anan et al. (2007) proposed four dimensions of psychological distance based on CLT. Most modern studies are based on Trope's four psychological distances:

- Temporal distance: the distance between the target event in the past or the future and the individual in time;
- Spatial distance: how far the stimulus or target event is from the center in space;
- Social distance: the affinity or similarity between the social object and center;
- Hypothetical distance: the proximity of an event or object to reality or the probability of its occurrence or existence.

As the distance system of CLT, the psychological distance is not perfect. Whether there are other distance dimensions has always been controversial. Liberman et al. (2007) claimed that in addition to the above four dimensions, the psychological distance should include others. Based on the perspective of social psychology, this paper reviews the relevant literature and summarizes the psychological distance dimensions studied by many scholars (see Table 1).

Table 1. List of psychological distance research dimensions

Researchers	Dimensions
Tolman (1932)	Spatial dimension, temporal dimension, energy input dimension
Engebretson (1973)	Interaction distance
Boroditsky & Ramscar (2002)	Temporal dimension, spatial dimension
Bar-Anan et al. (2006)	Temporal distance, social distance, spatial distance, probability of occurrence
Liberman et al. (2007)	Spatial dimension, temporal dimension, social dimension, hypothetical dimension
Fiedler (2007)	In addition to the four dimensions of psychological distance proposed in traditional studies, information distance, perspective distance, emotional distance and experience distance can also be used as research dimensions

Maglio & Polman (2014)	Based on the four classical dimensions, the research on psychological distance is expanded from a static spatial position to a dynamic moving point in space
Chen & Guibing (2014)	Temporal distance, social distance, probability distance
Chen & Li (2018)	Experiential distance, behavioral distance, emotional distance, cognitive distance, spatial and temporal distance, objective social distance
Horvath (2018)	Identification distance, safety distance, value distance, control distance
Li et al. (2019)	Cognitive distance, emotional distance, expectancy distance, behavioral distance
Liu et al. (2020)	Spatial distance, temporal distance, social distance, hypothetical distance

1.1.3. Research on psychological distance in the field of education

In recent years, the theories of CLT and psychological distance have also been widely used in the field of education. Vaughn and Baker (2004) found that psychological distance contributes to teaching effects and satisfaction. Lee (2010) examined the relationships among the psychological distance perceptions of students and online teachers, academic performance, and willingness to continue online learning. Zhbanova and Rule (2014), using CLT, noted that focusing on distant (distal), in contrast to near (proximal), content promotes mental levels of abstract thought increasing creative performance. Ho et al. (2015) discussed the problem that users' CLT and perception of e-learning systems affect their willingness to adopt. Neroni et al. (2015) explored the biological and psychological factors associated with learning achievement in adult distance education. Lee et al. (2017) took four university courses as the object of study to explore the effect of cognition of instructors, tutors and students on the role of tutoring and whether tutoring affects the psychological distance between different types of participants. Sungur et al. (2017) discussed the meaning of psychological distance and CLT in the context of online inspiration and persuasion. Weidlich et al. (2018) examined the relationship between transaction distance and satisfaction in the context of distance education.

The literature reveals that scholars have conducted extensive research on students' behavior, attitude and views from the perspective of psychology, enhanced their comprehensive understanding of education, and laid a good foundation for the development of network education research. However, the theory and framework of psychology have not matured. According to CLT, the underlying psychological mechanism is not fully developed, including the psychological distance. We found that in the new environment of online education, the four dimensions widely used by most scholars (Bar-Anan et al., 2007) cannot explain the psychological perception and behavioral results of online learners well. For example, a student has strong expectations for the learning effects of an online course and has a well-functioning computer and independent space, but he often cannot complete the course and always gives up halfway through it. Interviewing different respondents, we found that the reasons for this occurrence are diverse: because there are too many learning resources, they develop choice anxiety and linger in multiple courses; although they have a clear goal, they cannot successfully complete the course due to laziness or procrastination; their learning interest is not stimulated due to the lack of full interaction with teachers or synchronous learners, whether in troubleshooting or creating classroom atmosphere. Are there other new dimensions of psychological distance that can explain the user experience and behavior of learners in online education? This study will construct a new dimension of psychological distance in the online education process based on the psychological perception of online learning users and the extensive collection of all types of learner data.

1.2. Grounded theory

Grounded theory was first proposed by two American scholars, Glaser and Strauss (1967) in The Discovery of Grounded Theory. Grounded theory is not a fixed theory but a research approach or "methodology" in the field of qualitative research. The purpose of the research is to put forward the theoretical concept and clarify it through the systematic collection and analysis of empirical data, existing literature and researchers' knowledge to excavate the connotation and extension of the concept from practice. If the connotation and extension of theoretical concepts have been well explained and widely supported, quantitative research is suitable for verification; if the connotation and extension are unclear or controversial theoretical concepts remain, it is more suitable to adopt qualitative research, especially qualitative research based on the grounded theory research method. Grounded theory is especially suitable for research fields that lack theoretical explanation or the explanatory power of existing theories and research on the micro- and action-oriented social interaction process (Corbin & Strauss, 2014). However, in grounded theory, discovery is guided by data collection and inductive analysis instead of by existing theoretical models (Sahoo et al., 2015). It is innovative instead of verifiable.

Some scholars have also proposed that content analysis and coword analysis can be used to construct some theories, but the difference between them and grounded theory is that grounded theory is the overall methodology to systematically collect and analyze data. Content analysis is the collection and analysis of specific data in specific situations and only one of many data collection methods based on grounded theory. Coword analysis is only a part of content analysis, such as the relationship between word frequency and word meaning, but this simple relationship cannot fully satisfy the requirements of using grounded theory to explain the real situation (Krippendorff, 2018).

This study focuses on the issue of psychological distance, which has been controversial among scholars. In addition, in the network education environment, the real experience and behavior of learners can no longer be explained by the existing dimension of psychological distance. Therefore, the grounded theory method is appropriate in this study.

A literature review has found that this method is rarely used in the psychological distance in the online education process. Only Green (2013) used the grounded theory method to describe the social process of relative distance, and it was found that participants paid more attention to some learning achievements than others. However, it does not truly involve the discussion of the complete dimension of psychological distance in the online education process. Therefore, this study completely relies on learner data, uses grounded theory to summarize and refine the dimension of psychological distance, and seeks to build a theoretical model of the psychological distance against the background of network education.

2. Materials and methods

2.1. Research steps

We follow the Glaserian or "classic" method to generate the grounded theory. This approach begins with identifying categories of behavior (open coding) to determine the core categories that represent the central idea or structure of the research. Then, selective classification analysis of the concepts and core categories is conducted (selective coding). Finally, theoretical coding is used to generate concepts that explain the relationships between the integrated core categories and other elements (Gasson & Waters, 2013).

The specific research steps of this paper are as follows: first, user groups are selected according to the theoretical sampling requirements; second, secondary information is collected from official online education websites, official apps, major forums, and other channels; third, according to the secondary data collation results, an interview outline is drawn up, and in-depth interviews are conducted to obtain primary data; fourth, based on the rules of grounded theory and coding techniques, the theoretical model of the new dimension of psychological distance in online education is extracted; and fifth, a saturation test is conducted.

2.2. Sampling procedure

American online education is mainly supplied by large-scale colleges, public colleges, and private nonprofit colleges and shows high concentration. According to a report released by the Sloan Alliance in 2017, 47.7% of online education students are concentrated in approximately 5 percent of schools. The top 47 schools, accounting for only 1% of the total number of schools, contain 23% of the total online education population. In China, according to a 2018 white paper on China's online education industry released by iMedia in December 2018, learners aged 16-35 are the main age group of online education users, accounting for 62.1% of the total number of online education users; learners aged 16 to 45 account for 84%.

Young people, especially those still in the stages of education and career advancement, and middle-aged people constitute the main body of online education users.

Consequently, high school students, college students, graduate students, and young people entering the workforce were selected as the respondents in this study. The age range was concentrated in the 17-35 age group, with an equal number of males and females, and we followed the nonprobability sampling principles of purposeful sampling and heterogeneous sampling. To ensure that the interviewees could provide the information needed for this research, we sought to cover as many different types of interviewees as possible, recruiting participants from different industries, with different education levels, with different learning objectives and from

different regions. When using a purposeful sampling method, potential participants are deemed eligible, and their insights enable exploration of the phenomena of interest (Creswell, 2006).

2.3. Sources

From January to April 2020 and January to March 2021, we collected and sorted the primary and secondary data, providing opportunities for data testing through a variety of data collection techniques (Holt et al., 2017). Secondary information was mainly collected from the official websites, official apps, and official microblogs of MOOC (massive open online courses) and NetEase Cloud classrooms. Some data were also obtained from ZhiHu.com. Through keyword searches, we obtained a total of 35 relevant materials. The search content was mainly related to online education and learning environments, learning efficiency, classroom interaction, personalization, learning self-discipline, Q&A and other high-frequency keywords.

The primary data were collected through in-depth interviews and questionnaires. According to Patton (2014), creative fieldwork means using all of the researcher's senses to experience and understand what is happening. Creative insight comes from being directly involved in the situation under study. Therefore, the focus of this study was on collecting original data in the form of in-depth interviews. Before the interviews, an in-depth interview outline was designed to develop the research in accordance with the results of the secondary data collection. During the interview process, the focus of and questions asked during the interviews did not strictly follow the outline but were adjusted according to the interviewees and the progress of the interview. It is not possible to know the exact number of study participants who will be sampled before a study begins (Foley & Timonen, 2015). Ultimately, through screening, we conducted in-depth interviews with 52 respondents online.

The questionnaire method in this study involved integrating the interview outline into a set of items and sending them to the research subjects via the internet to supplement or verify the interview results. A total of 278 supplementary questionnaires were analyzed.

For convenience, the in-depth interviews and questionnaire surveys were mainly conducted in China. The respondents were 330 online education users in Sichuan, Beijing, Jilin, Qinghai, Shanxi, Shanghai, Shenzhen, Yunnan and Guangzhou, and most were high school students, college students, and graduate students, with a few young men who had just started working. The interviewees were interviewed for approximately half an hour. The interview steps were as follows:

2.3.1. Interviewee recruitment

In general, grounded theory research involves deliberately selecting participants who can provide valuable insight into the research topic (Sbaraini et al., 2011). Therefore, we used the following two approaches. (i) The online education platform "course evaluation" or "discussion board" features were used to find interviewees, explain the purpose of the research, ensure understanding and obtain consent, and conduct the interviews. (ii) Following the theoretical sampling principle, this study selected various types of interviewees from different regions, identities, age stages, and industries, as shown in Table 2.

Table 2. Data collection method

	High school students (person.)	College students (person.)	College students just entering the workplace (person.)	A graduate student (person.)	Combined (person.)
Questionnaires	84	102	47	45	278
In-depth interviews	12	24	9	7	52
Combined	96	126	56	52	330

2.3.2. Design of the interview content

The interview outline used in this study was based on the prior collection and analysis of secondary data. The questions related to three stages of online education.

(i) Before online education (preparation)

- What are the reasons you chose online education? Which platform...
- What's your expectation for every online learning course? What is the basis?

(ii) Online education in progress (actual results)

- Offline learning status? Online learning status and mindset? What makes these differences for you?
- Which learning efficiency do you think is more efficient for you? Why?
- Will your psychological feelings affect your final learning effect? If so, what is your specific psychological feeling?

(iii) After online education (experience)

- Usually, after your actual experience, have you met your expectations for online learning? If not, what do you think is the reason?
- Do you take the initiative to give feedback with learning questions, feelings and suggestions to teachers and platforms? What is the reason?

2.2.3. Interview principles

Lofland (2006) suggested that the principal obligation of the researcher to the respondents is to guarantee anonymity through a "confidentiality agreement." Therefore, the respondents' responses were kept strictly confidential in this study. The interview content was saved in the form of text. The data were sorted within 24 hours after each interview to ensure that the meaning expressed by the interviewees was accurately recorded.

3. Results

After the data were collected and preliminarily sorted, grounded theory was applied to conduct further in-depth analysis in three main steps: open coding, axial coding and selective coding (Corbin & Strauss, 1990). The grounded theory terms relevant to data analysis are explained below (Corbin & Strauss, 2014).

- Concept: A conceptual label attached to an individual event, case, or phenomenon.
- Category: When a group of concepts all refer to the same phenomenon, they are identified by a higher and more abstract concept called a category.
- Core category: A categorical concept used to encompass the events or phenomena reflected in the case as a whole.
- Dimension: A subdivision of a category based on certain attributes that enables a better understanding of the meaning of the category.
- Context: If the case has clear category dimensions, this case-specific content can be referred to as the location of the dimension. The context is a set of special conditions in which action or interaction strategies occur.
- Storyline: The main thread of the case story summarized in one sentence.

3.1. Open coding

Open coding refers to encoding the similarities and differences in the data; the data are constantly compared with new data indices and concepts to create new concepts (Patton, 2014). In this process, the names of the concepts and categories come from the literature, interview records, and discussion among the researchers. The name can be a word, a phrase, or even a short sentence, not just a simple "abstract." In this study, Michael Quinn Patton's mutual comparison method was used to determine whether to continue data collection. If 20 consecutive texts were compared with each other and no new content was found, data collection was stopped. Examples of concepts and open coding from this study are presented in Table 3. The code ai represents the original interview sentence. The code Ai indicates a refinement of the original interview statement. The code bi refers to the conceptual content. The code Bi represents the categorized content.

Table 3. Examples of concepts extracted from the original data (sorted by source)

Interview notes (ai)	Memo (ai)	Conceptualization (bi)
(a2) At noon at the company lunch, I can also watch some micro courses on software application skills on my mobile phone.	A2 Not limited by learning places	b9 Study anywhere
…	…	…
(a29) Usually, I can easily find the online courses I need, but sometimes I can find too many courses. It may be difficult to choose the ones that truly suit me.	A29 Find suitable online courses online	b17 Accuracy of resource selection
…	…	…
(a32) In my studies, if I constantly encounter problems, I will be very flustered and depressed. If I know that the people studying with me are the same, I will feel better and have more confidence to solve problems.	A32 Common experiences of CO learners	b33 Peer motivation
…	…	…
(a147) For simple or mastered knowledge content, I can choose to watch it faster to save learning time and improve efficiency.	A147 Watch course at double speed	b6 Save time watching learning
…	…	…
(a266) I cannot concentrate on my studies alone. I always have to think about other irrelevant things in my mind.	A266 Inability to concentrate	b26 Short attention span
…	…	…
(a384) This teacher is a famous teacher at Peking University. I think I can learn better!	A384 Excellent teachers enhance learning confidence	b23 Expectations of teachers
…	…	…

Through the open coding of the psychological distance data from the interviews on online education, 38 concepts were abstracted, as shown in Table 4.

3.2. Axial coding

Through the above collation and analysis of the data, we sought to establish preliminary relationships among the categories and concepts. By exploring these relationships, the concepts could be used to develop the categories in more detail (Foley & Timonen, 2015). Therefore, this paper now turns to the relationships among the categories.

The main task of axial decoding is to identify and establish the relationships among categories, which can be causal, similarity, difference, equivalence, structural, or functional relationships, among others.

The typical model is an important analytical tool in the grounded theory approach, and it is an effective means to connect and further explore the categories. It contains six aspects – causal conditions, phenomena, context, mediating conditions, action/interactive strategy, and results – which are used to guide the sorting and analysis of the categories (Corbin & Strauss, 1990). In the third edition of Strauss's book, Corbin modified this model by adding "emotion" to the "action/interaction" section (Corbin & Strauss, 2014).

With the help of this model, this paper constructs the relationships among the concepts and categories, as shown in Table 4.

Table 4. Correspondence between concepts and categories

Number	Category	Concept
B1	Time	b1 Commissioning time
		b2 Time for complete mastery of knowledge
		b3 Dressing time
		b4 Arrange time independently
		b5 Time to deal with interference events
		b6 Save time watching learning
		b7 Fragmented time utilization

B2	Space	b8 Learning environment is more comfortable
		b9 Study anywhere
		b10 Shorten the distance from high-quality curriculum resources
B3	Resources	b11 More kinds of learning resources
		b12 Multiple learning platforms
		b13 Free resources
		b14 High-quality resources
		b15 Online knowledge is highly refined
		b16 Online course can be reviewed repeatedly
		b17 Accuracy of resource selection
B4	Cognition	b18 Awareness of social needs
		b19 Cognition of self-knowledge level
		b20 Knowledge of specific courses
		b21 Self-motivated to learn
B5	Anticipation	b22 Expectations of course content
		b23 Expectations of teachers
		b24 Expectations of learning outcomes
		b25 Expectations about the learning process
B6	Self-control	b26 Short attention span
		b27 Poor ability to resist distraction
		b28 Learning enthusiasm decreases gradually
B7	Supervision	b29 Examination supervision
		b30 Drive of the atmosphere
		b31 Curriculum planning
B8	Emotions	b32 A preference for courses
		b33 Peer motivation
		b34 Preference regarding teachers and platforms
		b35 Strong learning atmosphere
B9	Behavior	b36 Communication between teachers and students
		b37 Peer discussion
		b38 Classroom activity

3.3. Selective coding

The aim of selective coding is to identify a core category that encompasses the other categories or supersedes them in terms of explanatory importance. The relations among categories constitute entity theory (Foley & Timonen, 2015). Based on continued analysis of the original materials, concepts, and categories and their relations, four core categories are extracted: cost distance, initiative distance, control distance, and interactive distance. Finally, the online educational psychological distance model is constructed. That is, the relationship between core categories and categories, as shown in Table 5 and Figure 1.

Table 5. Correspondence between core categories and categories

Number	Core category	Category	Core category interpretation
C1	Cost distance	B1 time B2 space B3 resources	It shows that users perceive that online learning saves time, space, and resources.
C2	Initiative distance	B4 cognition B5 expectations	It refers to the degree of users' cognition and expectations with respect to online courses.
C3	Control distance	B6 self-control B7 supervision	It is manifested in users' perception of their own and others' control in the learning process.
C4	Interaction distance	B8 emotions B9 behavior	It is the users' perception of emotion and interaction in online learning.

The storylines for each psychological distance dimension are as follows:

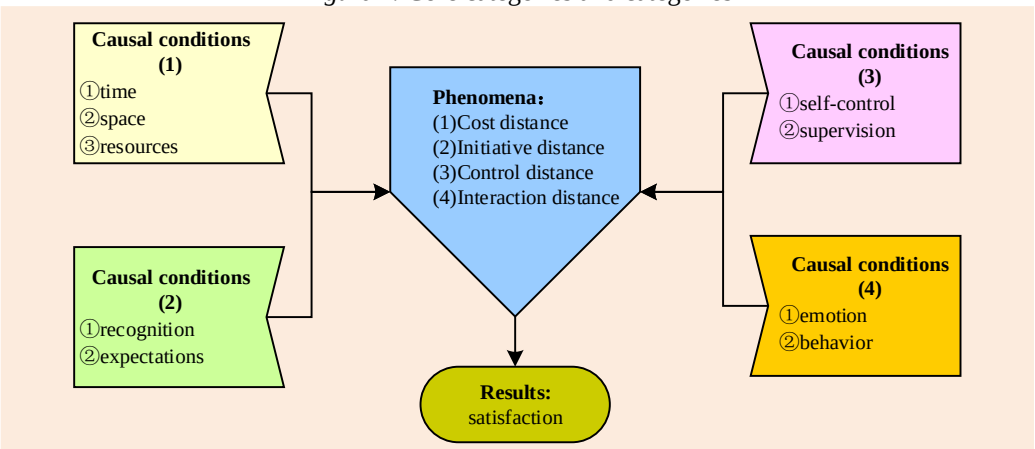
C1 Cost distance: refers to the users' perception of the change in the cost of online education. Examples include eliminating teaching location restrictions, flexible course times, and availability of quality courses. This dimension can be regarded as the distance judgment of users with respect to time costs, space costs, and resource costs.

C2 Initiative distance: refers to the users' perception of their subjective initiative. Examples include the expected effect of online learning, i.e., the higher the expectation is, the more active the user is in learning, and vice versa. Users' cognition and judgment of their self-learning ability will also affect their learning initiative. This dimension can be regarded as the distance judgment regarding users' subjective initiative.

C3 Control distance: refers to the users' perception of control ability in the learning process. This control ability includes self-control and others' control, self-discipline in learning and supervision of the learning process by the teacher or the platform. This dimension can be regarded as the distance judgment regarding the users' control ability or as the management distance.

C4 Interactive distance: refers to the users' perception of interactivity in online learning. Such interactions include behavioral and emotional interactions. Behavioral interactions can motivate users to learn. Emotional interactions contribute to users' sense of trust in and dependence on the course, the teachers and the platform, fostering acceptance and recognition at the psychological level, improving learning stickiness and producing the ideal learning effect. This dimension can be viewed as the users' distance judgment regarding interactivity.

Figure 1. Core categories and categories



3.4. Saturation test

Theoretical saturation means that all the genera are fully developed in their attributes, dimensions, and forms of change. The saturation test is used to determine whether any new contributions can be made to the conceptualization through further data collection and analysis. If no new contributions emerge, the model is considered to have achieved theoretical saturation (Corbin & Strauss, 1990).

In this study, two-thirds of the data were randomly selected, and the remaining data were used to test the theoretical model of psychological distance in online education. Examples of theoretical saturation tests are as follows:

- a41: In the case of online teaching, it is not very convenient for teachers to communicate with students (interactive distance-behavior), and problems cannot be identified or solved in a timely manner via feedback (cost distance-time).

- a70: I think for me because I am, to an extent, forced to take offline classes (initiative distance-cognition), I don't like some courses, so I don't listen carefully to them. Generally, my learning state is not very good. In contrast, online learning is purposeful, and you will look for courses that you are satisfied with (cost distance - resources). However, exam-oriented offline education is a little bit obsessive; it should be a little easier to stick to it (control distance - supervision); online education is susceptible to other factors that require self-discipline (control distance - self-discipline).

- a168: You can watch the playback online without worrying about keeping up with it, but it is common for there to be a lack of learning supervision (control distance - self-control).

- a273: Sometimes the offline learning environment will be noisy, affecting the learning efficiency. On the internet, you can choose a quiet environment such as a library. In case of bad weather and for other reasons,

such as rain, online learning is relatively flexible and can be pursued in the same way in a dormitory (cost distance-space). There is also the problem of time allocation. When the study schedule is not flexible enough, online learning can be easily adjusted (cost distance-time).

- a372: Online teaching is separated by a screen, so there is no learning atmosphere in the classroom (interactive distance- behavior). Online, however, you can choose the courses of famous schools and teachers, and your knowledge absorption and learning effect can be guaranteed (initiative distance - expectation).

4. Discussion

In the context of competent network education, the psychological distance element model constructed in this paper summarizes four main categories: cost distance, initiative distance, control distance and interaction distance. The four dimensions are further explained and discussed below.

(a) Cost distance includes the time distance, space distance and resource distance. In the network education environment, learners attach importance to freedom in learning; i.e., they can learn anytime and anywhere. For example, "a9 I prefer online courses that can be watched anytime (time) and anywhere (space), so that I can make better use of my time." Therefore, the temporal and spatial distance here refers to the nonlimitation of time and space. The resource distance emphasizes the richness and optimization of resources. "a81 I usually take some basic courses online, but there are too many network resources for such courses, which leads to my confusion in choosing. If only the online education platform had intelligent recommendations according to personal needs (preferred)." Learners require the autonomy of online courses and want accuracy in course selection. Therefore, this study finds that the cost distance here is no longer simple space-time distance but the psychological perception of learners and their experience of the convenience of online courses.

(b) Initiative distance includes the cognitive distance and expectation distance. Learners' understanding and expectations of social needs, personal ability and curriculum will also affect their actual perception of the learning effect. For example, "a11, I found that professional knowledge in management is also very important, especially for engineering students like me (cognition). I expect to improve my work efficiency and ability (expectation) through online learning of management knowledge. Since there is no professional foundation, I prefer to choose online courses with richer cases and more classic theories (cognition). It can make me get more." Therefore, the active distance is also a subjective evaluation of learners of whether they can complete the curriculum task. It will directly affect the learning motivation, i.e., self-efficacy, of learners (Bandura, 1986).

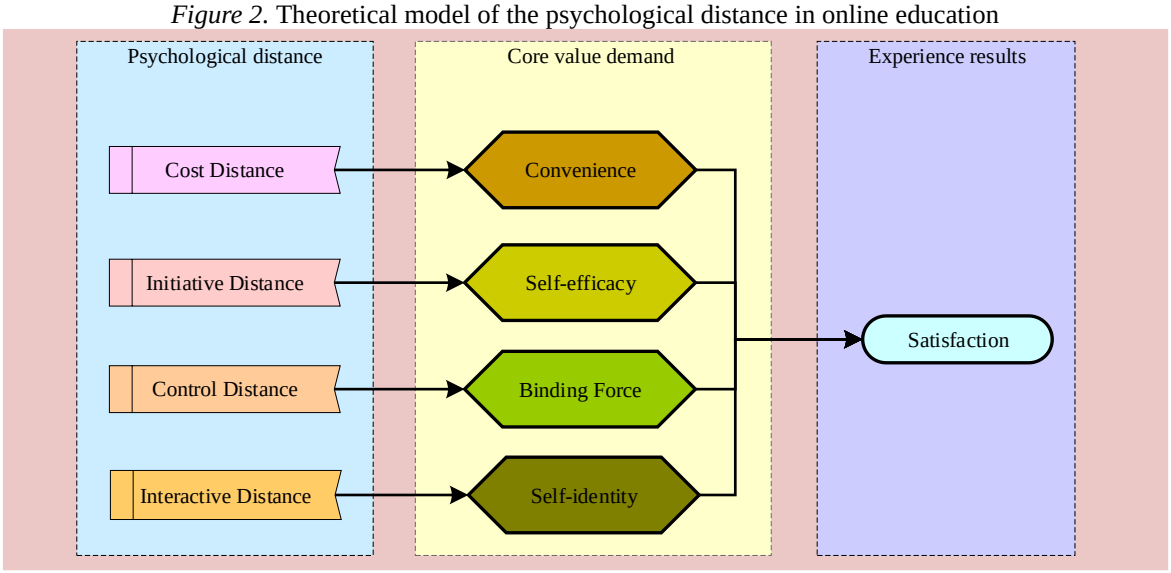
(c) Control distance includes the self-control distance and supervision distance. It is found that while the learning autonomy of online courses is greater, it also requires a type of control constraint. This type of control includes both own active and third-party control to help learners complete the course smoothly." a113 In e-learning, I always procrastinate more. I must make a detailed learning plan to supervise myself (self-control) in order to successfully complete the course." "a54 I prefer to choose online courses with periodic assessment requirements (supervision), which is a good constraint for me." Therefore, the controlling distance can also be understood as a binding force on learners.

(d) Interaction distance includes emotional distance and behavioral distance. Learners hope to enjoy the flexibility and convenience of online course learning, and it is a reproduction of offline courses. There can be sufficient teacher-student interaction, student discussion, teacher attention and timely feedback on problems in the classroom. "a239 I enjoy having a heated discussion with CO learners on some issues in the learning forum, especially when my views or explanations are adopted by others (others' recognition of me), I will have a sense of achievement (self-identity)." The other is learners' recognition of the views, styles and cultures of teachers, learning teams and even learning platforms, which has gradually evolved into an emotional identity and preference, increasing the emotional distance. "a97 I like Professor Mengman's class (recognition of others). Taking her class, I will not only acquire knowledge but also feel more confident (self-identity)." Whether behavioral or emotional, such interaction also assists a learner in "identification with others" or "identification with me" to "self-identity." In turn, it improves his learning motivation and effect.

The uniqueness of this study is that it uses the grounded theory method, directly starts from actual observations with no previous assumptions, summarizes the experience from the original data, and subsequently establishes the theory. In the past, scholars used more quantitative analysis methods to conduct confirmatory research on educational psychological factors. Therefore, this study more completely shows the psychological perception

discovery of learners in e-learning (including cost distance, initiative distance, interaction distance and control distance) instead of only an analysis of the relationships among individual factors. In addition, this study finds that the four dimensions reflect the four core values needs of learners for online education. In other words, the learners' initial experience of online courses must have good convenience (cost distance) to give full play to the learning autonomy and accuracy of learners. However, the real learning motivation comes from the subjective evaluation of learners of their ability to complete online courses, i.e., self-efficacy (initiative distance). In addition, good user experience and user satisfaction also require learners to realize self-identity (interaction distance) in the links in online education. Moreover, the entire network teaching process requires a strong binding force (control distance) to help learners effectively complete learning tasks and ultimately achieve user satisfaction, as shown in Figure 2. Therefore, these four dimensions of psychological distance complement one another. Intelligent online education optimization can be considered from these four levels to improve the user experience and satisfaction of learners.

Figure 2. Theoretical model of the psychological distance in online education



5. Conclusions and future work

- Four new dimensions of psychological distance in online education

  Based on qualitative research employing the grounded theory approach, this study finds that psychological distance in online education includes four core categories, namely, four new dimensions. (i) Cost distance, or users' perception of distance in terms of time costs, space costs, and resource costs; (ii) Initiative distance, or users' subjective active distance perception; (iii) Control distance, or users' perception of their control ability in the process; (iv) Interactive distance, or distance perception based on interaction in online learning.

- In the context of network education, learners need to meet their four core values from the level of psychological perception.

  Cost distance is learners' specific perception of the convenience of online courses, which is expressed as the primary level of online education user experience satisfaction. Initiative distance is the perception of self-efficacy, that is, the level of learners generated learning motivation through cognition and expectation. Interaction distance is the process of achieving self-identity through behavioral and emotional interaction, which is expressed as the advanced level of online education user experience satisfaction. Control distance is a self or third-party binding perception to promote learners to smooth completion of the course. Therefore, these four dimensions of psychological distance interact with each other and ultimately form user experience and satisfaction in online education.

As exploratory research, this paper uses grounded theory to obtain four dimensions of learners' psychological distance against the background of network education to optimize user experience and satisfaction in intelligent network education. Combined with the research of this paper, the following problems merit further discussion.

- This paper categorizes the psychological distance of online education learners into four dimensions. With the development of online education, whether there are other dimensions remains to be further discussed. In addition, the conclusion of this study still lacks empirical testing.

- Some aspects of the application of grounded theory in this study need to be further improved in the specific research process. For example, how should the category be defined in the formation process from concept to category, and what is the theoretical basis of the defined category? I believe that with the continuous improvement of grounded theory, its research will become more standardized.

Acknowledgement

This study is supported by the Development Program for Young and Middle-aged Key Teachers of Chengdu University of Technology 2020.

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