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Maximizing Cognitive Surplus for TVET:

Motivation for User-Generated Content in

Technical Instructional Videos

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Abstract

Skilled or educated Internet users use their free time to produce 'user-generated technical instructional videos' (User-Generated Content, UGC) as Open Educational Resources (OER), which are considered a type of cognitive surplus in the didactics field of Technical and Vocational Education and Training (TVET). However, not every 'user-generated technical instructional video' can be involved in OER owing to unclear producers' UGC motivation. To explore this motivation, this dissertation comprehensively reviewed the English and Chinese literature on UGC-generative motivations published from January 2005 to June 2024. The Web of Science (WoS) and China National Knowledge Infrastructure (CNKI) databases were used. The identified studies were screened based on specific inclusion and exclusion criteria, resulting in 66 primary studies. 66 studies were analyzed to extract 13 UGC-generative motivations, 46 motivation influence factors, and 22 theoretical perspectives. Based on the results, this dissertation proposed an insight that the five motivational dimensions of cognitive surplus creation can explain part of UGC-generative motivation; however, there are notable empirical and theoretical gaps in studying UGC generation from cognitive surplus and knowledge ecosystems perspectives, particularly in the context of TVET.

To leverage cognitive surplus to enhance the UGC knowledge ecosystem, specifically recommending targeted strategies for educators and platform designers to motivate knowledge groups, like TVET teachers, to contribute to UGC effectively, a motivation measurement scale was developed, and the scale's psychometric properties (factor structure, reliability and construct validity) were evaluated. The five motivational dimensions of cognitive surplus creation (sharing, membership, competence, autonomy, and reward) were used as the dimensions for the Motivation scale of User-generated Technical Instructional Videos (MUTIV) to address the empirical and theoretical gaps. Employing a cross-sectional research design, two rounds of self-administered surveys were conducted in mainland China (N = 271/N = 318). Phase 1 involved item generation through both deductive methods (reviewing existing scales in the literature) and inductive methods (analyzing online discourse). Phase 2 focused on the scale development and questionnaire design. Five factors, sixteen items, were extracted by Exploratory Factor Analysis (EFA; Principal Components Analysis) and confirmed by analysis of moment structures, forming the initial 5-factor-16-item MUTIV. Phase 3 included the scale evaluation and validation assessment. All Goodness of Fit (GoF) indices generated by Confirmatory Factor Analysis (CFA) were found satisfactory ($\chi 2$ / df = 2.620, root mean square residual (RMR) = 0.033, root-mean-square error of approximation (RMSEA) = 0.076, incremental fit index (IFI) = 0.934, Tucker-Lewis index (TLI) = 0.915, comparative fit

index (CFI) = 0.933). Cronbach's alpha value formed at α = 0.911. The 5-factor-16-item MUTIV was developed and successfully verified.

Overall, the MUTIV effectively assesses the motivation to produce 'user-generated technical instructional videos', identifying key factors like sharing, membership, competence, autonomy, and reward. TVET stakeholders, media and online education platforms can utilize this tool to promote and assess motivation in educational contexts. For example, measures to promote cognitive surplus can be taken to encourage TVET teachers to contribute cognitive surplus in their spare time and thus enhance the UGC knowledge ecosystem.

Zusammenfassung

Qualifizierte oder gebildete Internetnutzer erstellen in ihrer Freizeit „benutzergenerierte technische Lehrvideos“ (Benutzergenerierte Inhalte, User-Generated Content, UGC) als offene Bildungsressourcen (Open Educational Resources, OER), die als eine Art kognitiver Überschuss im didaktischen Feld der der technischen und beruflichen Bildung und Ausbildung (Technical and Vocational Education and Training, TVET) gelten. Allerdings kann nicht jedes „benutzergenerierte technische Lehrvideo“ in OER einbezogen werden, da die UGC-Motivation der Produzenten unklar ist. Um diese Motivation zu untersuchen, hat Diese Dissertation die englische und chinesische Literatur zu UGC-generativen Motivationen, die von Januar 2005 bis Juni 2024 veröffentlicht wurde, umfassend überprüft. Es wurden die Datenbanken Web of Science (WoS) und China National Knowledge Infrastructure (CNKI) verwendet. Die identifizierten Studien wurden anhand spezifischer Einschluss- und Ausschlusskriterien geprüft. Das Ergebnis waren 63 sowie 3 weitere Primärstudien. 66 Studien wurden analysiert, um 13 UGC-generative Motivationen, 46 Motivationseinflussfaktoren und 22 theoretische Perspektiven zu extrahieren. Die Überprüfung ergab, dass die fünf Motivationsdimensionen der Schaffung kognitiver Überschüsse einen Teil der UGC-generativen Motivation erklären können. Es bestehen jedoch erhebliche empirische und theoretische Lücken in Bezug auf die Untersuchung der UGC-Generierung aus der Perspektive kognitiver Überschüsse und Wissensökosysteme, insbesondere im Kontext der TVET.

Um den kognitiven Überschuss zu nutzen und das UGC-Wissensökosystem zu verbessern, und insbesondere Pädagogen und Plattformdesignern gezielte Strategien zu empfehlen, um Wissensgruppen wie TVET-Lehrer zu motivieren, wirksam zu UGC beizutragen, hat Diese Dissertation eine Skala zur Motivationsmessung entwickelt und die psychometrischen Eigenschaften der Skala (Faktorenstruktur, Reliabilität und Konstruktvalidität) bewertet. Die fünf Motivationsdimensionen der Schaffung kognitiver Mehrerträge (Teilen, Mitgliedschaft, Kompetenz, Autonomie und Belohnung) wurden als Dimensionen der Skala „Motivation für benutzergenerierte technische Lehrvideos“ (Motivation of User-generated Technical Instructional Videos, MUTIV) verwendet, um die empirischen und theoretischen Lücken zu schließen. Unter Verwendung eines Querschnitts Forschungsdesigns wurden zwei Runden selbst durchgeführter Umfragen auf dem chinesischen Festland durchgeführt (N = 271/N = 318). Phase 1 umfasste die Itemgenerierung sowohl mit deduktiven Methoden (Überprüfung vorhandener Skalen in der Literatur) als auch mit induktiven Methoden (Analyse des Online-Diskurses). Fünf Faktoren, sechzehn Items, wurden mittels explorativer Faktorenanalyse

(EFA; Hauptkomponentenanalyse) extrahiert und durch eine Analyse der Momentstrukturen bestätigt, wodurch die anfängliche MUTIV-Skala mit 5 - Faktoren - 16 - Items entstand. Phase 3 umfasste die Skalenbewertung und Validierungsbeurteilung. Alle durch konfirmatorische Faktorenanalyse (CFA) generierten Güteindizes wurden als zufriedenstellend befunden ($\chi 2$ / df = 2.620, root mean square residual (RMR) = 0.033, root-mean-square error of approximation (RMSEA) = 0.076, incremental fit index (IFI) = 0.934, Tucker-Lewis index (TLI) = 0.915, comparative fit index (CFI) = 0.933). Der Cronbachs Alpha-Wert liegt bei $\alpha = 0{,}911$. Die 5-Faktoren-16-Items-MUTIV-Skala wurde entwickelt und erfolgreich verifiziert.

Insgesamt beurteilt die MUTIV-Skala effektiv die Motivation zur Produktion „benutzergenerierter technischer Lehrvideos“ und identifiziert Schlüsselfaktoren wie Teilen, Mitgliedschaft, Kompetenz, Autonomie und Belohnung. TVET-Interessenvertreter, Medienplattformen und Online-Bildungsplattformen können dieses Tool nutzen, um die Motivation in Bildungskontexten zu fördern und zu bewerten. Beispielsweise können Maßnahmen zur Förderung der kognitiven Überschüsse ergriffen werden, um TVET-Lehrer zu ermutigen, einen kognitiven Mehrwert zu erbringen in ihrer Freizeit und so das UGC-Wissensökosystem zu verbessern.

Included Publications

The present dissertation was written cumulatively and includes two English-language journal articles published in international peer-reviewed journals. The author of this dissertation is the first author of both articles (Article A: 75 %, Article B: 70 %) and was primarily responsible for developing and designing the study, collecting and analyzing the data and writing and revising the two publications.

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1 Introduction

A noteworthy phenomenon in the realm of TVET is the increasing trend of Internet users from diverse backgrounds generating user-generated instructional videos for online didactics. I term these videos as 'user-generated technical instructional videos'. This phenomenon is supported by the User-Generated Content (UGC) model relevant to video-sharing platforms (Arkenbäck, 2023; Gotlieb & Cheema, 2017; Song et al., 2020; Stoeckl et al., 2007). Original media content generated by amateurs in professional fields and publicly released online is classified as UGC (Daugherty et al., 2008), and some knowledgeable UGC holds significant educational value (Zeng et al., 2016). These knowledgeable UGC have emerged as a significant source of cognitive surplus (Fatayer, 2016; Fatayer & Tualaulelei, 2023), which involves 'attention increments' generated by connecting fragments of human knowledge, time and attention (Tian & Niu, 2022), promoted by the knowledge ecosystem (Pór, 2012).

The cognitive surplus is a concept proposed by Shirky (2010), referring to knowledgeable individuals repurposing their spare time for knowledge-sharing to create benefits for human society. In the didactic field, a cognitive surplus involves educated or experienced individuals using their spare time, knowledge, skills, or experience to participate in knowledge-sharing activities, thereby providing Open Educational Resources (OER) (Tian & Niu, 2022). A prime example of this is the generation of 'user-generated technical instructional videos', a cognitive surplus in online TVET didactics under the UGC model (Zhang et al., 2024b). However, not every user-generated instructional video is suitable for educational and didactical purposes, as the professionalism of the content is contingent upon the background and motivation of the video producers (Farnan et al., 2009). The intrinsic and extrinsic motivations of the UGC generation are complex (Poch & Martin, 2015), and the motivations of online video producers vary widely (Lu & Nam, 2021). Now, increasing interest has been in understanding the motivations driving UGC generation, particularly in web management and business contexts (Sun et al., 2017; Ma & Sun, 2022). At the same time, educational researchers have highlighted the importance of UGC-generative motivations within virtual learning communities (Du, 2015). Despite these studies, there is still a lack of comprehensive reviews that systematically examine UGC-generative motivation across various theoretical perspectives and disciplines (Makinen & Tuominen, 2017; Hofman-Kohlmeyer, 2023; Zhang & Zhao, 2017).

Shirky (2012) further stated that the motivation for cognitive surplus is that well-educated or experienced humans with the freedom to manage their spare time will have strong motivations to share knowledge to create a cognitive surplus. The five cognitive surplus motivation

dimensions (sharing, competence, autonomy, membership, and reward) were proposed by Shirky (2010), Barrett (2010), and Paul (2010). Nevertheless, it is still unknown whether the motivation to create a cognitive surplus relates to the motivation to generate UGC. The 'user-generated technical instructional video', as OER produced under the UGC model, offers cognitive surplus to online TVET didactics, so it is necessary to recognize the motivation to produce 'user-generated technical instructional video' (Zhang et al., 2024b).

In response to the above, this dissertation's first objective is to systematically review the literature on UGC-generative motivations over the past 18 years (details in Journal Article I). The dataset was comprised of empirical papers, analyzed across multiple review stages to understand the most utilized theories in UGC-generative motivation studies and identify the main motivations and motivation influence factors driving UGC generation. It seeks to uncover gaps in the theoretical perspectives of cognitive surplus. Additionally, it aims to establish a three-level classification framework for UGC-generative motivation and motivation influence factors. The five cognitive surplus motivation dimensions (sharing, competence, autonomy, membership, and reward) were proposed by Shirky (2010), Barrett (2010), and Paul (2010), but the influence factors corresponding to these five motivations were not determined. The insight gained from this review is that a part of UGC-generative motivations aligns with the five cognitive surplus motivational dimensions (Zhang et al., 2024a). This insight from the literature review provides a theoretical basis for using these five motivational dimensions of cognitive surplus creation as measurement dimensions of a motivation measurement scale. Also, it provides a thematic basis for developing a scale pool.

Educated or experienced groups, such as TVET teachers, have great educational potential if their cognitive surplus can be maximized as an OER (Zhang et al., 2024a). So, how can we encourage these groups to contribute their cognitive surplus? Enhancing motivation can enhance intention, thus predicting future contribution behavior (van den Hooff et al., 2004). To this end, the second objective of this dissertation aims to explore and measure the motivations driving Internet users to produce 'user-generated technical instructional video' for online TVET didactics. The comprehensive motivation behind this behavior encompasses three key areas: user-generated video production, online didactics, and cognitive surplus creation. Although well-established motivation scales for user-generated video producers exist in the literature (e.g., Guo & Kang, 2022; Martinez, 2022; Rodrigues et al., 2021; Stoeckl et al., 2007), they lack the perspective of cognitive surplus, particularly concerning motivation for UGC in technical instructional video under the context of TVET. To address this gap, the Motivation scale of User-generated Technical Instructional Videos (MUTIV) was developed and validated

to assess the motivation of these UGC producers (details in Journal Article II). This scale was developed and validated by constructing a conceptual model based on five motivational dimensions of cognitive surplus creation, followed by an empirical analysis using survey data from mainland China. This research significantly enhances the theoretical understanding of motivations behind UGC production, empirically verifies the concept of cognitive surplus in didactic contexts, and highlights the cognitive surplus motivations of 'user-generated technical instructional video' producers.

2 Conceptual & Theoretical Background

This section delves into the conceptual and theoretical background that forms the basis of the dissertation's research. The subsection "Concepts Introduction" will present several relevant concepts that will help formulate and guide the investigation of the influence of motivation for UGC in technical instructional videos. In addition, the introduction of related concepts will also help support the 'Theoretical Underpinnings' subsection, which will thoroughly explore the essential theoretical foundations for understanding the research context of the dissertation.

2.1 Concepts Introduction

2.1.1 User-Generated Content (UGC)

User-generated content (UGC) refers to content co-created and/or shaped by Internet users, mainly spread through the Internet (Daugherty et al., 2008). Meeker first proposed the term UGC in 2005 and pointed out that UGC is the key to developing Web 2.0 (Kidd, 2024). Media content has to meet three requirements to be considered as UGC: (1) the content publishing website should be public, in the case of social media, should be open to specific groups; (2) the content should have a certain degree of creativity, prohibiting the mere republishing of existing content without modification; and (3) the content should not be produced in a professional or commercial environment, such as instructional videos created by teachers during work hours are not considered as UGC (Stoeckl et al., 2007; Vickery, 2007).

Media content is now accessed via the Internet, where users interact and collaborate to create UGC (Harris & Rea, 2010). Content-consuming and content-generating can be observed in the UGC model (Ahn et al., 2016). The UGC model supports any type and form of media content created, published and shared by amateurs on consumer terminals (Clever et al., 2009). These forms include blogs, user reviews, forum posts, podcasts, and videos (Ahn et al., 2016). Meeker's Internet Trends Report showed that UGC is 50% more trusted than other media types (Kidd, 2024). Organizations should manage UGC because it can boost or secure their reputation, as many users base their decisions on others' opinions (Manaman et al., 2016). In particular, the UGC creates new patterns for social interactions, empowers users to be more creative, and develops new educational opportunities (Zhang et al., 2024a).

2.1.2 User-Generated Technical Instructional Video

Instructional videos have an explicit learning goal or an intent to teach factual, conceptual, or procedural knowledge (ten Hove & van der Meij, 2015), and they have content, concepts and skills that are explicitly explained (Winslett, 2014). Various types of instructional videos suit a

specific audience or style of training. Seven common types of instructional videos are micro videos, screencasts, explainer videos, demonstrations and how-to videos, tutorial videos, training videos, and lecture videos (Guy & McNally, 2022; Pappas, 2023). Video is an essential content-delivery tool in TVET (Chebor et al., 2018; Koko, 2022). Additionally, instructional videos are instructional products with video-based content for didactic purposes in TVET (Cattaneo et al., 2019). With the rise of the UGC model, the 'user-generated instructional videos' for fragmented, formal or informal TVET on video-sharing platforms are common (Homburg, 2017). Instructional videos generated by users are an opportunity for formal and informal education (Riley, 2017).

Although the 'user-generated technical instructional video', as an OER (open educational resource), profoundly impacts the dissemination of vocational knowledge or technical skills in online education, they are rare in TVET practices (Zhang et al., 2024b). The reason may be due, in part, to the lack of terminological clarity of OER in online education (Fatayer & Tualaulelei, 2023). I term 'user-generated instructional videos' for online TVET didactics as 'user-generated technical instructional videos'. The concept was derived from UGC (user-generated content) as a cognitive surplus; it emerged in online education, referring to any knowledgeable or skilled individual's teaching process, which was recorded as technical instructional videos, including 'user-generated content' and 'user-as-producer' (Zhang et al., 2024b). For example, technical instructional videos that TVET teachers produce in their spare time and are open to all users are called UGC, and the essence of this knowledgeable UGC is a cognitive surplus for online TVET didactics. They differ from PGC (professional-generated content), such as instructional videos produced by TVET teachers during working time.

2.1.3 UGC-Generative Motivations

Motivation is a psychological process of human activities guided, stimulated and maintained by goals or objects (Petri, 1996). It is defined as the degree to which a particular behavior is chosen and engaged, and it is divided into intrinsic and extrinsic categories (Shapira et al., 2001). Intrinsic motivation refers to a motivation to participate in an activity or work that comes from the characteristics of the activity itself; extrinsic motivation refers to the external reward for an individual to perform an activity (Davis & Wiedenbeck, 2001; Shapira et al., 2001). Motivation is a matter of factors that cause, inhibit or prevent behaviors (Petri, 1996). Motivation causes intentions, and intention drives humans to conduct a certain behavior (Ajzen, 1985; Davis & Wiedenbeck, 2001). The future self-congruity concept also supports how humans motivate and manage their behavior by thinking about the future and the present

(Blouin-Hudon & Pychyl, 2015). Bentham (1781) pointed out that intention predicts behavioral dispositions, and motivation causes intention (Hacker, 1976; Yang, 2014).

A literature review was conducted to understand the past 18 years of research on UGC-generative motivations. First, a systematic literature retrieval was conducted based on information sources and database search strategies, see Table 1.

Table 1: Information source and search strategies (published in Zhang et al., 2024a)

Information Source	Search string and parameters
WoS Core Collection	#1: "User Generated Content*" #2: "motivation*" #3: "User Created Content*" #4: "influencing factors*") #5: #1 OR #3 #6: #1 AND #2 #7: #1 AND #4 #8: #3 AND #2 #9: #3 AND #4 Filter Timespan: 2005-01-01 --- 2022-12-31 Document type: Journal Articles
CNKI	S1: "User Generated Content*" S2: "motivation*" S3: "User Created Content*" S4: "influencing factors*") S5: S1 OR S3 S6: S1 AND S2 S7: S1 AND S4 S8: S3 AND S2 S9: S3 AND S4 Filter Timespan: 2005-01-01 --- 2022-12-31 Scope: Topic Document type: Journal Articles, Master Thesis, Doctoral Dissertations Language: Chinese

Second, a thorough analysis of articles was conducted by adapting the categorization criteria from Tian et al. (2022), where retrieved articles were further reviewed against the inclusion (IC) and exclusion (EC) criteria. The inclusion criteria were IC1: English journal articles, Chinese journal articles, Chinese master's theses and Chinese doctoral dissertations; IC2: Peer-reviewed empirical study from all fields; IC3: The study's topic is the relationship between UGC-generative motivation and UGC-generative behavior, or the relationship between UGC-generative motivation and UGC-generative intention; IC4: The study's object is UGC-generative motivation; IC5: The study is not listed in another database. The exclusion criteria of the study were: EC1: Comment studies, literature review studies, non-peer-reviewed empirical studies, English master's theses and English doctoral dissertations; EC2: The study's object is UGC-using motivation; EC3: The study's object is knowledge-sharing motivation; EC4: The study's number of citations below five; EC5: Unpublished Chinese masters' theses and doctoral dissertations which are about UGC-generative motivation.

Third, the article collection was conducted in five phases following the PRISMA 2020 guidelines and the flow diagram of Page et al. (2021), as shown in Figure 1. After the collection in five phases, 63 full-text papers (56 were from database searching and 7 from citation searching) were included for further analysis. When the search was updated in November 2024, another 3 peer-reviewed articles were included. Finally, 66 full-text papers were included. To ensure the inclusion of high-quality papers in the review, the 66 papers were evaluated according to the quality evaluation rubric developed by Mullet (2016) and used in other systematic reviews, such as Pappa et al. (2024) and Margot et al. (2019). After assessment, all 66 studies met the required quality standards. An Excel spreadsheet (Zhang et al., 2024a) records information, including author, publication year, theoretical basis, motivation and motivation influence factor.

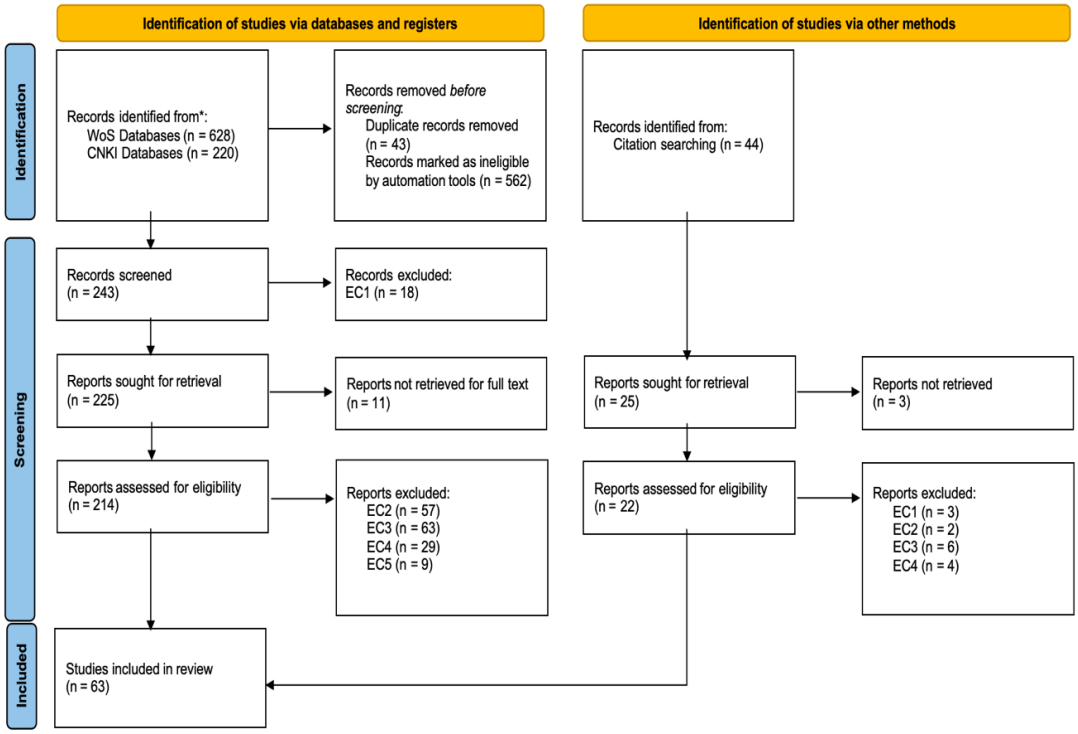

Figure 1: PRISMA flow diagram (published in Zhang et al., 2024a)

Economical Motivation

Economic motivation is individuals' UGC-generative motivation under external requirements and forces (Rebecca & Brett, 2015). Sun et al. (2017) and Ma et al. (2022) found that the economical motivation for generating UGC includes economic incentives and monetary rewards. Such motivation can promote stable and long-term UGC generation and guarantee the quality of the content (Rebecca & Brett, 2015). By generating high-quality and attractive content, producers are pushed to the centre of social network influence, and this influence can

be turned into an economic benefit (Wang, 2016. Some online platforms and social media also launched hierarchical badge systems corresponding to levels of economic rewards and monetary incentive systems to motivate producers to generate high-quality content (Ma et al., 2022; Rebecca & Brett, 2015). Thus, UGC producers' economical motivations were influenced by their interest in the activity and by external pressures to achieve profit or gain (Wang, 2019).

Social Motivation

Social motivation arises from users' social and cultural needs, driving them to generate UGC based on their experiences and interactions within their social environment (Xu & Zhou, 2017). The proliferation of mobile devices and social media has led the UGC generation to a prevalent social trend driven by herd mentality (Yin, 2015). More users are involved in UGC-generative activities under the influence of social engagement and herd mentality (Lan, 2011; Xu & Zhou, 2017). For example, breaking news and friends' posts motivate producers to practice UGC-posting (Ren, 2019). They are also motivated by attaining social benefits, social capital, and professional development (Makinen & Tuominen, 2017; Rebecca & Brett, 2015; Wang, 2019).

Identity Motivation

Extrinsic motivations, such as identification, are crucial in driving human behavior (Vignoles, 2011). This motivation compels UGC producers to pursue specific self-concepts or self-evaluations from outside (Nanne et al., 2023; Tang, 2023). When producers believe generating content will earn social attention, status, and recognition, it enhances their motivation to generate content (Atreyi et al., 2005). The pursuit of social praise and esteem also plays a significant role, as producers seek self-esteem and respect from others (Huang, 2019). Many UGC producers desire to enhance their status and identity within virtual networks (Xia, 2024). UGC community categorize producers into different levels and assigns various titles to encourage content production and boost community engagement (Tang, 2023).

Self-presentation Motivation

Self-presentation motivation is characterized by showing a human's status, prestige, wealth and value; corresponding self-presentation strategies are model demonstration, ability display, weakness for help, flattery and coercion (Jones & Pittman, 1982). For users transitioning from content consumption to content generation, self-presentation motivation plays an intrinsic role (Lan, 2011). This motivation is manifested by UGC producers' self-expressiveness and value-expression (Cai, 2017; Wang, 2019). Self-expression is when producers actively present themselves online to establish a virtual image to achieve influence or benefits (Nanne et al.,

2023; Wu & Atkin, 2017). Value expression allows producers to express or relate their self-concepts, self-worth, values, attitudes, opinions and comments, enhancing their online image through matching moral beliefs (Higgins et al., 2023).

Efficacy Motivation

Effort expectancy is producers' confidence in their competence and self-control to complete UGC generation (Du, 2015). Past studies showed that effort expectancy, self-efficacy, knowledge self-efficacy, and knowledge achievement are intrinsic influence factors for producers to generate UGC to contribute knowledge (Li, 2020; Ren, 2019). Self-efficacy is producers' self-judgment of competence in organizing, implementing, and controlling content generation to achieve desired results (Cai, 2017). Knowledge self-efficacy and achievement refer to UGC producers' perceptions that their knowledge, skills, or information are valuable to others (Atreyi et al., 2005). They find it easier to generate and share content with confidence in their expertise and control over their knowledge or technology tools (Atreyi et al., 2005; Zhang, 2011).

Hedonic Motivation

Hedonic motivation states that users' UGC-generative behavior is driven by a desire to seek pleasure and enjoyment (Huang, 2019). The result of pleasure gained during and after UGC generation or generative activity is perceived enjoyment (Leung, 2013; Ren, 2019). Hedonic motivation positively impacted producers' intention or behavior to post UGC (Ma et al., 2022). The stronger the sense of enjoyment perceived by producers in the process of UGC generation, the greater their motivation to engage in UGC activities (Cai, 2017). In addition to perceived enjoyment, producers generate UGC to express their emotions and share information to obtain psychological satisfaction of entertainment, relaxation and time-killing (Mosemghvdlishvili & Jansz, 2012; Skjuve & Brandtzaeg, 2019). When producers have interests and hobbies in UGC activities and UGC themes, UGC activities themselves become the content-generative motive force (Skjuve & Brandtzaeg, 2019; Yin, 2015; Zhang, 2011).

Altruistic Motivation

Altruism is an attitude of self-actualization and is an inner force that motivates individuals to carry on selfless behavior (Wasko & Faraj, 2000). The altruism is voluntary and aimed at benefiting others, and there is no expectation of compensation to UGC generation (Cai, 2017). Specifically, some UGC producers generate content for information dissemination, information exchange and popularization of science (Mosemghvdlishvili & Jansz, 2012; Skjuve &

Brandtzaeg, 2019; Stoeckl et al., 2007). Some purposes mainly relate to sharing opinions or experiences, advice/suggestions, helping others, and enjoyment in helping (Tang, 2023). While some UGC producers are motivated by material or spiritual rewards when generating content, others are motivated purely by altruism (Atreyi et al., 2005; Ren, 2019).

Study Motivation

The UGC community offers an open online platform where users can exchange expertise, experiences, and insights while integrating diverse views (Li, 2020). UGC supports lifelong learning, facilitates interaction with others, provides feedback, and improves learning outcomes and self-enhancement (Nanne et al., 2023; Yin, 2015), and by a desire to learn, expand knowledge, exercise personal abilities, and enhance awareness (Du, 2015; Tang, 2023). Some users realize they need access to information to organize and understand their environment for competence improvement (Wang & Li, 2017). Consequently, they generate UGC to foster reciprocity and enhance community participation (Yin, 2015).

Affiliation Motivation

Affiliation motivation refers to UGC producers' pro-social behavior to gain care, sympathy, support, and cooperation (Atreyi et al., 2005; Wasko & Faraj, 2000). Numerous studies have demonstrated that producers generate UGC to foster social interaction and enhance social connectedness, giving them a sense of belonging to a specific community (Cai, 2017; Sun et al., 2017; Zhang, 2011). Achieving a sense of belonging to a community, which involves being a member, drives Internet users to transfer from passive consumers to active producers (Huang, 2019; Nanne et al., 2023). This affiliation motivation leads them to invest their time and energy into the UGC generation, fostering community, alleviating loneliness, and seeking companionship or support (Chang & Yang, 2009; Lan, 2011; Skjuve & Brandtzaeg, 2019).

Technology Acceptance Motivation

Davis (1985) proposed the technology acceptance model (TAM). The TAM model has two core variables: perceived usefulness and perceived ease of use. This model is widely used to explain and predict the motivation of users who choose technologies or systems to generate UGC. Based on the TAM model, some verified incentives include perceived usefulness, perceived ease of use and perceived entertainment (Tang, 2023; Wang, 2016; Yin, 2015). The convenience offered by social media has become a significant driver of UGC generation (Lan, 2011), leading to technical factors in driving users to engage in UGC-generative activities

(Xu & Zhou, 2017). They are also motivated to generate UGC depending on whether they perceive technologies or systems as useful, convenient, and easy to use (Xia, 2024).

Autonomy Motivation

The 'trust in technology' motivates producers' intention and behavior for UGC production (Wang & Li, 2017). There are benevolence trust, competence trust, and integrity trust, which enhance perceived autonomy (Tang, 2023; Wang & Li, 2014). The benevolence trust refers to producers acting in the interests of those they trust, reflecting altruism (Ren, 2019). Benevolence for the security of the Internet or social media environment allows users to feel they can control and initiate their content-generative behavior, which enhances their perceived autonomy in technology (Wang & Li, 2017; Yin, 2015). The competence trust refers to a confidence that a platform or a system has in the foundational capabilities to support interaction, content generation, and privacy protection (Wang & Li, 2014; Wang & Li, 2017).

Cultural Dimensions

An investigation of the impact of 'national culture dimensions' found that social media users from countries with strong individualism and low uncertainty avoidance were more motivated to generate content; in contrast, users from countries with low individualism and high uncertainty avoidance were more reluctant to generate content (Krasnova et al., 2012). Additionally, another study found that 'ethnic culture orientations' of Americans with different ethnic descendants affected the way they communicate or express themselves online, thereby affecting motivation for UGC production (De Andrea et al., 2010). Furthermore, a study showed social media users with Western 'regional cultural traits' represented by advocating independence had high self-efficacy to generate content to show personal uniqueness and value, in contrast, users with oriental 'regional cultural traits' represented by restraint and implicitness had low self-efficacy to generate content (Ayeh et al., 2016).

Individual Traits

The motivation for the UGC generation is somewhat different due to 'background features (demographic characteristics)' and 'personality traits' (Gonzalez-Rodriguez et al., 2021; Wu & Atkin, 2017). Demographic characteristics in various countries or regions impact human behavior (Liu et al., 2021), such as age, gender, Internet age, educational background, job occupation and values, which affect producers posting UGC (Lan, 2011; Li, 2020; Ren, 2019; Huang, 2019). Past studies highlighted that personality traits like empathy, creativity, curiosity,

and innovation affect producers' online comments contribution, those with agreeable and narcissistic characters with high motivation to post UGC (Leung, 2013; Wu & Atkin, 2017).

2.1.4 Three-Level Classification Framework of UGC-Generative Motivation

This subsection summarizes verified UGC-generative motivations (n = 13) and motivation influence factors (n = 46) as part of the content analysis process. The recommended pre-coding data size randomly analyzes at least 30% of a data set (Pieper et al., 2017). This study selected to randomly pre-code 50%. Holsti's coefficient was used to ensure coding reliability, with a reliability threshold set at > 0.90 (Pieper et al., 2017). The reliability of the classification was confirmed through the pre-coding reliability. The pre-coding reliability test calculated in the SPSS 27.0 software yielded Holsti values ranging from 0.90 to 0.98, indicating a high level of consistency between coders' classifications. Then, the remaining data were encoded with the analysis categories and coding scheme (Zhang et al., 2024a).

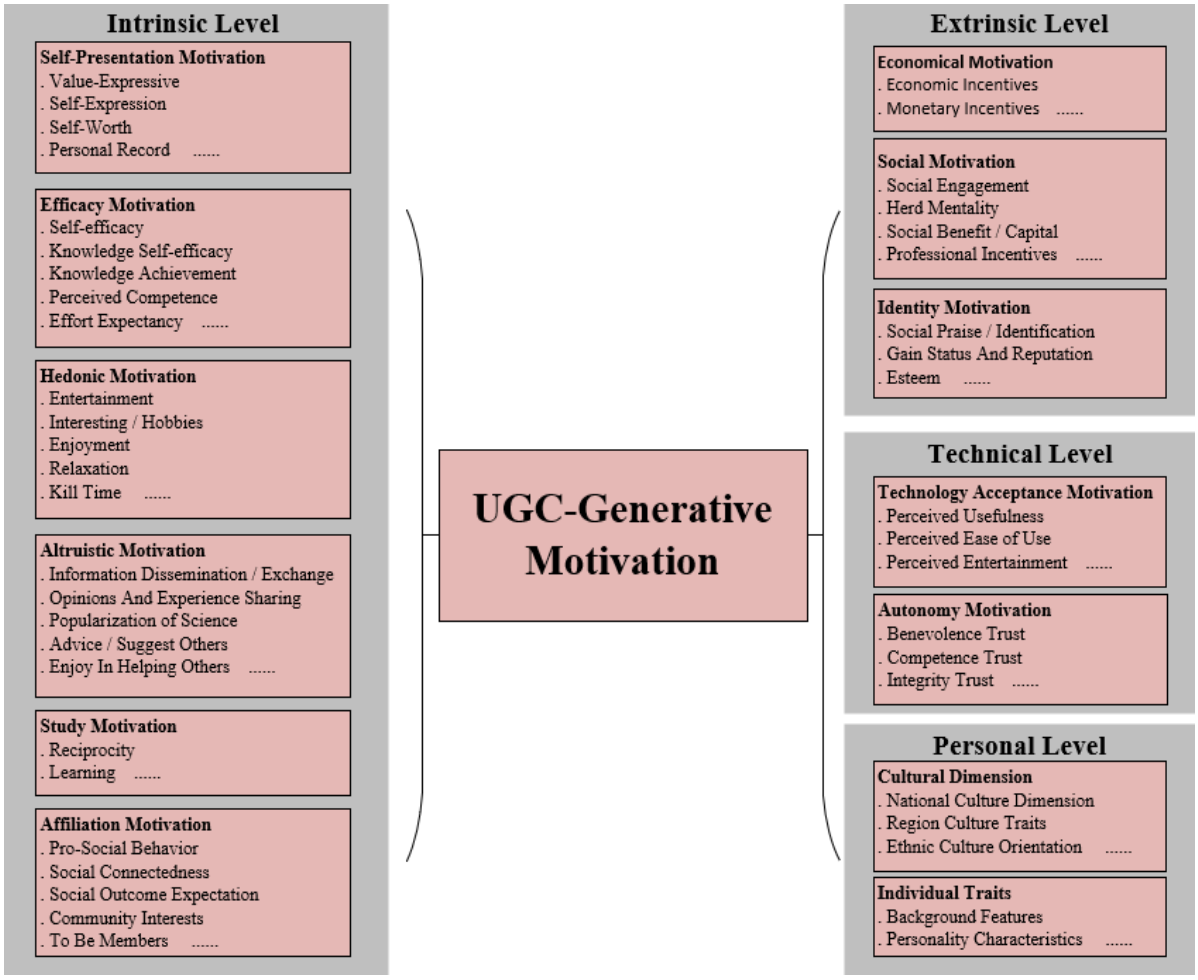

Figure 2: Three-level framework of UGC-generative motivation (published in Zhang et al., 2024a)

Respectively review each level category's description and classification in the corresponding study to determine whether it belongs to the next level category. Given that the main

categories of UGC motivation and its subcategories are clearly defined into overarching categories in the past studies, including social, personal, and technical levels (Liu et al., 2013); extrinsic, intrinsic, and contextual levels; and personal, intrinsic, and extrinsic reward levels (Rebecca & Brett, 2015). Ultimately, these categories are refined, and the 13 UGC-generative motivations and 46 motivation influence factors are re-classified into four levels: extrinsic, intrinsic, technical, and personal. The coding aimed not to quantitatively assess the strength of relationships between categories but to establish a clear three-level classification framework for UGC-generative motivation, detailed in Figure 2.

An insight was proposed from the review that the motivations for UGC generation align with these categories of motivations for cognitive surplus creation, particularly in the aspects of sharing, membership, competence, autonomy, and reward. Sharing motivation corresponds to altruistic motivation, including influence factors like enjoyment in helping, information dissemination/exchange, science popularization/sharing, opinions/experience sharing, and suggestion providing. The membership motivation aligns with the affiliation motivation, encompassing factors like social connectedness, social outcome expectations, community interests, pro-social behavior, and the desire to belong. The competence motivation relates to motivations for self-presentation, efficiency, and study, with factors like value-expressive, personal records, self-expression, self-worth, knowledge self-efficacy, perceived competence, effort expectancy, knowledge achievement, and reciprocity. The autonomy motivation corresponds to the technical motivation, influenced by perceived usefulness, ease of use, entertainment, and trust in technologies. The reward motivation is reflected in extrinsic motivation and hedonic motivation, influenced by social capital, recognition, entertainment, interests/hobbies, enjoyment, relaxation, and killing time.

2.1.5 Knowledge Ecosystem

It also systematically reviewed the literature on the key theoretical foundations of UGC-generative motivation, including intrinsic and extrinsic perspectives, as identified in empirical studies from the last 18 years. The 22 theoretical perspectives used in the 66 studies were catalogued, including technology acceptance model, social exchange theory, uses-gratifications theory, social identity theory, needs hierarchy theory, social capital theory, self-determination theory, self-presentation theory, perceived risk theory, social motivation theory, expectancy theory, integrated framework of the attitude behavior model, goal-setting theory, status hierarchies theory, relatedness-autonomy-mastery-purpose framework, stimulus-organism-response model, self-construal theory, self-efficacy theory, information disclosure

behavior theory, flow theory, two-factor theory, achievement theory, and word-of-mouth effects. The top six frequently cited are selected for detailed interpretation (see Table 2).

Table 2: Top 6 theoretical basis of UGC-generative motivation studies (published in Zhang et al., 2024a)

Theoretical basis	Theoretical goals	Theoretical value	Measurement
Technology acceptance model	• Analyze how easy it is for an individual to use a specific system.	• Explore the motivations that influence the generation of UGC when Internet users are exposed to UGC generation systems.	Technology acceptance model scale, Technology perception pleasure scale, etc.
Self-determination theory	• Sub-theories include: Self-presentation theory; • Analyze the degree to which UGC producers present their true selves; • Analyze Internet users' motivation, internal needs, and emotions for generating UGC.	• Explore the impression that a UGC generates when Internet users reveals themselves to others, and how this process is affected by individual differences; • Explore how the three basic psychological characteristics of autonomy, competence, and relationship can enhance Internet users' internal motivation to generate UGC.	Self-focused attention scale, Self-determination scale, Appreciation in relationships scale, etc.
Social identity theory	• Sub-theories include self-efficacy theory; • Analyzes the group interaction, community norms, self-efficacy, social identity and social network of UGC producers.	• Explore the intentions and attitudes, confidence, etc. of users or groups in generating UGC on the Internet; • When Internet users have a prominent social identity in a group, they tend to behave in a way that is beneficial to the members of the group.	Social support appraisals, Self-esteem scale, Self-efficacy scale, Attitude scale, Group identification scale, etc.
Social exchange theory	• Analyze the process and mechanism of generating knowledge UGC as capital on the Internet, involving psychological needs, personal gains and losses, value judgments, and emotional attitudes, etc.	• Revealing the internal and external reasons for the generation and continuous generation of UGC on the Internet from an economic perspective.	Expected reward scale, Expected relationship scale, Expected contribution scale, Reputation scale, etc.
Social capital theory	• Analyze the social relationships, structural relationships, and social cognition of UGC producers.	• Using interpersonal relationships as capital to discuss the influencing factors of UGC generation on the Internet.	Interpersonal trust scale, Social interaction analysis scale, Structural dimension, Relational dimension, Cognitive dimension, etc.
Need hierarchy theory	• Sub-theories include: uses-gratifications theory and achievement motivation theory; • Analyze UGC producers' motivations for media exposure and which needs these exposures meet.	• From the perspective of communication, reveal whether the producers' UGC-generative needs on the Internet are met or not.	Media gratification scale, Motivations for using internet scale, etc.

The intrinsic reason users participate in UGC generation is based on the need hierarchy theory and self-determination theories. Extrinsic UGC motivation mainly involves theories like social exchange, social capital, social identity, and the technology acceptance model. There are still gaps in the theoretical perspectives of the knowledge ecosystem and cognitive surplus.

Dutch scholar Pór (2000, 2001) proposed the theory of knowledge ecosystems, emphasizing the interconnected development of knowledge, technology, people, and the environment. He advocated for creating knowledge ecosystems that enable effective knowledge-sharing and collaboration across different locations and foster the dynamic evolution of knowledge interactions between entities (Pór, 2012). This approach integrates knowledge and media, breaking traditional learning barriers and fostering an open, interactive, albeit fragmented, digital learning environment (Yu, 2017). The current Internet can be seen as a knowledge ecosystem (Winberger, 2012), where professional circles in subdivided fields are opened up, allowing more individuals to address shared challenges (Yu, 2017). The flow of UGC diverts a UGC knowledge ecosystem, enabling professionals from different fields to effectively share knowledge and collaborate during their spare time (Zhang et al., 2024a).

2.1.6 Cognitive Surplus

American writer Shirky proposed in 2010 that with the era of fragmentation, knowledgeable individuals can utilize their spare time to consume and generate content, but the values of content-generating and content-sharing are far more significant than content-consuming; the reuse of this spare time for knowledge-sharing created a new potential value range — cognitive surplus (Shirky, 2010). That is, 'cognitive surplus' refers to the dividends of knowledge sharing brought to human society, and this surplus is cognition and consciousness levels (Teng & Zhao, 2017). Shirky (2012) also linked the cognitive surplus with the sharing economy, emphasizing four value forms of 'cognitive surplus', including personal value generated by individual creation and sharing; communal values are more participatory and occur in a collaborative group; public value is collaborative groups actively try to create public resources, intending to help people outside the group; and civic values is a group actively trying to change society or collaborating on a project that benefits society (Shirky, 2010).

Knowledge has the characteristics of non-exclusivity and non-competitiveness; knowledge is "a fluid mix of framed experience, value, contextual information, and expert insights" (Davenport & Prusak, 1998, p.5). As a result, the flow of knowledge is accelerated, the cost of knowledge acquisition is reduced, and the value of knowledge is maximized in the process of dissemination and diffusion, thus forming a cognitive surplus (Teng & Zhao, 2017). The

perceived usefulness of cognitive surplus further stimulates users' enthusiasm for knowledge-sharing (Tian & Niu, 2022). More users are willing to share their cognitive surplus in virtual communities. Thereby, knowledge-sharing in the knowledge ecosystem has emerged in online education, promoting knowledge production and transformation and greatly changing the configuration pattern of OER. It enables ordinary citizens previously excluded to use their free time to engage in knowledge-sharing that they like or care about (Teng & Zhao, 2017).

Under such a context, Shirky (2012) further stated that the motivation of cognitive surplus is that well-educated or experienced humans with the freedom to manage their spare time will have four strong motivations to share knowledge to create a cognitive surplus. Due to the scarcity of knowledge and the permeability of capital, some cognitive surplus was changed from free sharing to paid consumption (Barrett, 2010). The motivation to create a cognitive surplus was divided into intrinsic and extrinsic motivations. Intrinsic motivations include sharing (exchanging information and experiences), competence (demonstrating or enhancing skills), autonomy (perceived control over activities), and membership (belonging to groups with shared values and beliefs); extrinsic motivations include reward (gaining economic reward or recognition from behaviors) (Barrett, 2010; Shirky, 2010).

2.2 Theoretical Underpinnings

2.2.1 UGC As Cognitive Surplus to Support UGC Knowledge Ecosystem

The digitalization trend compels educators, particularly in TVET, to explore new methods that align with younger generations' cognitive patterns and personalized learning needs. Weinberger (2012) noted that knowledge is not confined to books or minds but exists across the Internet's vast network in the digital age. Kelly (1995) emphasized that connectivity enhances individual value, underscoring the importance of linking knowledge through the Internet. Teachers can utilize online platforms and social media to share their insights or experiences, effectively connecting and expanding upon existing knowledge (Yu, 2017). However, while platforms like Massive Open Online Courses (MOOCs) provide opportunities for knowledge sharing, they support a one-way flow of information with limited student-generated content and interaction (Lee et al., 2019). This issue may stem from the need for a well-established UGC knowledge ecosystem.

Building on this, Shirky (2010) introduced the concept of cognitive surplus. A cognitive surplus is a unique form of knowledge that emphasizes content creation and sharing by educated individuals in their spare time (Ji, 2016). In addition, the essence of UGC is still a cognitive surplus proposed by Shirky (2010) in the digital era (Homburg, 2017). Internet users are in an

era of individual pursuit of cognitive surplus (Meng & Sun, 2017). Digital technology and the Internet have provided platforms for cognitive surplus creation, and the UGC model in platforms supports cognitive surplus gathering to enhance the UGC knowledge ecosystem.

2.2.2 Cognitive Surplus Enhancing User-Generated Instructional Videos for TVET

The cognitive surplus theory suggests that knowledgeable users can independently utilize their spare time to share knowledge and information, creating a new model of learning activities that significantly impacts online education (Tian & Niu, 2022). A 'user-generated instructional video' represents this cognitive surplus flow in online education, facilitated by the UGC model (Homburg, 2017). Compared with conventional instructional videos for formal schooling, user-generated instructional videos enable fragmented learning characterized by non-standardized, flexible times, occasions, and formats (Riley, 2017). Learning with instructional videos is becoming increasingly frequent, presenting new challenges and opportunities for educators to adapt their teaching strategies to this evolving landscape.

While cognitive surplus theory has primarily been applied in media, communication, and business contexts, its potential in educational settings remains underexplored. Neus (2014) demonstrated how companies could motivate customers to utilize their cognitive surplus for innovation. The potential and value of cognitive surplus and its ability to generate motivation in teaching and learning should be deeply developed. Fatayer (2016 proposed a model to engage students in contributing their cognitive surplus as a sustainable open educational resource. Further studies by Fatayer and Tualaulelei (2023) investigated the value of student-generated content but did not extend their exploration to broader teaching contexts. Pushkarna et al. (2021) explored students' cognitive surplus within a 'student-as-producer' framework, focusing on enhancing digital didactic skills in legal education. However, their study was confined to students and did not address the broader potential of cognitive surplus in enhancing user-generated instructional videos, especially for TVET. Although some scholars, e.g. Neus (2014), Fatayer (2016, and Pushkarna et al. (2021), have further expanded and deepened the research on cognitive surplus based on the characteristics of the Internet era, less research about cognitive surplus guides the production of instructional videos generated by users, which is fragmented (Guo & Kang, 2022). Thereby, exploring the role of cognitive surplus in enhancing 'user-generated instructional videos' for TVET becomes necessary. The concept of cognitive surplus, when utilized effectively, has the potential to transform traditional learning paradigms.

2.2.3 Didactic Potential of User-Generated Technical Instructional Videos in TVET

While previous studies have recognized the practical utility of instructional videos across different fields, including clinical education and general knowledge distribution (Cooper et al., 2017; ten Hove & van der Meij, 2015), the focus on 'user-generated technical instructional videos' for TVET remains limited. Arkenbäck (2023) categorized these instructional videos into professional and peer-generated formats (vlogs) within the TVET domain but did not explore their didactic potential as a cognitive surplus. A cognitive surplus in the didactic field refers to individuals using their spare time, knowledge, skills, or experience to engage in knowledge-sharing activities to produce OER (Tian & Niu, 2022).

The 'user-generated technical instructional video' represents a valuable form of UGC in online education, offering substantial untapped TVET didactic potential (Zhang et al., 2024b). This concept aligns with Shirky's (2010) discussion on digital interactions, highlighting how knowledge is a cognitive surplus that generates beneficial content for broader audiences. Shirky (2010) argued that contemporary technologies allow cognitive surplus to be captured faster and on a wider scale than ever. For knowledge groups, using their cognitive surplus can provide 'value' for the hours of cognitive effort they invest in their spare time. The cognitive surplus has become popular since its birth, causing scholars to discuss its connotation, origin, and manifestations (Tian & Niu, 2022). However, the current practice of cognitive surplus and its application is mainly concentrated in media and communication, and few know its vast potential and value in didactic (Zhang et al., 2024b). Therefore, exploring the didactic potential of 'user-generated technical instructional videos' in TVET is urgent.

3 The Present Study

This section serves as a link between the previous and the latter sections of this dissertation. The subsection "3.1 Theoretical and Empirical Gaps" explains the UGC-generative motivation studies' theoretical and empirical gaps in online learning, especially in the context of TVET. To respond to the research gaps, the subsection "3.2 Aims and Hypotheses" further states two research questions and develops all hypotheses to support the motivation scale development and validation. At the same time, the insight from the literature review in Section 2 supports the development of hypotheses.

3.1 Theoretical and Empirical Gaps

The literature review identified 22 theoretical foundations of UGC motivation. Despite the extensive research on UGC motivation, significant gaps remain, particularly in understanding how newer theoretical perspectives, such as knowledge ecosystems and cognitive surplus, influence the generation of UGC.

As Pór (2012) noted, creating ecosystems that enable effective knowledge sharing and collaboration across different locations is essential. The Internet functions as a knowledge ecosystem in the online context, enabling professionals from different fields to collaboratively address common challenges (Sadaf et al., 2021). The flow of UGC online can be seen as forming part of this knowledge ecosystem. However, despite its potential, there is a limited empirical exploration of how knowledge ecosystems relate to UGC-generative motivation. Building on this, Shirky (2010) introduced the concept of cognitive surplus, which argues that knowledgeable or experienced individuals utilize their spare time to create content, thereby adding value to collective knowledge. In the aspect of motivation, Shirky (2010) stated that well-educated or experienced individuals are strongly motivated to create a cognitive surplus when given the freedom to manage their spare time. Moreover, motivations for cognitive surplus creation are categorized into intrinsic and extrinsic motivations, including membership (belonging to groups with shared values and beliefs), sharing (exchanging information and experiences), competence (demonstrating or enhancing skills), autonomy (perceived control over activities), and reward (material and mental benefits) (Paul 2010; Shirky, 2010).

The review identified 13 UGC-generative motivations and 46 motivation influence factors. They can be categorized into four levels: intrinsic, extrinsic, technical, and personal. Through the three-level classification for four levels, 13 motivations and 46 motivation influence factors, an insight was proposed that motivations for UGC generation align with categories of motivations for cognitive surplus creation, particularly in membership, sharing, competence,

autonomy, and reward (Zhang et al., 2024a). Although some theoretical studies (e.g., Fatayer & Tualaulelei, 2023; Guo & Kang, 2022; Homburg, 2017; Neus, 2014; Tian & Nui, 2022) have acknowledged the importance of cognitive surplus in understanding UGC motivation, empirical validation remains scarce. There is a gap in using cognitive surplus theory to explore the motivation for UGC in technical instructional videos.

3.2 Aims and Hypotheses

In response to the research gaps, A Motivation scale of User-generated Technical Instructional Video (MUTIV) combining the five motivational dimensions of cognitive surplus creation (membership, sharing, competence, autonomy, and reward) and the three-level classification framework of UGC-generative motivation will be developed. This tool will identify and assess these motivations for UGC in technical instructional videos from the perspective of cognitive surplus.

Regarding instructional video exploration, existing research predominantly emphasizes the pedagogical and professional aspects of instructional videos but overlooks the underlying motivation aspect of user-generated instructional videos, particularly in the context of TVET. Although Homburg (2017) introduced 'user-generated instructional video' as a manifestation of cognitive surplus in educational contexts, the motivations driving users to create the cognitive surplus have not been thoroughly investigated. This led to the following two research questions:

1) From the cognitive surplus motivation dimensions perspective, what are the motivations for user-generated technical instructional videos, and what implications does it have for its application in the didactic practice?
2) Can the motivation to generate instructional videos for TVET be measured by the five cognitive surplus dimensions (sharing, competence, membership, autonomy, and reward), and what are the recommendations for TVET-related stakeholders?

The present study addresses a significant gap in the literature by focusing on the motivational aspects of UGC in online TVET, explicitly exploring the concept of the cognitive surplus creation. This research integrates three primary motivations: the generation of UGC, the production of instructional videos, and the pedagogical aspects of online teaching. Consequently, the following hypotheses are formulated:

1) The Motivation scale of User-generated Technical Instructional Video (MUTIV) for video production, online didactic, and cognitive surplus creation is described with a five-factor model.
2) The scale factors of sharing, membership, competence, autonomy, and reward represent independent latent factors (motivation) of user-generated technical instructional videos.
3) Initially assumed that the overall model fitness index approached the ideal level.
4) The five-factor model with high construct validity.
5) The five-factor model has acceptable items and internal consistency reliability.

4 Methodology

This section discusses the methodological basis for the research designs. The qualitative phase focused on item and scale creation, while the quantitative phase centered on scale validation. Following Carpenter's (2018) ten-scale development and reporting steps, the methodology proceeded through several phases. Five foundational dimensions were identified through a review of existing literature and an online survey. The literature review results of Section 2, including the commonly used theoretical basis in the study of UGC-generative motivation, UGC-generative motivation, and motivation influence factors, serve as the base for measurement instrument development, particularly the development of a 38-item pool. Subsequently, expert discussions refined this 38-item pool to 36 items, constituting the MUTIV-I. Pilot testing of Questionnaire I, incorporating MUTIV-I, provided initial feedback, followed by formal data collection and subsequent exploratory factor analysis using first-round data. This analysis refined the scale to a 16-item version, MUTIV. In the scale evaluation phase, Questionnaire II, featuring MUTIV, was administered to collect second-round data, which underwent confirmatory factor analysis (CFA) to validate the scale's structure. Comprehensive reliability and validity assessments were conducted, including internal consistency and construct validity measures.

4.1 Item and Scale Development

Five foundational dimensions were identified — membership, sharing, competence, autonomy, and reward — through a thorough review of existing literature. Then, an online survey about the motivation for online video generation was posed on a Chinese virtual forum (https://www.zhihu.com). A deductive content analysis was conducted, sorting the responses (N = 65) using MAXQDA software into predefined codes based on Shirky's (2010, 2012) theory. After analyzing the results and the literature, items were developed and aligned with the five dimensions (membership, sharing, competence, autonomy, and reward) as outlined in Shirky's theory. This process collected 38 items across the five dimensions.

Subsequently, seven experts with extensive experience producing instructional videos for blended learning, online education, and specific target groups and who are proficient in questionnaire design discussions, refined these 38 items to 36 items, see Table 3. Several adjustments were made, such as items: "I feel free to do whatever I want to do in my spare time." and "If I require help, Internet platforms will do their best to help me." were removed; item: "The process of generating instructional videos is enjoyable." was added; item: "In my experience of website, I feel free to say what I want to say." was revised to item: "I can freely

manage my spare time." Ultimately, a Likert 5-point 5-factor-36-item scale (MUTIV-I) was developed, with responses ranging from strongly disagree (1) to strongly agree (5).

Table 3: 36-item pool (MUTIV-I) (published in Zhang et al., 2024b)

No.	Membership
1	Sharing technical knowledge online helps to maintain social interaction to build personal intellectual property (IP).
2	I want to sign a work contract with an influencer management company, so I generate technical instructional videos.
3	I want to generate technical instructional videos because I am a member of a technical association, school or organization.
4	I have a technical knowledge learning and working background, which is one of the reasons why I want to generate technical instructional videos.
5	I want to be more involved in the Internet community, therefore I want to generate technical instructional videos and post them online.
6	I want to attract people with the same interests; therefore, I want to generate technical instructional videos and post them online.
7	Generating technical instructional videos and posting them online can improve my online image and identity.
	Sharing
8	I am willing to re-post and share technical knowledge and content that I find valuable.
9	I am willing to spend time to participate in online technical knowledge sharing modules.
10	I am willing to share my technical knowledge, experience and insights on the Internet.
11	I feel very proud to share my favorite things with everyone through videos.
12	I think the process to share my knowledge is enjoyable.
13	I am willing to share valuable technical knowledge, insight and experience.
	Competence
14	I feel confident answering questions and comments from fans on the online platform and offering advice to them.
15	I feel that I have several good qualities.
16	I can do things as well as most other people.
17	No matter how more or less my videos get attention, I don't doubt my technical knowledge and skill levels.
18	My technical knowledge, experience, skills and opinions need to show.
19	I can express my knowledge and opinion correctly in my videos.
	Autonomy
20	I feel I can decide whether to answer questions and comments from fans or offer advice.
21	I feel that I can post videos and edit uploaded content whenever and wherever on Internet platforms.
22	I feel that I can decide the content and topics within my technical instructional videos.
23	I do what I do because it interests me.
24	In my experience of website, I feel free to say what I want to say.
25	I feel that I am easy to master the functions of video editing tools, video sharing platforms, video applications and video shooting devices.
26	I feel free to post information on website.
27	I can freely manage my spare time.
28	I feel that video applications and online video-sharing platforms can protect my privacy.
	Reward
29	Generating technical instructional videos and posting them online can bring me more followers and influence.
30	Generating technical instructional videos and posting them online can help me gain some financial income or business cooperation.
31	Online video platforms and video applications have a reward system, and I can accumulate levels by generating technical teaching videos to obtain certain permissions.
32	I feel very happy when I generate the video.
33	Generating technical instructional videos and posting them online helps me gain recognition and respect from others.
34	Generating technical instructional videos satisfies my personal interests.
35	Generating technical instructional videos and posting them online can enrich my spare time.
36	The process of generating technical instructional videos is enjoyable.

4.2 Questionnaire Design and Data Collection

The official version of Questionnaire I contains two main parts, including the first part of 5 items on the subject's general characteristics. The second part is the MUTIV-I with 7 items on the 'membership' dimension, 6 items on the 'sharing' dimension, 6 items on the 'competence' dimension, 9 items on the 'autonomy' dimension, and 8 items on the 'reward' dimension. In addition, the questionnaire included an introduction outlining the research purpose, addressing potential concerns, and assuring participants that their privacy would be protected. Pilot testing was done through five video producers (vloggers; the Channel's number of fans is above 20,000) and seven experts, and then initial feedback was provided. Followed by formal data collection was conducted using Questionnaire I and subsequent Exploratory Factor Analysis (EFA) using first-round data. This analysis refined the scale to a 16-item version, MUTIV. In the scale evaluation phase, Questionnaire II, the introductory section of Questionnaire II was identical to that of Questionnaire I, but the second part featured MUTIV, was administered to collect second-round data, which underwent Confirmatory Factor Analysis (CFA) to validate the scale's structure.

A Chinese online questionnaire platform, Wenjuanxing (https://www.wjx.cn/), was used to host and issue Questionnaire I and II. In the introduction of the questionnaires, participants were informed about the purpose of the research, the assurance of anonymity, the procedures for storing survey data, ethical issues, and any potential risks associated with participation. Access to the two main parts of the questionnaires was granted only after participants clicked a confirmation button. A reward of RMB 3.33 (US$0.48) was settled for each questionnaire to enhance participation. The sample groups of the two survey rounds were randomly selected from mainland China between 20 February 2023 and 10 April 2023. First, a vocational college, a technical university, a contracting company (businesses including civil, electrical, and mechanical), and a retirement engineers association were commissioned to distribute online questionnaires to their teachers, students, employers, and members. Second, 20 online open instructional video producers who teach TVET spontaneously online on Chinese video-sharing platforms (Bilibili & Douying) were contacted to fill out and post online questionnaires on their video channels. Third, the snowballing method was also used to identify target groups.

4.3 Sampling and Respondents

According to the UGC model and cognitive surplus theory, a TVET-related or technically skilled person who can arrange their spare time freely is motivated to conduct online didactics by generating 'user-generated technical instructional videos' to create the value of cognitive

surplus. They may be teachers, students, engineers, technicians, or workers in technical fields, or maybe individuals from other fields with skills in TVET fields. Therefore, this study did not limit the target group's identity, occupation and age. The target population is those with specific TVET knowledge or skills and who have generated or want to generate technical instructional videos and upload them to the open web, where anyone can access them. The inclusion criteria were as follows: 1. Individuals who have created or intend to create technical instructional videos during their free time and have shared them online within the last 5 years; 2. Participants who were informed about the study and consented to be investigated.

In the first-round survey, a sample size of 271 participants was obtained. 22 samples were excluded based on the screening question: "Have you generated technical instructional videos in your free time and posted them online for everyone's access in the last 5 years?". Additionally, 10 samples were removed due to inconsistencies with teaching content, insufficient time to complete the questionnaire and logical problems. Valid samples (Sample A, N = 239) from the first-round survey were included in Table 4, reflecting an effective recovery rate of 88.33%. According to Wu (2010), a recovery rate above 70% supports using results to draw conclusions.

Table 4: Characteristics of samples (N = 239 & N = 279) (published in Zhang et al., 2024b)

Characteristic	Subjects	%
Gender		
Male	170 / 194	71.13 / 69.5
Female	64 / 79	26.78 / 28.3
Diverse	3 / 4	1.26 / 1.4
I do not want to answer	2 / 2	0.84 / 0.7
Age		
Under 20	15 / 17	6.28 / 6.1
20~29	107 / 126	44.77 / 45.2
30~39	61 / 67	25.52 / 24.0
40~49	31 / 38	12.97 / 13.6
Above 50	25 / 31	10.46 / 11.1
Education Background		
Primary school or below	1 / 1	0.42 / 0.4
Junior school	14 / 19	5.86 / 6.8
High school	15 / 15	6.82 / 5.4
Higher vocational college	86 / 101	35.98 / 36.2
Bachelor's degree education	62 / 68	25.94 / 24.4
Master's degree education	43 / 52	17.99 / 18.6
Doctoral degree education	18 / 23	7.53 / 8.2
Have you generated technical instructional videos in your free time and posted them online for everyone's access in the last 5 years?		
Yes, I did.	207 / 234	86.61 / 83.9
No, but I want to do it.	32 / 45	13.39 / 16.1
No, and I do not want to do it.	Skip directly to the end	

Valid samples (Sample B, N = 279) were selected from 318 respondents in the second-round survey. Both Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA) were appropriately applied to evaluate the hypothesized measurement model. According to Ekbäck et al. (2013), the sample size for such analyses should ideally be at least 5 to 10 times the number of items, confirming the adequacy of this study's two rounds of data collection.

4.4 Statistical Analysis for Scale Validation

In current analysis procedures, the testing indicators followed Carpenter's (2018) scale development framework. Comprehensive reliability and validity assessments were conducted. The analysis encompasses the following steps:

1) Descriptive statistics: Utilizing SPSS 26.0 software, descriptive statistics (frequency and percentage) were employed to describe the characteristics of the target populations (N = 239 and N = 279).

2) Item analysis: First, in SPSS 26.0 software, the Critical Ratio (C.R.) and homogeneity test were conducted for item analysis and removal of ineligible items. The C.R. method was applied to analyze sample A (N = 239); after sorting scale scores from high to low, the top 27% and the bottom 27% of the target populations were selected as high and low subgroups, respectively. Second, the two independent samples T-test was performed to compare the difference between the scores of the top 27% and the bottom 27%. Finally, the correlation analysis was conducted between correlation coefficients (r) between the scores of items within a scale and the total score.

3) Validity analysis: Validity is usually defined as the consistency between the definition of a construct and the test. It is generally divided into content and construct validity (including convergent and discriminant validities) (Driver & Watson, 1989). Experts initially evaluated content validity during the content validity and pilot-testing phase. First, EFA was conducted using Principal Component Analysis (PCA) with maximum variance orthogonal rotation on sample A (N = 239) in SPSS 26.0. The analysis was iterated 20 times based on deletion criteria: items with factor loadings < 0.45, items loading > 0.45 on multiple factors, and items misassigned to inappropriate factors (Wu, 2010). Each iteration involved deleting one non-conforming item, followed by EFA repetition. Second, CFA was performed using Amos 26.0 software to illustrate the model and evaluate how well sample B (N = 279) data fit the 5-factor solution we identified in the EFA. Third, the Average Variance Extracted (AVE) and factor loadings are convergent validity's upper and lower bounds (Wu, 2010). Subsequently, I

computed the standardized factor loadings for each latent variable's corresponding items to determine AVE values. Finally, a Pearson correlation analysis was conducted using SPSS 26.0 software on sample B (N = 279) to derive correlation coefficients (r) between each factor and its constituent items. These analyses collectively ensured a robust assessment of construct validity and reliability.

4) Reliability analysis: First, reliability analysis was conducted using several methods. Initially, we computed the mean of all item correlation coefficients within each factor facet to derive the Mean Inter-Item Correlation (MIIC) coefficient. Second, Composite Reliability (CR) was calculated as an indicator of internal consistency reliability. Following CFA, I determined each latent variable's standardized factor loadings for corresponding items to establish CR values. Finally, Cronbach's α coefficient and Slip-half reliability analysis were performed on sample B (N = 279) in SPSS 26.0 to test the internal consistency of each factor within the scale. These analyses collectively ensured robust evaluation of the instrument's reliability across various dimensions, supporting the validity of my findings.

5 Results

This section reports and interprets the analyses' results, clearly presenting the scale's psychometric properties and insights into the cognitive surplus motivation factors under investigation. First, the item analysis results justified the rationale for retaining 36 items before further Exploratory Factor Analysis (EFA). Second, based on the iterative analysis results of EFA in the validity analysis, the 36 items were reduced to 16 items, and the 16 items were loaded into the corresponding factor facets. Subsequently, the results of Confirmatory Factor Analysis (CFA) showed that the goodness-of-fit, convergent validity and discriminant validity of the 16-item scale all met the standards, indicating that the validity of the 5-factor-16-item model was verified, and the items corresponding to the 5-factor facets were all valid. Then, the results of the 5-factor-16-item model's internal correlation and internal consistency reliability tests also meet the reliability indicators. Finally, through the comprehensive reliability and validity assessments, the validated motivation measurement scale (MUTIV) illuminates the generative motivation for UGC in technical instructional videos, like sharing, competence, autonomy, membership, and reward. All five hypotheses in Section 3 were positively verified.

5.1 Main Result and Interpretation for Item Analysis

In the initial analysis with sample A (N = 239), results indicated statistically significant differences ($p < 0.05$) between high and low-scoring groups for all 36 items, leading to the retention of 36 items at this stage. The Critical Ratio (C.R.), expressed as a t-value, was employed to assess item discrimination, with a criterion typically set at $t > 3.0$, $p < 0.05$ (Carpenter, 2018). C.R. values ranged from 9.826 to 16.458 ($t > 3.0$, $p < 0.001$), indicating strong statistical significance and excellent discriminatory power for all 36 items, thereby confirming their retention. Additionally, the Pearson Correlation Coefficient (r) was analyzed to assess the correlation between individual item scores and the total scale scores, with a threshold typically set at $r > 0.30$, $p < 0.05$ (Carpenter, 2018). Correlation coefficients ranged from 0.339 to 0.681 ($r > 0.30$, $p < 0.05$), demonstrating strong correlations among the 36 items.

In summary, the primary objective of item analysis is to test the appropriateness or reliability of individual scale items (Carpenter, 2018). All 36 items in the MUTIV-I scale were retained following rigorous item analysis procedures.

5.2 Main Result and Interpretation for Validity Analysis

5.2.1 Exploratory Factor Analysis (EFA)

EFA proceeded with the number of factors fixed at five. Sample A (N = 239) demonstrated a Kaiser-Meyer-Olkin (KMO) measure of sampling adequate of 0.906, surpassing the threshold of 0.60, and Bartlett's test of sphericity was significant ($\chi 2$ = 219,772, df = 94, $p < 0.001$) confirming suitability for EFA (Worthington & Whittaker, 2006). EFA was conducted 20 times, following item deletion guidelines from Wu (2010), resulting in the retention of 16 items.

Table 5 illustrates how these 16 items were distributed across the five factors after EFA iterations. The model's 5-factor structure comprised Factor 1 (4 items), Factor 2 (3 items), Factor 3 (4 items), Factor 4 (3 items) and Factor 5 (2 items), aligning well with the scale development standard, suggesting each factor should ideally include more than two items (Driver & Watson, 1989). According to Bollen (1989), if only one factor exists, then the model should be identified with at least three observation indicators; still, if there are more than two correlated factors, each factor can be identified with two indicators. So, Factor 5 with two items was reasonable because the five factors are correlated according to the item analysis results.

The cumulative Variance Contribution Rate (CVCR) was 72.394%, exceeding the recommended threshold of 70%, indicating a satisfactory structural model (Zhang et al., 2016). Eigenvalues for Factor 1 (7.205), Factor 2 (1.402), Factor 3 (1.115), and Factor 4 (1.058) were all above 1.0, supporting their retention as factors. Factor 5's eigenvalue was 0.806, which is considered acceptable in context due to its proximity to 1.0 and the fixed number of factors based on prior conceptual frameworks (see Table 5) (Cotter, 2011).

Table 5: Rotated component matrix after EFA (N = 239) (published in Zhang et al., 2024b)

Items	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
A1	0.744	—	—	—	—
A2	0.689	—	—	—	—
A3	0.634	—	—	—	—
A4	0.595	—	—	—	—
B1	—	0.751	—	—	—
B2	—	0.735	—	—	—
B3	—	0.686	—	—	—
C1	—	—	0.841	—	—
C2	—	—	0.696	—	—
C3	—	—	0.589	—	—
C4	—	—	0.568	—	—
D1	—	—	—	0.784	—
D2	—	—	—	0.751	—
D3	—	—	—	0.684	—
E1	—	—	—	—	0.900
E2	—	—	—	—	0.790
Eigenvalue	7.205	1.402	1.115	1.058	0.806
Cumulative variance contribution rate (CVCR)	16.389%	31.669%	46.747%	59.862%	72.394%

To summarize, the decision to retain five factors was supported by robust statistical analysis, with all 16 items appropriately loaded onto their respective factors. This culminated in the development of a 5-factor-16-item MUTIV scale, where factors were named as follows: Factor 1 - Sharing (4 items), Factor 2 - Competence (3 items), Factor 3 - Autonomy (4 items), Factor 4 - Membership (3 items), and Factor 5 - Reward (2 items) (see Table 6).

Table 6: The 16-item pool of MUTIV (published in Zhang et al., 2024b)

Dimension		Measurement items	Adapted
Factor 1: Sharing	A1	I am willing to share my technical knowledge, experience and insights on the Internet.	Rodrigues, et al., (2021)
	A2	I am willing to spend time to participate in online technical knowledge sharing modules.	
	A3	I think the process to share my knowledge is enjoyable.	Self-developed
	A4	I am willing to share valuable technical knowledge, insight and experience.	
Factor 2: Competence	B1	No matter how more or less my videos get attention, I do not doubt my technical knowledge and skill levels.	Self-developed
	B2	I can express my knowledge and opinion correctly in my videos.	
	B3	My technical knowledge, experience, skills and opinions need to show.	
Factor 3: Autonomy	C1	I feel that I can post videos and edit uploaded content whenever and wherever on Internet platforms.	Self-developed
	C2	I feel that I can decide the content and topics within my technical instructional videos.	
	C3	I feel that I can decide whether to answer questions and comments from fans or offer advice.	
	C4	I feel that I am easy to master the functions of video editing tools, video sharing platforms, video applications and video shooting devices.	
Factor 4: Membership	D1	I want to be more involved in the Internet community, therefore I want to generate technical instructional videos and post them online.	Self-developed
	D2	I want to attract people with the same interests; therefore, I want to generate technical instructional videos and post them online.	
	D3	I have a technical knowledge learning and working background, which is one of the reasons why I want to generate technical instructional videos.	
Factor 5: Reward	E1	Generating technical instructional videos and posting them online can help me gain some financial income or business cooperation.	Self-developed
	E2	Generating technical instructional videos and posting them online can bring me more followers and influence.	

5.2.2 Confirmatory Factor Analysis (CFA)

CFA was conducted to evaluate the goodness-of-fit and construct validity of the model (Prudon, 2015). The CFA with sample B (N = 279). The model diagram is depicted in Figure 3.

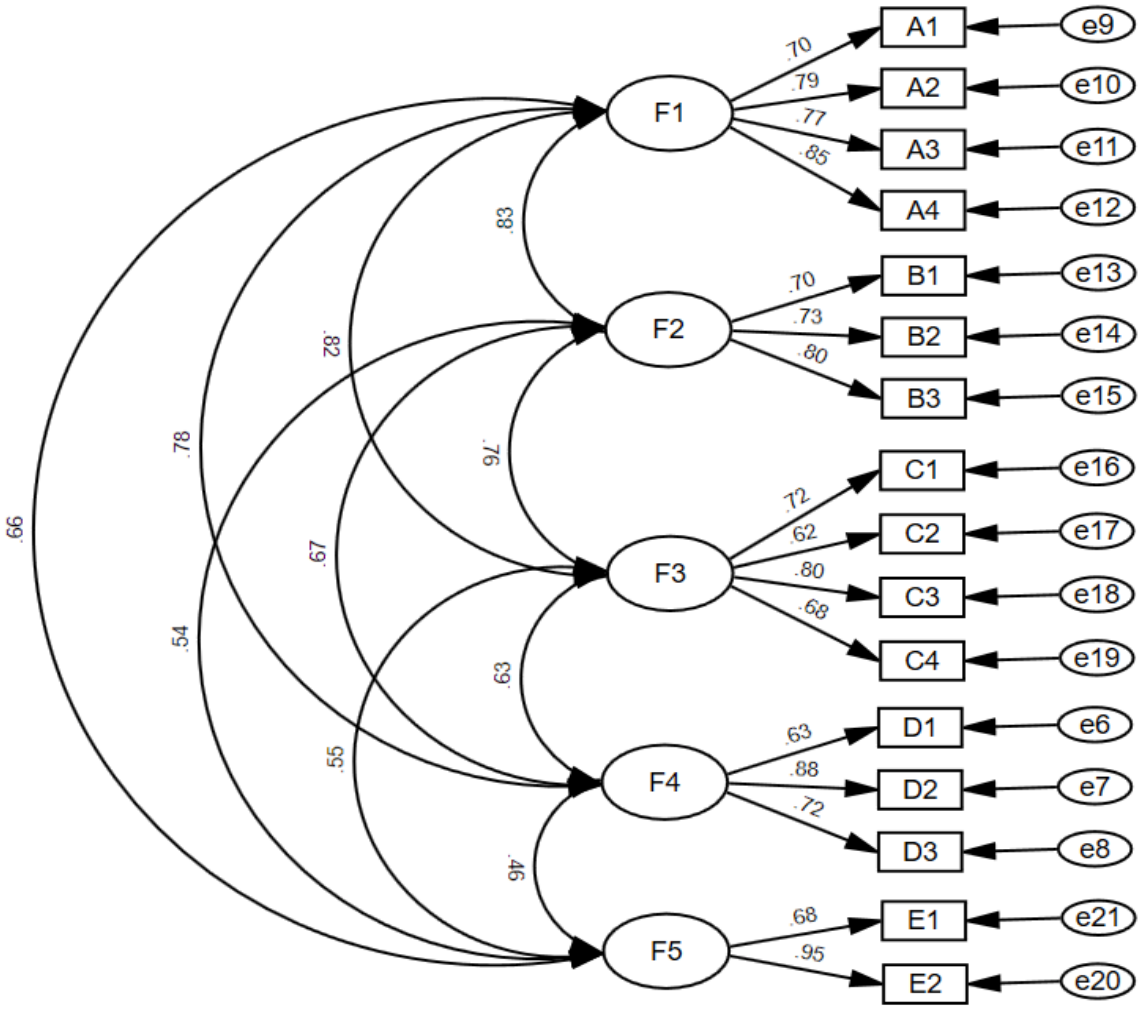

Figure 3: Standard path and parameter estimation of CFA (N = 279) (published in Zhang et al., 2024b); (Note: F1: Factor 1- Sharing; F2: Factor 2 - Competence; F3: Factor 3 - Autonomy; F4: Factor 4 -Membership; F5: Factor 5 – Reward)

Goodness-of-Fit

A p-value is typically set as $p > 0.05$; however, with large samples such as $N > 200$, p-values may become less critical (Andrade, 2019). Therefore, the insignificant p-value ($p < 0.05$) observed in my model fit with N = 279 was deemed acceptable. The goodness-of-fit (GoF) of the model was assessed using several indicators, including $\chi 2$ / df (1.0 ~ 3.0 acceptable), RMA (< 0.05 acceptable), RMSEA (< 0.08 acceptable), GFI (> 0.90 acceptable), CFI (> 0.90 acceptable), IFI (> 0.90 acceptable) and TLI (> 0.90 acceptable) (Prudon, 2015; Wu, 2010). Table 7 shows the acceptable results ($\chi 2$ / df = 2.620, RMR = 0.033, RMSEA = 0.076, IFI =

0.934, TLI = 0.915, CFI = 0.933), revealing that both the goodness-of-fit and stability of the 5-factor-16-item model structure in Figure 3 are ideal.

Table 7: Overall fit index of the model (N = 279) (published in Zhang et al., 2024b)

	χ^2	*df*	χ^2 / *df*	*RMR*	*RMSEA*	*IFI*	*TLI*	*CFI*
Reference standards			1.0 ~ 3.0	< 0.05	< 0.08	> 0.9	> 0.9	> 0.9
Model correction	246.28	94	2.620	0.033	0.076	0.934	0.915	0.933

Note. χ^2, Chi-square value; df, degrees of freedom; χ^2 / df, Chi-square value/degrees of freedom; RMR, root mean square residual; RMSEA, root-mean-square error of approximation; IFI, incremental fit index; TLI, Tueker-Lewis index; CFI, comparative fit index.

Convergent Validity

Significant standardized loading estimates are typically acceptable at 0.50, ideally 0.70 or higher, but lower than 1.0 (Briggs & Cheek, 1986; Hair et al., 2018). In Figure 3, Factor 1 exhibits loading estimates of 0.70, 0.79, 0.77, 0.85 (> = 0.70) for four measurement items, while Factor 2 shows loading estimates of 0.70, 0.73, 0.80 (> = 0.70) for three measurement items. Factor 3 displays loading estimates of 0.72, 0.62, 0.80, 0.68 (> 0.50) for four items, Factor 4 has loading estimates of 0.63, 0.88, 0.72 (> 0.50) for three items, and Factor 5 shows loading estimates of 0.68, 0.95 (> 0.50) for two items. These results are all deemed acceptable, indicating strong correlations among items within each factor facet and demonstrating high convergent validity of the model (Wu, 2010). For instance, in Factor 2 - Competence, items B1, B2, and B3 show significant correlation and convergence.

Fornell and Larcker (1981) suggested that an Average Variance Extracted (AVE) value of 0.50 indicates satisfactory convergent validity, with higher values indicating greater variance explained by the underlying variables. Table 8 shows the four latent variables' AVE ranged from 0.5581 to 0.6864 (> 0.50), except for the autonomy factor. However, Lam (2012) emphasized that AVE is infinitely close to 0.5 and is acceptable. So, the autonomy factor's AVE = 0.4998 was acceptable. All acceptable results indicate that measurement items can better reflect the potential characteristics of their common factor construct. For example, three items (B1, B2, B3) effectively capture the attributes of Factor 2 - Competence.

The convergent validity tests whether items used to measure the same construct are highly correlated and convergent (Velayutham & Aldridge, 2011). Overall, the strong factor loadings and acceptable AVE values confirm that items within each factor facet are highly correlated and convergent. Hence, the convergent validity of our 5-factor-16-item model is robust.

Table 8: CR and AVE value (N = 279) (published in Zhang et al., 2024b)

	Sharing	Competence	Autonomy	Membership	Reward
CR	0.861	0.791	0.798	0.793	0.810
AVE	0.608	0.558	0.4998	0.566	0.686

Note. CR (composite reliability) reflects whether all questions in each latent variable consistently explain the latent variable, reference standards > 0.70; AVE (average variance extracted) measures aggregation validity, reference standards > 0.50.

Discriminant Validity

The diagonal elements (in bold) are the square root of AVE values, and the non-diagonal elements are standardized factor correlation coefficients (see Table 9). The standardized correlation coefficients between five factors were all lower than the square root of AVE values corresponding to factors, e.g., 0.682 lower than 0.752, indicating an excellent discriminant validity between factors.

Table 9: Correlation coefficients and discriminant validity test (N = 279) (published in Zhang et al., 2024b)

Factors	Reward	Membership	Autonomy	Competence	Sharing
Reward	**0.780**				
Membership	0.353***	**0.747**			
Autonomy	0.439***	0.531***	**0.707**		
Competence	0.422***	0.530***	0.595***	**0.752**	
Sharing	0.512***	0.651***	0.670***	0.682***	**0.828**

Note. ***. Correlation is significant, p < 0.001.

Discriminant validity assesses whether measurement items intended for different constructs do not exhibit high correlations with each other. Specifically, items designed to measure distinct constructs should not predominantly load on the same factor. This ensures the items maintain clarity and do not overlap across different aspects of the construct (Velayutham & Aldridge, 2011). Like, within Factor 2 (competence), items B1, B2, and B3 are clearly differentiated from those belonging to the other four facets, exclusively loading under the competence facet.

Construct validity encompasses the alignment between the underlying structure revealed in measurement outcomes and the intended measured constructs, encompassing convergent and discriminant validity (Velayutham & Aldridge, 2011). In summarizing the results of convergent and discriminant validity tests, the 5-factor-16-item MUTIV demonstrated strong construct validity. Specifically, the individual components within the scale's measurement

outcomes (such as items B1, B2, and B3) consistently reflected the domains (e.g., competence motivations) that were intended to be measured.

5.3 Main Result and Interpretation for Reliability Analysis

5.3.1 Internal Correlation Test

An internal correlation analysis assessed the relationships among the five factors and their correlations with the overall MUTIV. According to Ekbäck et al. (2013), a moderate level of factor correlation is deemed acceptable if $r > 0.30$. Table 9 reveals significant correlation coefficients among the five factors ranging from 0.353 to 0.682 ($r > 0.30$, $p < 0.001$), and Table 10 reveals significant correlation coefficients among each factor with whole MUTIV ranging from 0.668 to 0.884 ($r > 0.30$, $p < 0.001$), all results indicate satisfied correlations among the factors and among each factor with the entire MUTIV.

Table 10: Whole scale and mean inter-item correlation coefficients (N = 279) (published in Zhang et al., 2024b)

Variables	Reward	Membership	Autonomy	Competence	Sharing
MUTIV	0.668***	0.772***	0.835***	0.809***	0.884***
MIIC	0.650	0.545	0.496	0.555	0.607

Note. ***. Correlation is significant, $p < 0.001$; MIIC: mean inter-item correlation coefficient.

Additionally, the mean inter-item correlation coefficient (MIIC) serves as a measure of internal consistency reliability, with MIIC > 0.20 considered acceptable (Komagamine et al., 2014; Reissmann, 2015; Schmitt, 1996). Table 10 further demonstrates that the MIIC values across the five factors and the entire MUTIV range from 0.496 to 0.650 (MIIC > 0.20, $p < 0.05$), indicating a satisfactory internal consistency and homogeneity among the measurement items within each factor facet (Briggs & Cheek, 1986).

5.3.2 Internal Consistency Reliability

The upper bounds of internal consistency reliability were evaluated by Composite Reliability (CR), where values exceeding 0.70 indicate robust internal consistency (Hair et al., 2018). Table 8 displays CR values for the five factors, ranging from 0.7907 to 0.8606, all surpassing the 0.70 threshold, affirming the strong reliability of the extracted latent variables.

Table 11: Reliability of the whole scale and each factor (N = 279) (published in Zhang et al., 2024b)

Variables	Cronbach's α	Spearman-Brown
MUTIV	0.911	0.900
Sharing	0.860	0.808
Competence	0.774	0.809
Autonomy	0.796	0.761
Membership	0.774	0.763
Reward	0.753	0.788

Note. Internal consistency reliability: Cronbach's α > 0.60, the validity is acceptable. Slip-half reliability: Spearman-Brown > 0.60, the validity is acceptable.

For the lower bounds of internal consistency reliability, Cronbach's α and Spearman-Brown coefficients were examined (Reissmann, 2015). Table 11 demonstrates that Cronbach's α coefficients range from 0.753 to 0.911 for both the overall MUTIV and each individual factor, exceeding the 0.70 criterion and indicating consistent internal reliability. Similarly, Spearman-Brown coefficients for the MUTIV and each factor range from 0.761 to 0.900, further supporting the scale's internal reliability. According to Cronbach (1951), coefficients within this range signify reliable internal consistency, reinforcing the validity of the 5-factor-16-item MUTIV across various reliability measures. Consequently, the internal consistency reliability analysis confirms robust reliability across the scale's factors, meeting both the upper and lower bounds of reliability criteria.

6 General Discussion

In this section, a comprehensive exploration unfolds. The study and findings in this dissertation are discussed. The theoretical and practical implications inspired by these findings for didactic practice are pointed out. The recommendations are made to research perspectives, TVET educators, policymakers, and platform designers. The limitations and future research directions on the motivation of user-generated instructional videos for TVET are also proposed. Finally, a conclusion is provided to highlight the essential points from the discussion.

6.1 Discussion

The number of instructional videos for online education has grown rapidly (Tseng et al., 2022). Internet users from different backgrounds freely record, edit and upload 'user-generated technical instructional videos' while watching others' creations and interacting with others. Learners can quickly sort out various 'user-generated technical instructional videos' from Internet channels. By transcending disciplinary and space-time boundaries, 'user-generated technical instruction video', as UGC (user-generated content) in video form, bridges informal and formal TVET (technical and vocational education and training). The growing prominence of UGC in online communities highlights a critical need to understand the motivations behind content creation, particularly within the context of TVET. Despite extensive research on UGC motivation, significant gaps remain in understanding how theoretical perspectives, such as knowledge ecosystems and cognitive surplus, influence UGC generation. As Pór (2000, 2001, 2012) described, knowledge ecosystems highlight the need for interconnected and collaborative knowledge sharing. Meanwhile, Shirky's (2010) concept of cognitive surplus highlights the value of content created and shared during individuals' spare time. Through the literature review in the previous section, although some studies have acknowledged the relevance of these perspectives in understanding the motivation of UGC generation, there is limited empirical research exploring how these theories can be applied to enhance the quality and effectiveness of UGC.

Furthermore, the insights from previous literature review indicate that the four motivational dimensions of cognitive surplus creation (sharing, competence, membership, autonomy, and reward) align with the part of validated UGC-generative motivations at extrinsic, intrinsic, and technical levels. In other words, the five motivations of cognitive surplus creation can motivate UGC generation. However, empirical evidence to support this insight is still lacking.

In the TVET field, it is necessary to consider the flow of 'user-generated technical instructional videos' on the UGC knowledge ecosystem and encourage more knowledge groups to interact

with online education, exert the value of personal cognitive surplus, and generate, share or disseminate knowledge. Recognizing that knowledge groups, like TVET teachers, also use their spare time to create UGC, contributing their cognitive surplus to the didactic field, opens new avenues for research. Previous theoretical analyses have suggested the potential for teachers to enhance their competencies through 'teachers-as-producers', integrating cognitive surplus into fragmented learning environments (Tian & Niu, 2022). Despite these insights, there is a need for empirical study to substantiate the motivations behind knowledge groups' cognitive surplus contribution. Identifying and assessing these motivations makes it feasible to predict and support individuals likely to contribute cognitive surplus to the didactic field. Further research, like developing and validating a motivation measurement tool, is needed to validate the findings in the TVET context, respond to the theoretical and empirical gaps, and empirically validate the review's insights.

According to successful instrument development suggestions from Driver and Watson (1989), the analysis of two-round data confirms that the 5-factor-16-item MUTIV (Motivation scale of User-generated Technical Instructional Videos) exhibits satisfactory item and internal consistency reliability, construct validity, convergent validity, composite validity, and an ideal goodness-of-fit. This successfully verified the five hypotheses in this dissertation. The validated MUTIV responds to the first research question: the composite motivation of 'user-generated technical instructional video' producers can be effectively measured by five factors: sharing, competence, autonomy, membership, and reward. Additionally, the validated MUTIV responds to the second research question and empirically validates motivation for user-generated instructional video through cognitive surplus theory (Shirky, 2010) and its application in the didactic field (Tian & Niu, 2022). The theory suggests that well-educated or experienced users with the freedom to manage their spare time are motivated by these five factors to produce 'user-generated technical instructional videos' to share their cognitive surplus. Investigating the motivation for UGC in technical instructional videos under the context of TVET through the lenses of cognitive surplus can reveal how interconnectedness and individual contributions to UGC generation, helping to identify opportunities for enhancing the effectiveness of the UGC knowledge ecosystem (Zhang et al., 2024b).

6.2 Implications for Didactic Practice

The results of this dissertation offer significant insights into vocational didactics, guiding us to recognize and leverage the didactic motivations of Internet users. The results help to improve the theoretical system. They provide a new perspective on the cognitive surplus motivation

dimension for theoretical development in user-generated OER (open educational resources), a UGC. The validated motivation measurement scale (MUTIV) provides an important impetus for applying the motivation part of the cognitive surplus theory in didactic practice. In practical terms, the three-level classification framework and MUTIV scale can predict highly motivated TVET teachers, enabling education stakeholders to provide targeted encouragement based on the UGC-generative motivation and the five motivations of cognitive surplus creation. By understanding these motivations, online TVET communities can encourage users to contribute instructional videos, fostering a positive feedback loop between 'producers-consumers-producers' and enhancing platform engagement. In addition, the five motivation factors of cognitive surplus creation impact teaching and learning in online education by encouraging more individuals to create a cognitive surplus in the didactic field, thus providing OER. This has two major effects. Positively, it can mix up teaching monopolies in online education, allowing students access to a broader range of learning resources and breaking down information cocoons. Negatively, the diversification of 'user-generated technical instructional video' producers may challenge didactic professionalism. The plethora of online education resources may exceed students' learning needs and ability to select and absorb information, resulting in information overload.

6.3 Recommendations for Research

As Weinberger (2012) and Kelly (1995) pointed out, knowledge exists on the Internet in the digital age, and individuals should connect to the online knowledge ecosystem through social media. Teachers, such as TVET teachers, also need to use the Internet to share their cognitive surplus and effectively connect to the UGC aspect of the online knowledge ecosystem. Although there are open online learning networks like MOOCs (massive open online courses), the flow of knowledge is one-way and less in student-generated content (Lee et al., 2019). This limitation is due to the lack of integration with the broader UGC knowledge ecosystem. Addressing this gap involves several key connections that need further research:

First, the connection between teachers themselves. The research of Collinson (2001) found that while teachers need more time to cooperate and share content with peers, they often lack the time for autonomous study and reflection. The emergence of the UGC platforms can help break these time-space boundaries. Teachers generating UGC on the Internet can span various knowledge and subject areas, significantly expanding the breadth of learning among educators. Compared with the traditional face-to-face skill training and other re-learning methods, the degree of freedom on the Internet UGC communities allows teachers of different

disciplines to freely share, learn, cross-border, and integrate knowledge and experiences such as teaching practice, perceptions, reflections, beliefs and emotions. The UGC generated by these teachers can then be applied and tested in offline teaching practices, leading to the reflection and reconstruction of both producers and consumers, ultimately promoting the enhancement of professional knowledge among teachers.

Second, the connection between teachers and the public. Through UGC communities, teachers can interact with, exchange experiences, and explore new knowledge alongside elites and professionals from various technical fields, forming a ubiquitous exchange-learning network. This is particularly important for school TVET teachers, who receive basic induction training in many countries and have limited workplace experience (OECD, 2021). For these educators, communicating with industry workers can provide valuable practical insights and deepen their theoretical understanding.

Third, the connection between teachers and students. The traditional teacher-student relationships often limit opportunities for questioning, reflecting on knowledge, and fostering knowledge re-creation. In contrast, virtual UGC platforms allow students and teachers to communicate and share as equals. Decentralized and deauthorized expression and interaction on these platforms can continuously arouse resonance and discussion between teachers and students on various subjects, both within and across disciplines. In this way, communication and exchange continuously refine the cognitive surplus generated from different perspectives.

In addition, future research is recommended to explore UGC-generative motivation through the lens of cognitive surplus (Zhang et al., 2024a). From a research perspective, the motivation measurement scale (MUTIV) opens the door for developing additional motivational models, examining factors influencing cognitive surplus creation.

6.4 Recommendations for TVET Educators, Policymakers and Platform Designers

Digital technology has enabled massive information accumulation, bringing humanity into an era of fragmented learning (Riley, 2017). Many cognitive surpluses, such as 'user-generated technical instructional videos', have emerged online to provide OERs for fragmented learning. However, under the UGC model, the varied backgrounds of video producers can weaken the reliability of these videos in terms of knowledge extraction (Farnan et al., 2009). Teachers, on the other hand, are well-suited to contribute reliable cognitive surplus in TVET didactics. They possess the necessary conditions for creating a cognitive surplus.

Firstly, sharing, competence, and membership motivations play a crucial role. Teachers are integral members of the didactic field with expertise in pedagogy, TVET backgrounds and technical subjects, which makes them confident in their knowledge reserves and didactic skills. Secondly, autonomy motivation is significant as training in digital didactic tools enables teachers to master technology, video, and media tools, providing them with greater autonomy in the instructional video creation process. Lastly, reward motivation is evident as participating in online education communities allows teachers to share their expertise and interact socially with peers across industries, primarily gaining non-material rewards. In addition, fragmented learning is becoming a normalized learning behavior (Tian & Niu, 2022), and TVET teachers need to adapt to these changes. They should be able to break down knowledge-sharing barriers and use their spare time, professional teaching skills, and technical knowledge to engage in UGC activities, maximizing the value of their cognitive surplus.

As Ginn (2010) pointed it, the online frenzy makes it harder to distinguish between reader and author, artist and propagandist, literature and advertising, amateur and expert. We are now living in an era of 'intelligence surplus'. With the generation of a large amount of cognitive surplus, if the UGC producers cannot be managed in a timely manner, it will bring negative energy to society. Educated or experienced groups, like teachers, with the flexibility to manage their spare time, will be motivated to share knowledge, creating a cognitive surplus (Shirky, 2010). However, it is essential to empirically investigate how groups with educational backgrounds, like teachers, are motivated to generate UGC through the practice of cognitive surplus theory. Our findings indicate a significant overlap between the motivation influence factors for creating cognitive surplus and those for generating UGC. Given that TVET teachers fit this profile, they can be encouraged by educators, policymakers and platform designers to contribute their cognitive surplus by leveraging specific UGC-generative motivations.

At the technical level, factors such as technology's perceived usefulness, ease of use, and entertainment value can significantly drive autonomy motivation. To attract TVET teachers to contribute valuable UGC that enhances online learning, platform designers must prioritize user-friendly system designs and intuitive page layouts while actively seeking feedback from content creators. It is necessary to maintain high visibility for the original UGC and generate, introduce, commend, promote the content, and encourage producers to update it regularly. Meanwhile, privacy protection and avoiding hidden charges are critical to fostering a positive UGC community atmosphere (Ren, 2019).

At the intrinsic motivation level, TVET teachers who become UGC producers are inspired by the sharing motivation, which is driven by altruism and reciprocity. When these TVET educators recognize the value of contributing technical content in their spare time, they are more likely to embrace the digital platforms they use (Homburg, 2017). Online TVET managers can entice users to engage in group interaction to satisfy their needs for social outcome expectations and to inspire their membership motivation. Altruism can also be pronounced as encouraging technical knowledge-sharing for online education. However, purely altruistic behavior will not last long for most users, and it will be difficult to ensure the quality of the content. To maintain continuity for quality contribution, reward motivation is helpful. Therefore, technology platforms and UGC communities should implement reward and incentive systems, such as hierarchical badges, monetary rewards, and point-rating systems. Providing some material rewards or opening some permissions for producers who have made outstanding contributions to UGC communities can sustain their engagement and motivation.

At the extrinsic motivation level, video-sharing platforms should actively promote the benefits of utilizing personal cognitive surplus to produce 'user-generated technical instructional videos' to improve Internet users' competence and motivation, providing opportunities for peer communication, teaching practice, self-expression improvement, etc. Historically, there has been a lack of dialogue among teachers across different disciplines, limiting collaboration and knowledge exchange (Tian & Rui, 2022). Effective partnerships can transcend the traditional barriers between teaching, research groups, schools, and regions, fostering a more integrated discourse that reflects diverse perspectives (Levine, 2010). Educators and policymakers can establish expert teams of highly active producers with controlled access or allow active producers to form self-sustaining communities to motivate and influence peers. Facilitating offline events can also enhance their sense of belonging, meeting their needs for social interaction, recognition, and personal expression.

6.5 Limitations and Future Research

The literature review has language bias, publication bias, methodological limitations, geographical limitations, database limitations, time frame limitations, exclusion of certain study types, and citation threshold limitations. Special notice of two limitations: (1) Theoretical limitations: my review mainly focuses on the gaps in the empirical research on the knowledge ecosystem and cognitive surplus in UGC-generative motivation. Other relevant theories or frameworks may be ignored, limiting the review's theoretical comprehensiveness; (2) Dynamic

nature of UGC: the UGC space is dynamic, and the review findings may not fully capture the complexity and fluidity of UGC-generative motivations in this ever-changing environment.

The limitation of scale validation is the inability to determine the test-retest reliability for motivation measurement scale development and verification. The test-retest typically indicates the stability and consistency of a scale over time (Rodrigues et al., 2021). However, my study utilized online questionnaires distributed through the personal channels of video producers, reaching a mobile and anonymous audience. Future studies should employ two-round surveys targeting a more stable and identifiable participant group to address this limitation to ensure reliable measurements. Additionally, the existing literature lacks scales explicitly addressing the motivation for cognitive surplus creation, making criterion validity assessment unsuitable for this study. Future research should explore alternative approaches to validate the scale's efficacy and relevance in different contexts, ensuring a comprehensive understanding of the motivations behind 'user-generated technical instructional videos' production.

The review shows that users' ethnic-cultural orientations, background features and personal characteristics influence their UGC-generative motivation at the individual level. It can be considered placing the populations in different ethnic groups in the same country to explore the ethnic-cultural orientations as a motivational influence factor. The MUTIV (Motivation scale of User-generated Technical Instructional Videos) can be combined with the personality scale to further explore the generative motivation of 'user-generated technical instructional videos'. According to Hofstede's (2001) cultural dimension theory, Germans exhibit high individualistic and low group integration, obligations, and dependence on groups (Bluszcz & Quan, 2016). This cultural trait could potentially impact their motivations for membership and sharing (Zhang et al., 2024a). Understanding these motivations across various cultures is crucial, as user-generated OER increasingly play a significant role at all educational levels. Future studies should explore these cultural dimensions to ensure the global applicability and effectiveness of the MUTIV in fostering user-generated instructional content for TVET.

Improving the UGC knowledge ecosystem requires a flow of higher-quality cognitive surplus. The 'user-generated technical instructional videos', as OER, are one of the cognitive surpluses that flow in the online TVET didactic (Zhang et al., 2024b). Thereby, there is a need to encourage knowledge groups, like TVET teachers, to produce high-quality technical instructional videos in their spare time to support their cognitive surplus flow. According to future self-congruity and Ajzen's idea, there is some predictability between intention and

behavior (Ajzen, 1985, 1991; Blouin-Hudon & Pychyl, 2015). Further exploration can focus on the relation of 'motivation influence factor – motivation – intention'.

According to Clay (2010) and Barrett (2010), one motivation for creating cognitive surplus is to gain outside recognition. Recognition can be reflected by 'popularity', which represents the probability of a video being requested by users at a particular time, reflecting in loved, famous, or hit (Jin & Bestavros, 2000). Further exploration can focus on the 'popularity-as-motivation influence factor', such as how 'popularity' affects users' motivation to generate instructional videos to contribute to their cognitive surplus for TVET and which motivation is mainly affected.

6.6 Conclusion

The COVID-19 pandemic has accelerated the shift of educational content to online platforms, increasing the production of knowledgeable UGC (user-generated content) for online didactics. As online content generation continues to expand, forming a vast UGC knowledge ecosystem, it is crucial to understand the motivations driving these content producers and their impact on online didactic and learning. This dissertation reviewed the theoretical perspectives and UGC-generative motivation in the past 18 years, and a three-level classification framework of UGC-generative motivation and motivation influence factors was constructed. The review found that some verified UGC-generative motivations overlap with cognitive surplus's five motivational dimensions (sharing, membership, competence, autonomy, and reward). Although some theoretical feasibility discussions were provided in some UGC-generative motivation studies (e.g., Chebor et al., 2018; Homburg, 2017; Teng & Zhao, 2017), there is still an empirical gap in cognitive surplus motivation, especially in TVET. Under this context, this dissertation used five motivational dimensions of cognitive surplus creation as scale dimensions to build a Motivation scale for User-generated Technical Instructional Videos (MUTIV); then, the analysis results with Chinese TVET-related data tested this instrument.

The potential of UGC in the educational domain underscores the importance of understanding the motivations behind such contributions. The MUTIV serves this purpose and facilitates the identification and encouragement of motivated producers. This, in turn, can lead to a richer repository of high-quality OER (open educational resources). An effective UGC knowledge ecosystem relies on Internet users with specialized subject knowledge to contribute their cognitive surplus during their spare time. The findings of this dissertation suggest that TVET teachers are well-positioned contributors to cognitive surplus for online didactics. Educators, policymakers, and platform designers are recommended to encourage teachers to generate instructional content in their spare time to further enrich the UGC knowledge ecosystem.

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8 Appendix

Appendix 1 Journal Article I

Zhang, Y., Pappa, C. I., & Pittich, D. (2024). Exploring user-generated content motivations: A systematic review of theoretical perspectives and empirical gaps in online learning. Computers and Education Open, 7, 100235. https://doi.org/10.1016/j.caeo.2024.100235

Appendix 2 Journal Article II

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