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Meaning-making in virtual learning environment enabled educational innovations: a 13-year longitudinal case study

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ABSTRACT

Despite the high expectation of virtual learning environments (VLEs) to accelerate meaningful educational innovations for more interactive learning and teaching, resistance to changes exists, and innovations are fading over time. How to promote widespread and steady adoption of VLE enabled innovations remains an open question. This study uses mixed methods to examine 13 years of VLE logs, archival documents, and interviews with 51 teachers to investigate two research questions: What is the threshold stage of the institutionalisation process of VLE enabled innovation, and how does the innovation become institutionalised in the threshold stage? We found that the majority VLE enabled innovations (such as virtual classrooms and interactive quizzes) were abandoned or faded before the new or changed learning and teaching practices were fully habitualised. The empirical results show that individual cognitive divergence and collective consensus could promote habitualised institutional leverage through a threshold process, namely, meaning-making. These findings extend our understanding of the cognitive mechanism, and we suggest that universities provide continuous facilitating and teacher support, both on technological use and pedagogical design, to help teachers develop the meaning of the action as a priority. Research significance and implications to the educational transformation in the COVID-19 pandemic are discussed.

Introduction

Although the virtual learning environments (VLEs) or learning management systems have been designed as integrative, communicative, and interactive learning environments to advocate new learning opportunities for online or hybrid learning, the educational innovations enabled by VLEs are not widespread as expected (Ashrafi et al., 2020; Flavin, 2020). Despite its negative impacts, the COVID-19 has accelerated the development of online education and provided opportunities for critical reflection on current educational practice (Green et al., 2020). However, people are missing the "old teaching norm" (i.e. face-to-face or any other instructional approaches that dominated higher education in the past), and resistance to changes exists (Chan et al., 2021, p. 169). It is still an open question if either or both the external disruption (e.g. COVID-19 and emerging technologies) or the internal cognitive evolution plays a critical role in promoting long-term transformative change in higher education (HE).

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Institutional theory "has proven generative for research and insightful for practice" (Marsan et al., 2020, p. 5) to study how human actors accept innovation and achieve stability and legitimacy in patterns of collective action (Greenwood et al., 2017). Many educational scholars started to adopt institutional theory and emphasized the importance of institutionalising educational innovations across the university (e.g. Huang et al., 2021; Nworie, 2015). Therefore, we use Tolbert and Zucker's (1996) three-stage model to study the institutionalisation process of VLE enabled innovations in HE. The term innovation in this paper is defined as a new or changed educational practice or idea enabled by VLE capabilities.

Specifically, we explore the threshold stage and how VLE enabled innovations can achieve institutionalisation by completing this threshold stage. We apply quantitative and qualitative methods to examine the institutionalisation trajectories of 19 VLE enabled innovations in an international university's 13 years of development. Our analysis finds that the threshold stage is from innovation initiation to habitualisation. Habitualisation may not be achieved if teachers fail to "create a meaning" of innovations, leading to incomplete institutionalisation. Meaning-making, therefore, plays a critical role in the threshold stage through two parallel dimensions: individual cognitive divergence (Colyvas, 2007) and collective cognitive consensus (Combe & Carrington, 2015).

This study highlights the value of integrating the sociological concept of meaning-making in an extended institutional theoretical model to specify the cognitive mechanism of institutionalising the VLE enabled innovations in HE. Further, we stress the importance of individual and collective cognitive filters (Combe & Carrington, 2015) to understand better how teachers create meaning from the VLE enabled innovations and habitualised standards (Colyvas, 2007) learning and teaching practices emerge in the institutionalisation process. We discuss the research significance and practical implications of the COVID-19 pandemic.

Literature review

Vle enabled innovations and educational transformation

Rogers (2003, p. 49) defined innovation as "an idea, practice, or object perceived as new by an individual or other unit of adoption". Prior scholars studied different drivers of innovations and included technology as one of the key drivers (Scott, 2014; Van de Ven & Hargrave, 2004). Universities are expected to provide new learning opportunities and promote educational innovations to reshape learning and teaching practices by integrating technologies (Pelletier et al., 2021). VLEs, as one of the universal educational technologies, are designed with critical pedagogical value (e.g. constructivism and connectivism) and technological functionalities (e.g. instant feedback, paperless multimedia submission and group discussion) to enable new learning opportunities in an interactive and communicative online or hybrid learning environments(Barari et al., 2020; Browne et al., 2006). We defined VLE enabled innovation as a new or changed educational practice or idea enabled by VLE capabilities.

However, the material benefits of VLE enabled innovations for the institutional structure are "not readily calculable" (Tolbert & Zucker, 1996, p. 186), which increases the complexity of understanding its mechanism (Sinclair & Aho, 2018). Studies found that many innovations "result in fads or temporary novelties, while others may endure for many years while receiving little attention" (Natividad et al., 2018, p. 85). "It is surprising that higher education has not been transformed by technology, as many other goods and services have been" (Flavin, 2020, p. 145). Further, the extant educational literature shows little evidence of wide-scale educational transformation with digital technologies (Blundell et al., 2020).

Technology acceptance models (Davis, 1986; Venkatesh et al., 2003) and innovation diffusion theory (Rogers, 2003) provided a valuable theoretical framework for emerging studies on VLE adoption and diffusion, while the institutional theory provides a processual perspective that considers the collective cultural influence and individual rationales to seek innovation institutionalisation (Li et al.,

2021). Further, institutional theory has made excellent contributions in stressing the "unreflective, routine, and taken-for-granted nature of most human action" (Raviola & Norbäck, 2013, p. 1173). Berger and Luckmann (1967) defined institutionalisation as a process occurring over time that could create rules, norms, and shared knowledge and belief systems with increasing objectification. Their discussion on institutionalisation inspired other institutional theorists to investigate the process further, leading to multistage models (Greenwood et al., 2017).

The sequential multistage institutionalisation model

In their three-stage sequential multistage model, Tolbert and Zucker (1996) expanded the objectification-based institutionalisation process (Berger & Luckmann, 1967). The three stages are habitualisation, objectification, and sedimentation. From an educational perspective, habitual actions require considerable repetition of a learning task (Sargent, 2015). The habitualisation process develops patterned behaviours and generates "new structural arrangements' (such as policies, procedures, and offices) to solve "a specific organizational problem or set of problems' (Tolbert & Zucker, 1996, pp. 181–182). Through the objectification process that produces tangible and intangible objects (Barman et al., 2016), an organization develops a certain "degree of social consensus among organizational decision-makers concerning the value of a structure"(Tolbert & Zucker, 1996, p. 182). Sedimentation contributes to achieving full institutionalisation (Van de Ven & Hargrave, 2004) by completing the spread of new arrangements and structures across generations of innovation adopters (Rogers, 2003) within and between organizations over time (Tolbert & Zucker, 1996). The sedimentation of new educational reality requires a reduction of origins (Kligyte & Barrie, 2014).

The three-stage institutionalisation model has been used in many studies (e.g. Marsan et al., 2020; Wei, 2021), but few educational studies so far. To address this research gap, we adopted the theoretical model to explore the institutionalisation process in the HE context, where organizations have a looser structure and higher autonomy (Hsu et al., 2018). Another research gap is about the threshold stage that determines the success of institutionalisation. Studies found that innovations faded or stopped progressing at different institutionalisation stages. For instance, Wei (2021) found that the habitualisation stage is unstable and, thus, has a higher failure rate for the institutionalisation of the innovation. Haack et al. (2021) argued that the objectification stage is the gatekeeper for full institutionalisation. To date, which stage is the threshold remains controversial.

Research questions

Our study investigated two research questions: what is the threshold stage of the institutionalisation process of VLE enabled innovations, and how do the innovations become institutionalised in the threshold stage?

Methodology

This longitudinal case study examined the institutionalisation process at an international university (from here on, "University") for the richness and openness of its technological innovation projects from 2006 to 2019. The University has integrated 65 digital technologies on the Moodle-based VLE, enabling various educational innovations. We collected quantitative and qualitative data, including 13 years of digital panel data, about 1248 pages of archive documents, and over 100 h of semi-structured interviews with 51 participants. Following the constructivist grounded theory (Bryant & Charmaz, 2019), we built a theoretical structure based on the original detailed data with high accuracy and integrated the theoretical concepts from substantive theory to a more general level (Gioia et al., 2013). This study received the University ethics approval, and we followed the case study protocol to conduct fieldwork for data collection, analysis, and study reports (Yin, 2018).

Data collection

Digital panel data

We identified VLE enabled innovations, tracked their changes, and determined the institutionalisation stage to explore the first research question. Specifically, we collected 13 years of digital panel data from the Moodle databases (about three terabytes of auto-recorded user logs). These data included vital information, like the number of formal courses taught per academic year, the type of digital technologies integrated, and the actual use of these digital technologies (see appendix Table A). We cleaned the raw data by eliminating erroneous or irrelevant information and scrubbed the data of digital technologies with shallow usage (i.e. no actual user attempts). The user logs reflected teachers' actual behaviours with the digital technologies, such as online activity creation time, time spent on VLE, and user attempts. These data helped triangulate the interview responses regarding technology usage in the innovation institutionalisation process.

Archival documents

To better understand the documented history of VLE enabled innovations, such as decision-making processes and policy implementation, we collected 1248 pages of 475 archival documents published between 2006 and 2019 (see Appendix Table B). For instance, the document "2017 Policy on student attendance and engagement" reported that all course leaders "should decide on the most appropriate way to record attendance" using VLE-based online attendance technology. All collected documents were imported into NVivo version 12 for content analysis and data coding.

Interviews

While the digital panel data and the archival documents showed "photos" of the University history, the interview informants played a critical role in narrating the vivid stories behind the static "snapshots." Applying the purposeful sampling strategy (Guest et al., 2006), we interviewed four staff members from different countries. They had worked at the University from 2006 to 2019 in different roles. Then, we adopted the snowballing technique (Aguinis & Solarino, 2019) to select referrals recommended by prior informants for further investigation. In line with the grounded strategy, we asked semi-structured open questions such as, "what learning technology did you use in the past years, and how was your experience?" The number of interviews continued until the data reached saturation (Bryant & Charmaz, 2019). Finally, we recorded over 100 h of in-depth interviews with 51 informants. They were representatives of the population of interest who had core leadership and academic roles, with a mixed international cultural background (including American, Australian, British, Canadian, Chinese, French, German, Greek, Indian, Italian, Malaysian, Mexican, Nepalese and Philippines), were diverse in gender and educational background, and had served for seven years in the University on average. We used the auto transcription technology with a manual audit. The non-English transcriptions were manually translated into English before data analysis.

Data analysis

The data collected were analysed in three steps. First, we conducted descriptive quantitative data analysis to "triangulate" the data and "paint the most comprehensive picture" for decision-making (Duesbery & Twyman, 2020, p. 94). The University implemented 65 digital technologies over the 13 years. The majority of them were excluded according to the following sampling criteria: 1) the tool should have been implemented and made available for all teachers and students between 2006 and 2019, and 2) the tool should have been used by teachers and students in a formal credit course. Figure 1 illustrates the 19 selected digital technologies. To compare the technology adoption in an academic year with that in other years, we calculated the technology usage rate by dividing the total number of all credit-bearing courses by the number of credit-bearing courses using technology per academic year. For example, in the academic year 2018–2019, there were 985 credit-bearing
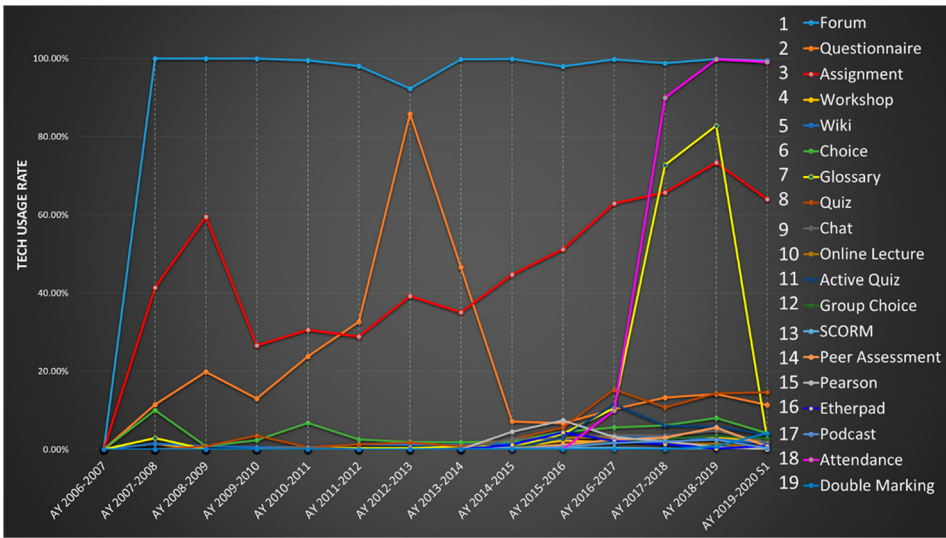
Figure 1. Technology usage rate chart (2006–2019).

courses, and 723 courses used the digital assignment tool. Therefore, the usage rate for the assignment tool in that academic year was 73%.

In the second step, we identified and labelled the institutionalisation stage of each innovation. Specifically, we utilised the ethnographic notes from the documentary content analysis and interviews. In chronological order, we reconstructed vital historical events in innovation with the following information: innovation name, the digital technology used in the innovation, time, institutionalisation stage, and empirical evidence. Figure 2 shows our definitions and references of the institutionalisation stages used for data coding. For instance, we quantified "patterned behaviours" (Berger & Luckmann, 1967) for when over 50% of credit courses had used the technology in learning and teaching practice.

In the final step, we divided the 19 innovations into two groups – complete and incomplete institutionalisation. We considered the institutionalisation stage where most innovations failed to cross the threshold stage. By applying a three-phase grounded coding process (see Figure 3), we aimed to understand the mechanism for generalising the critical theoretical concept from empirical data
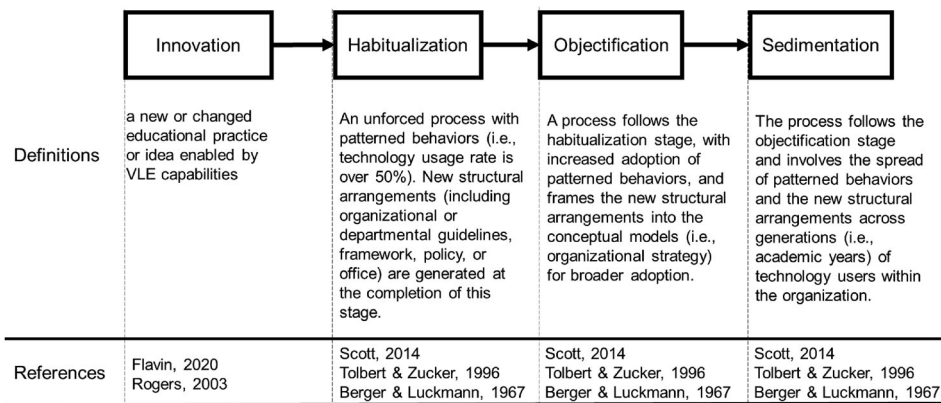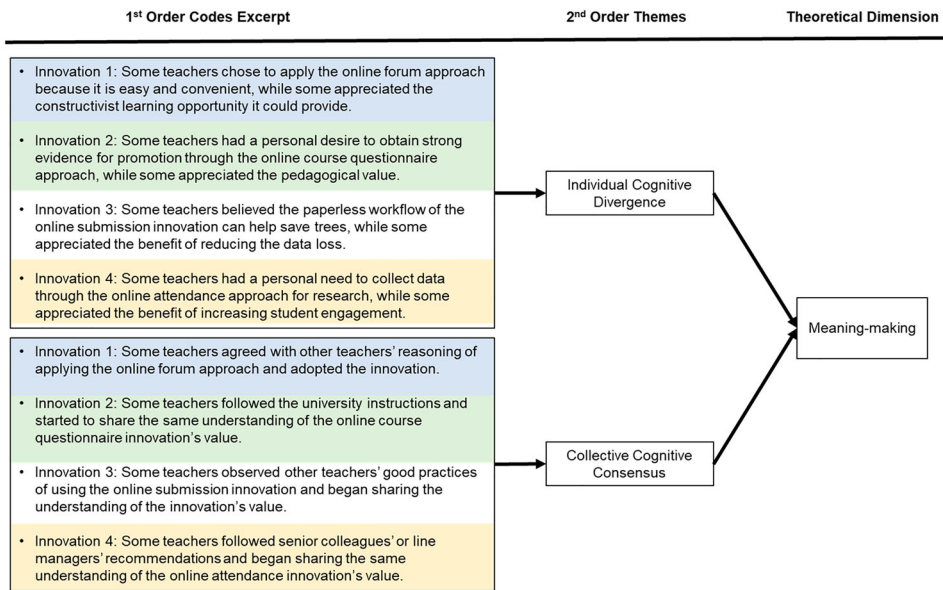

Figure 2. Our definitions of the institutionalization stages.

| 1st Order Codes Excerpt | 2nd Order Themes | Theoretical Dimension |

Figure 3. Data analysis structure.

(Bryant & Charmaz, 2019). We reviewed incidents in the identified threshold stage in the initial phase and started with open coding. As the analysis progressed, the coding moved "from comparing incident to incident to comparing incidents with properties of categories" (Bryant & Charmaz, 2019, p. 5) among the complete and incomplete innovations. The complete innovations crossed the threshold stage (thus entering the habitualisation stage) when both of the following conditions were met: 1) over 50% usage; 2) a new policy and/or new structure. However, the incomplete innovations were abandoned or neglected without evident institutional changes.

To discover the "underlying uniformities in the original set of categories or their properties" (Glaser & Strauss, 1967, p. 110), we went back and forth between the theoretical literature and the grounded data regarding various reasons for teachers to adopt these innovations at the early initiation stage. Then we reconsidered the connections and underlying logic among the individual teachers and groups of teachers. Ultimately, we moved two second-level themes—individual cognitive divergence and collective cognitive consensus—to a higher-level concept: meaning-making.

Results

The threshold stage of the institutionalisation process of VLE enabled innovations

This longitudinal study found that most VLE enabled innovations (79%) (see Figure 4) failed to get to the habitualisation stage. In other words, innovations need to complete the transition from initiation to habitualisation first, and only doing so will boost their chances of becoming fully institutionalised. Therefore, the threshold stage is between innovation initiation and habitualisation. Only 4 out of 19 innovations completed the institutionalisation process through the three stages of habitualisation, objectification, and sedimentation (Tolbert & Zucker, 1996). The remaining 15 innovations faded in the threshold stage.

Complete institutionalisation

Four innovations completed institutionalisation. Innovation 1 was enabled by the newly implemented VLE-based online forum in 2007. Instead of sending emails conventionally, the vice
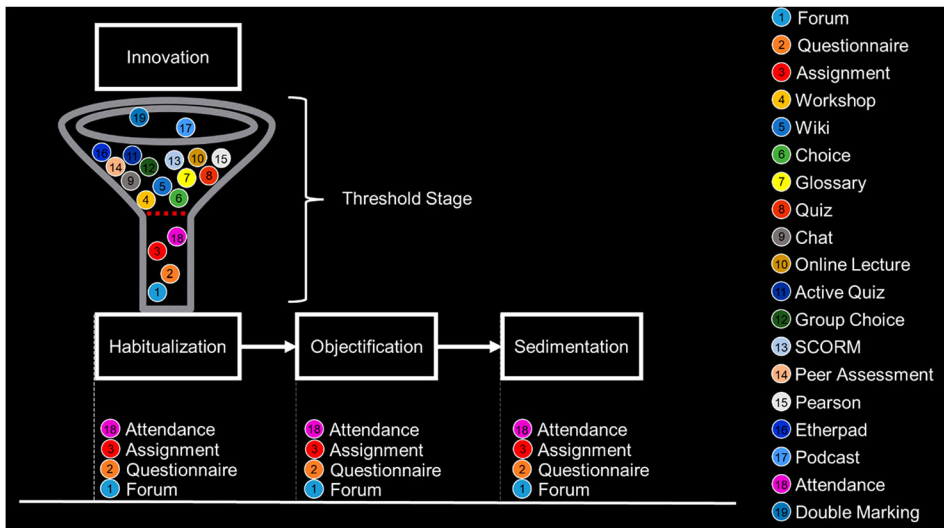
Figure 4. Overview of VLE enabled innovations at each institutionalization stage.

president for academic affairs modelled the new approach of using an online forum to communicate with staff and students. From the VLE logs, we observed a 100% usage rate of the online forum across the University in the first academic year, 2007–2008. According to our definition, having a 50% or higher usage rate is one of the two conditions to achieve habitualisation. The second condition was reached in the academic year 2014–2015. A new office was formed with the new function to better support the institutional technology-enhanced learning (TEL) and launched the TEL framework in 2016. For instance, the TEL framework reported: "effectively moderated discussion forums can provide a way to enrich formal and informal conversations within a subject via providing greater opportunities for open exchanges of ideas and views."

Innovation 2 (questionnaire) and 3 (assignment) were also inspired by the VLE-based digital technologies in 2007. The habitualisation process for Innovation 3 was just like Innovation 1 but slightly different for Innovation 2. The Innovation 2 usage rate kept increasing to 86% and dropped in 2013–2014. The University switched online questionnaires to another system that year. According to the archival documents and interviews, the approaches continued in the new system for all credit-bearing courses implementing the institutional guideline. Therefore, Innovation 2 achieved habitualisation. Innovation 18 (attendance) was implemented simultaneously with a university policy on attendance and student engagement in 2017. Resistances existed, but the usage rate kept between 90% to 99% since its initiation. It was a top-down approach initially but habitualised by the whole university over time.

The processes of objectification and sedimentation for the four innovations were quite similar. The habitualised behaviours were further standardized to seek institutional objectification, implementing the University's five-year academic strategy (2018–2023) more stable (Miles et al., 1987). Their high usage rates (over 50%) lasted for the remaining years, which evidenced the sedimentation of innovation across generations of teachers and students.

Incomplete institutionalisation

The remaining 15 innovations failed to complete the transition from initiation to habitualisation. For example, Innovation 7 used VLE-based online glossary technology to replace the paper-based glossary. Although the online glossary has been included in a VLE course template for all credit-bearing courses (which created a fake peak in Figure 1), actual student attempts to use this technology for learning were minimal (usage rate 1% – 11%). They never reached the "patterned behaviour"

condition of habitualisation. The University then removed the tool from the course template, and the innovation faded over time. The other 14 innovations faded at the threshold stage with lower usage rates.

Meaning-making through individual cognitive divergence and collective cognitive consensus

Based on the above findings for the first research question, we further investigated the key to crossing the threshold stage. We grounded the theoretical concept of meaning-making as the critical step that could be achieved through individual cognitive divergence or collective cognitive consensus. We define meaning-making as a threshold stage that enables innovation from initiation to habitualisation by evolving unique ideas (Colyvas, 2007) or developing shared beliefs (Combe & Carrington, 2015) that make sense to the innovation adopters' institutionalisation process. The individual cognitive divergence dimension emphasizes the importance of being inclusive, while teachers hold different opinions of the innovation's meaning at the early stage of institutionalisation. However, the collective cognitive consensus dimension reinforces the power of similarities in objectives and beliefs in compelling teachers to form patterned behaviours in the early institutionalisation stage.

Meaning-making through individual cognitive divergence
Individual cognitive divergence refers to how human actors actively interact with technologies and evolve independent ideas of institutional routines at the micro-level (Baptista, 2009). In the educational context, previous norms and practices of learning and teaching shape the appropriation of teachers' daily routines, such as sending emails to students as a way of formal communication. Giving up an existing familiar practice for an unknown new practice is risky and needs additional effort (Raviola & Norbäck, 2013). Using new technology, some teachers are self-initiated into thinking about the new opportunities that the new tool might bring, which helps them create their reasons for adopting VLE enabled innovations.

A senior lecturer noted: "you do need a way to send out messages, and the forum is the way … you could use email … but you would need an email address group for the students, which you do not always have." The pedagogical value of using an online forum is far beyond sending out announcements. According to another senior lecturer, "part of the benefit of the online discussion forum is that it gives students time to think before constructing an answer to another person, and my dream is to have students take part in conversation or discussions about topics."

A similar phenomenon occurred in the other three innovations that completed institutionalisation. For example, in Innovation 2, some teachers collected online student course feedback because they needed it as evidence for academic promotion. Simultaneously, some appreciated the pedagogical value of reflecting on students' voices. In Innovation 3, some language tutors piloted to use the of online assignment for paperless submission. They believed that creating a sustainable learning environment is their principle of faith. Teachers from other departments also started to adopt the innovation for different reasons. A senior lecturer from the Design School reflected, "online marking is important because it reduced the chances of loss [content]. It is a process with a lot more integrity … ."

In the case of Innovation 18, one of the meaningful outcomes was the auto-generated attendance report for the government, which was done by paper previously. It reduced the administrative workload and accelerated international students' visa applications and renewal. Some teachers think that online attendance made it possible to "take attendance effectively in large classes." Regarding the potential analytical value of such data, a senior lecturer said: "I am sure there is a causal, there is a correlation [between the attendance and student performance] … if you look at the data … there are still lots of students who do not attend many classes who pass [the examinations]."

Different people have different reasons for doing something, as long as those reasons make sense (Colyvas, 2007). In the 15 faded innovations, most people failed to find a convincing reason to give

up the old practice and adopt the new approach. Teachers' attitudes toward learning technology are the affective stances that might lead to technology use and innovation adoption (Wilson, 2021). For example, in Innovation 9, the University suggested that teachers and students use the VLE-based online chat for instant communication. However, some teachers argued, "no one will use the VLE for 24 h, but we do check our social media messages frequently." Social media (such as Reddit) plays a more sticker role in teachers' work and life in this digital era (Staudt Willet & Carpenter, 2020). We found that teachers gradually developed their cognition of what needs to be done and how it should be done in a meaningful way. The missing of "meaning" will lead to resistance.

Meaning-making through collective cognitive consensus

Apart from divergent individual meanings, collectively agreed cognition was influential as a parallel dimension in the threshold stage. Collective cognitive consensus refers to a phenomenon in which a group of human actors shares the acknowledgement of the innovation, and through this, they give their actions meaning (McGrath et al., 2019). We found that some teachers do not have a specific purpose for themselves. Nonetheless, collective cognition promotes a standardized process that supports "calculative framing, engaging, and valorizing" (Slager et al., 2012, p. 763) in the institutionalisation process. In the University, teachers shared a student-centred active learning culture and adopted VLE enabled innovations to better support student engagement. A senior manager commented: "there are specific things that have come out of using Moodle, which have shaped what we do as a student-centred institution."

Regarding paperless marking (Innovation 3), with the spread of the integrated learning course collaborations over time, more teachers observed the excellent practices. Some academic departments were influenced and cultivated a departmental learning culture that encouraged teachers to use the VLE-based online submission tool. A senior lecturer recalled that " … in my department, staff are not required but requested to provide assessment or possibly do marking … provide the feedback through the VLE." The department staff followed the collectively shared value and started using the online submission tool to support student-centred learning. Another senior lecturer commented: "teachers are now giving scores online, which they traditionally [did] on paper … they write feedback on a Word [document], but now it is showing on [a] separate [online text] box."

In the case of attendance (Innovation 18), a senior manager explained the university-wide consideration of promoting the innovation—

> [In] about 2015 … there was an assumption that students were failing their modules because they were not in the classroom. How do we know [that] they were not in the classroom? We need to have an attendance policy. Then, there was much discussion about how we should have a policy … after maybe two years of back and forth, it was decided that the best way of doing it would be to use the VLE. So, the students come in, scan a QR code … This was for both the local and international students.

Implementing online attendance innovation was a collective decision made by a University committee with representatives from all the departments. Some teachers were influenced by external pressure to take online attendance initially. Cultural framing takeovers changed in tandem with the progressive spread of the action, inspiring reflection on meaningful outcomes, and thus turned passive individual reaction into active collective appreciation (Hirsch, 1986). As a senior lecturer commented—

> When the policy [is] released, I do not take attendance with the expectation that the students will attend [the class] … I take attendance because I am required to … Earlier, we did not have a way of taking attendance in large classes, [but] we [now] have a way … which gives us a dataset … there would be a great deal of use.

While the four innovations achieved habitualisation through the collective beliefs, no cognitive consensus emerged for the other 15 innovations to be habitualised. For example, Innovation 10 used an online lecture tool (bigbluebutton aka BBB) to support distance lecture delivery. The online lecture has become a new norm for many universities worldwide since COVID-19

(Green et al., 2020). However, it was not the same in 2015 when online lecture innovation was initiated. A senior lecturer told us:

> "five years ago, everyone taught face-to-face … only the iMBA program used BBB because the students were busy leaders, so we taught through the virtual classroom … the technology capacity was limited to only support a dozen students for one session … students cannot use a mobile phone to join … without a technological upgrade, we have to stop using it."

The limited institutional resources (such as technical support and infrastructure investment) were prioritized to support more "popular" innovations, while the less "popular" and meaningful ones received less support and collective attention.

Discussion and conclusion

Explaining the cognitive mechanism of institutionalisation in an extended model

Our study contributes first and foremost to the emerging educational literature on the institutionalisation of VLE enabled innovations in HE. We extend the original three-stage institutionalisation model (Tolbert & Zucker, 1996) to a four-stage model (see Figure 5) and unfold the underlying transition mechanism from VLE enabled innovation initiation to habitualisation. Through this process, we emphasize the importance of meaning in acquiring institutionalisation. More importantly, we conceptualise the threshold stage as "meaning-making" to explain the challenging phenomenon (the habitualisation stage has a higher rate of structural failure than other institutionalisation stages) that prior researchers highlighted (Bryant & Charmaz, 2021; Hadjithoma & Karagiorgi, 2009). Our view of meaning-making is consistent with findings in the K-12 context in the UK, in which the researchers considered meaning-making "as mediated knowledge building in action" and "building and weaving over time, in often unexpected ways"(Twiner et al., 2021, p. 1).

This study addresses the above problems by introducing the concept of meaning-making from the sociological literature to help interpret the critical but intangible cognitive changes in the VLE enabled innovation institutionalisation process. The idea of meaning-making originates from the sociology literature that indicated multiple worlds constructed differently but meaningful to people who concur with the statements (Goodman, 1978). We agree with sociology theorists' belief that the behaviours of human actors are affective, shifting their cognitive framework back
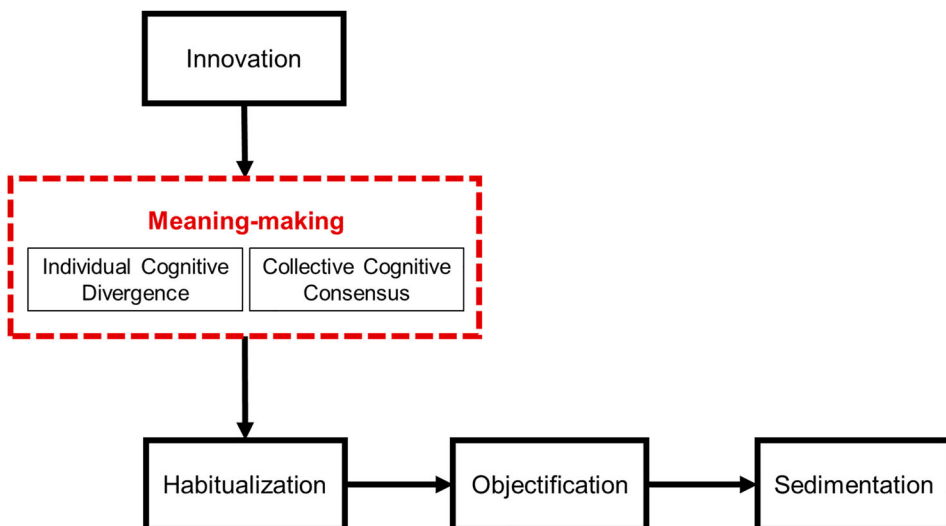
Figure 5. Our extended institutionalization process model that adapted from Tolbert and Zucker's (1996).

and forth (Heise, 1979). The above ontological perspectives guide our investigation and help specify the cognitive conditions under which teachers form collective behavioural patterns and build ''the connection between particular conditions and individuals' receptivity to cognitive reorientation and norm-breaking action''(Hinings & Tolbert, 2008, p. 486).

The diversity of meaning-making in the institutionalisation process

We argue that consistent meaning among teachers is not the only approach to institutionalisation; instead, divergent individual cognitions could also lead to institutionalisation. Our study reveals the constructive meaning-making process(Twiner et al., 2021)through individual cognitive divergence or collective cognitive consensus over time. Prior scholars have pointed out that many institutional analyses work assuming that collective consensus is the standard premise of institutionalisation (Greenwood et al., 2017). However, we argue that acquiring collective consensus (Combe & Carrington, 2015) is not the only way teachers develop the meaning of learning and teaching actions in the institutionalisation process. Individual teachers develop divergent understandings of institutional arrangements in a way that ''makes sense'' (Gioia & Chittipeddi, 1991) to them and thus achieve success in habitualised (Powell & Colyvas, 2008) learning and teaching routines.

Practical implications and limitations

The proposed empirical institutionalisation model provides theoretical and practical implications applicable to other educational institutions in different regions. First, although this study only investigated VLE enabled innovations before the COVID-19 pandemic, it provides a robust evidence-based solution to overcome the institutional barriers of tapping into teachers' intrinsic motivation for the widespread adoption of meaningful educational innovations (Lanford et al., 2019) for higher education institutions facing the same or more challenges in the COVID-19 pandemic worldwide. Society needs a more agile digital learning ecology where teachers and students can have higher autonomy to co-create future education in a more inclusive and communicative learning environment (Li, Wang, et al., 2022).

The four-stage model developed by this paper provides a practical pathway for educational policymakers and practitioners to rethink the power of constructive meaning-making in influencing innovative learning and teaching effectiveness. For example, decision-makers need to know that it takes time for teachers to create compelling cognitive meaning of the action (either a unique reason or a shared belief). The institutional policy should consider the resources and environment that can reward teachers for giving up existing teaching habits and adopting the new practices through the VLE enabled innovations. Especially in the COVID-19 with high uncertainty (Greener, 2020), we need to manage our expectations of teachers' uptake of the idea and the value of making extra efforts for the long-term educational transformation. Continuous institutional facilitating and pedagogical support on integrating educational technologies (like VLEs) into innovative practices, action learning and community of practice for teacher professional development (Li, Wang, et al., 2022) can help the innovation get through the threshold institutionalisation process.

Second, the conception of meaning-making through divergent individual cognition and the collective cognitive consensus is instrumental in attracting the attention of decision-makers to sociological ideas while providing a more inclusive innovation environment in higher education. Educational leadership can utilize the meaning-making conceptual model to develop the teacher professional development framework, and create a communicative learning and teaching environment that supports bottom-up practical innovations and top-down strategic interventions to enhance quality education through meaningful changes. The future-oriented mindset of inclusivity and humanity is critical for contemporary teachers and educational leaders to acknowledge problems and refer to widely institutionalised procedures rather than only technical measures

(Scott, 2014) in an environment with high uncertainty, ambiguity, complexity, and changeability (Luan et al., 2019; Xi, 2021).

We gain evidence-based insights from a longitudinal case study with rich grounded data to address the real-world problems of institutional educational change. The main limitation of a single case study lies in its generalizability. Generalising the present study's results beyond its empirical context depends on how the meaning-making approaches can be shared with other populations globally. Many institutional studies have discussed the broader implications of meaning-making in the digitalisation work process for knowledge-intensive employees in different industries (e.g. Colyvas, 2007; Raviola & Norbäck, 2013). Prior studies in different educational contexts have also emphasized the critical role of meaning-making in promoting effective learning and teaching actions facilitated by learning technologies (e.g. Furberg, 2010; Twiner et al., 2021). Our findings could add value to both theory development and practical improvements in other institutions with high knowledge intensity, where their well-educated employees appreciate high-level autonomy and are open to institutional partnership arrangements and governance structures (Dodgson et al., 2021).

For future development, we encourage researchers to test and supplement the historical and process-oriented institutionalisation model with studies employing quantitative, multi-case comparison approaches to measure the various factors that might affect the VLE enabled innovation institutionalisation, such as educational standards (Barari et al., 2020), perceived task performance (Rienties et al., 2016) and cultural influence on VLE adoption (Li et al., 2021; Teo & Huang, 2019). We would also suggest that future studies should examine the invisible reciprocal relationships between the individual cognitive divergence and collective consensus in meaning systems and educational ideologies.

This paper conceptualises the empirical findings of a 13-year longitudinal case study of VLE enabled innovations' institutionalisation. By analyzing how VLE based technologies become acceptable, enable innovations, and foster continuous transformation within an educational context, we found that innovation to habitualisation is the threshold stage for institutionalising VLE enabled innovations. The novelty of this study is in integrating what we call "meaning-making" before habitualisation to reveal the invisible process through which the VLE enabled innovations to acquire legitimacy through both individual cognitive divergence and collective cognitive consensus.

Notes on contributors

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