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Influence of Community of Inquiry on Knowledge Building in Online Learning During COVID-19 Pandemic

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Abstract

In Malaysia, the government and higher education institutions have introduced various policies and plans regarding online learning. When the Coronavirus disease (COVID-19) pandemic hit the world in 2019, the government implemented the Movement Control Order (MCO) starting on March 18, 2020. Consequently, Malaysian higher education institutions fully utilized online learning platforms such as Zoom, Microsoft Teams, Webex Blackboard, and Google Classroom in order to sustain the continuity of teaching and learning during the pandemic. Therefore, the main objective of this study is to determine the influence of community of inquiry (social presence, cognitive presence, and teaching presence) on knowledge building in online learning among undergraduate students in Malaysian public universities during the COVID-19 pandemic. This study adopted a correlational research design and was conducted at Malaysian public universities. The sample was selected based on the proportional stratified sampling method, and the recommended sample size for this study was 367. Statistical descriptive analysis discovered that knowledge building and community of inquiry were more inclined. From the direct effect of Structural Equation Model (SEM) analysis, the community of inquiry insignificantly effect knowledge building in online learning ($\beta = 0.072$; C.R. = 0.647; $p = 0.517$). Hence, future studies can compare the findings from different scholars in Malaysian and overseas contexts. This study offered an integrated, coherent, and actionable framework covering a variety of constructs in the context of online learning during a pandemic. In addition, it also provided insight for universities as to where future efforts need to be directed, especially in the areas related to the improvement of the facilities and infrastructure for online learning implementation.

Keywords: Online Learning, Higher Education Institutions, Covid-19, Community of Inquiry, Knowledge Building

Introduction

Online learning has been practiced in higher education institutions since the 1990s. Over the past two decades, online learning has been activated in some global institutes (Mahyoob, 2020). Through these years until now, the evolution of online learning has never stopped. Online learning has become a best friend of higher education institutions for some years, and its transformation is not a novel phenomenon anymore (Kopp et al., 2019; Leszczyński et al., 2018). Hence, higher education institutions should always prepare for any challenge or circumstance by developing strategies and new kinds of offerings in online learning for their students, including recruiting potential professionals to provide solutions (Sandkuhl & Lehmann, 2017).

When the Coronavirus disease (COVID-19) pandemic hit the world in 2019, the impacts of the disease beyond mortality (those who die) and morbidity (those who are unable to work for some time) have become apparent since the outbreak (McKibbin & Fernando, 2020). Millions of people were required to lockdown and quarantine, changing our landscape of life to the new norm and making everything digitalised. The shutdown of schools and higher education institutions as a social distancing measure to prevent community transmission has shifted face-to-face classes to online learning systems by utilising eLearning tools and platforms for effective student engagement (Rashid & Yadav, 2020).

To break the chain of COVID-19 transmission in Malaysia, the government has implemented the Movement Control Order (MCO) starting on March 18, 2020, requiring the closure of all businesses except those providing essential services and items (Tang, 2020). Consequently, Malaysian higher education institutions fully utilised online learning platforms such as Zoom, Microsoft Teams, Webex Blackboard, and Google Classroom to sustain the continuity of teaching and learning during the pandemic.

Background of Problem

One major problem encountered in the online learning environment is the separation between the instructor and the student and between the students. Students face phenomena such as dropout rate and loss of motivation due to separation in online learning (Stoytcheva, 2021) and disconnection with classmates or losing human touch (Khalili, 2020). This situation worsens during the COVID-19 pandemic because students are prohibited from leaving their houses and lack interaction with their peers (Irawan, Dwisona & Lestari, 2020). The feeling of isolation is due to a lack of awareness and understanding of presence (Khodabandelou, 2013). Presence is the main aspect that provides the structure of the community of inquiry. However, understanding presence in online learning is complex due to the separation of the physical space of the real world and the online space, as our sense of presence is felt and experienced in different ways. In the physical space, presence is easier to recognize through observation and perception, but in the online space, presence needs to be intentionally created (Lehman & Conceicao, 2010).

Furthermore, some research has been conducted in Malaysia to empirically examine knowledge building in online learning. An exploration of research papers on knowledge building in Malaysia within the last five years from major international databases such as Scopus and Emerald revealed minimal research directly focused on knowledge building in Malaysia. This is reinstated by Leh et al (2021), that there has been less scholarly attention to

scrutinise detailed knowledge for the context of the study, the trainee teachers in Malaysia. Similarly, few studies examined students' information search and skills in Malaysian higher education institutions (Karim et al., 2014; Karim et al., 2018). However, most of these studies attempted to correlate the information search and skills with academic programs and academic achievement. It is established that information search and skills lead to the development of knowledge building.

Although knowledge building is easier to develop face-to-face than online learning, it has become a new challenge during the COVID-19 pandemic. Over the past few years, there has been increasing research on MOOCs. However, investigations into other completely digitalized knowledge building communities are rare, especially during the pandemic (Wolfensberger & Ding, 2020). Both the teachers and students are struggling to find a way to create a committed community while not being physically present (Langeloo et al., 2021). Similarly, scholars Soliman et al (2021) stated that it is difficult for students to create community knowledge while at the same time, they need to engage in collaborative and progressive design work. They desired support in bringing them as a community that develops knowledge while continuing their education remotely. Therefore, this study aims to discover a new finding of whether knowledge building has been created during the COVID-19 pandemic.

Objective

1. Determine the extent of knowledge building and community of inquiry (social presence, cognitive presence and teaching presence) in online learning during the COVID-19 pandemic among undergraduate students in Malaysian public universities.
2. Determine whether the community of inquiry (social presence, cognitive presence and teaching presence) significantly influence knowledge building in online learning during the COVID-19 pandemic among undergraduate students in Malaysian public universities.

Community of Inquiry

Fundamentally, the community of inquiry framework consisted of three (3) elements of presence: social, teaching, and cognitive, as illustrated in Figure 1. These elements are independent and support each other during a learning experience. Garrison et al. (2000) considered these elements vital in a constructive learning environment (Khodabandelou, 2014). For each element, several categories are identified to represent the different aspects of the specified presence (Stenbom, 2018). For example, social presence consists of effective communication, open communication, and community cohesion; cognitive presence comprises triggering events, exploration, integration, and resolution; and eventually, the teaching presence consists of design and organisation, facilitating discourse, and direct instruction.

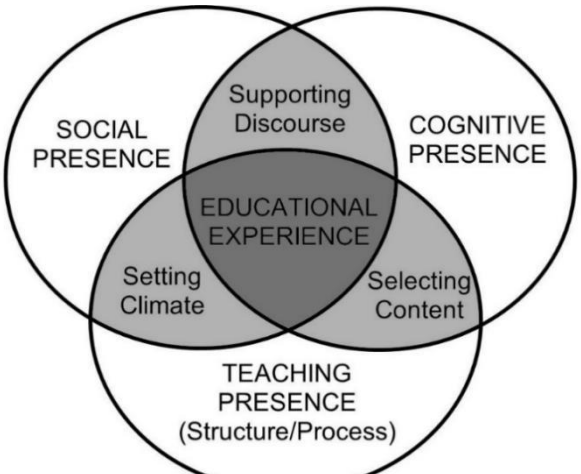

Figure 1: The Community of Inquiry Framework

The first element of the community of inquiry framework is social presence. Garrison et al (2000) defined social presence as the ability of students to project themselves socially and emotionally, thereby being perceived as real people in mediated communication. Garrison et al (2000) conceptualise social presence in three categories: (i) affective expression, (ii) open communication, and (iii) group cohesion.

The second element of the community of inquiry framework is cognitive presence. Garrison and Anderson defined cognitive presence as the ability to construct and validate meaning through reflection and discourse in an online learning environment. Moreover, cognitive presence can be conceptualised as an iterative relationship between students' understanding and shared dialogue with others (Diling, Varga & Mandernach, 2020). Garrison et al. (2000) argued that critical thinking is evidenced in four categories of cognitive presence known as triggering events, exploration, integration, and resolution.
The last element of the community of inquiry is teaching presence. According to Garrison et al (2000), teaching presence is the ability of a lecturer to create a close connection with students in an online learning environment. They also described teaching presence as the design, facilitation, and direction of cognitive and social processes to achieve learning outcomes. Therefore, as related to its name, teaching presence in a community of inquiry refers to the lecturer's role in an online learning environment.

Knowledge Building

Knowledge building provides an alternative that more directly addresses the need to educate people in a world in which knowledge creation and innovation are pervasive. Knowledge building may be defined as the production and continual improvement of ideas of value to a community through means that increase the likelihood that what the community accomplishes will be greater than the sum of individual contributions and part of broader cultural efforts (Scardamalia & Bereiter, 2003).

Social constructivism believes that knowledge is a constructive process that interacts with community members and cannot exist without the social and cultural context in which individuals live. During the process of knowledge building, the learner and team members have a common learning target and key points and share the learning achievements via synergistic learning (Yoon et al., 2011). Oshima et al (2012) stated that knowledge building engages belief mode and design mode. The belief mode is used by learners to investigate the current state of their community knowledge level to highlight any problems. Meanwhile, learning in the design mode enables the creation of knowledge to solve problems. The exchange between learning modes is iterative, such that learners continuously participate in social practices of knowledge creation and individuals generate knowledge that not only

directly contributes to the advancement of community knowledge but also determines how best to contribute to this advancement.

A lot of literature has mentioned that online learning environments can foster knowledge-building. For example, Guler (2022) posited that knowledge-building is a learning approach for structuring and conducting online courses. Furthermore, social interactions between students and lecturers during online learning can promote knowledge building (Chen & Hong, 2016; Zheng et al., 2021). Students can develop learning communities where they can share and transfer knowledge, hence building the knowledge. According to Wang (2011), students and student groups implement behaviours of cooperation, collaboration, and interaction to share information, compare perspectives, and construct knowledge.

Concurrently, in online learning, students attain learning goals by sharing resources, exchanging ideas, negotiating opinions, and constructing new knowledge. Students produce ideas, theories, or assumptions by collaborating and participating in purposeful learning activities in specific communities (Xu et al., 2018). Each student gains knowledge during the formation of the learning community. Xu et al (2018) also stated that knowledge of the whole learning community has been improved in depth and breadth through online dialogues and inquiry activities. Those activities, whether noticeable or not, are tremendously conducive to fostering knowledge-building in online learning.

Students go beyond simply retaining and applying what they have learned; instead, they explore advanced stages of analysis and creation. For example, Chan, Lam and Leung (2012) claimed that when learning science in a knowledge-building classroom, students pose cutting-edge problems, generate theories and conjectures, search for scientific information, elaborate on the ideas of others, and co-construct explanations, thereby collectively revising and refining their ideas.

Knowledge Building and Community of Inquiry

From the literature, there have been past studies to identify the significance between knowledge building and communities of inquiry. Garrison and Archer (2001) posit that at the heart of the community of inquiry is the idea that community, critical reflection, and knowledge construction are integral to learning, especially learning online.

Ke (2010), in a study about the community of inquiry, found correlations between various components of cognitive, teaching, social presence, and knowledge building for adult learners in online learning. Furthermore, a study by Kumar et al (2011) applying community of inquiry to an online course found that 81% of students reported that they applied the knowledge or skills gained from the first year of the online program to their practice, shared new knowledge with peers or colleagues in their professional environment, and have a better understanding of their roles as educators. However, a study by Liu and Yang (2014) found that the topic of constructing knowledge has a significant relationship with cognitive and social presence (X^2 = 126.34, Fisher's = 21.53, p <.001) and no association with teaching presence.

Lau et al (2021) indicated that teachers may need to create chances for group cohesion and collaboration in the class to gain knowledge. Moreover, the newest studies found a significant

relationship between teaching presence and knowledge building. Wang and Liu (2020) compared three courses in their study and found that instructors' design and organisation and facilitating discourse can facilitate students' knowledge building. A study by Wang et al (2021) found that assessment and technological support in the whole learning process can facilitate interaction and knowledge building.

Megli (2022) studied the relationship between social presence and the social construction of knowledge in asynchronous online discussion forums in higher education courses using instructional technology. The result found a positive and significant relationship ($r = 0.431$, $p > .001$) between social presence score and social construction of knowledge. The study also found that social presence is a predictor of the social construction of knowledge. Ribosa and Duran (2023), in a study about social presence when creating educational videos, found that when students feel the social presence, it can encourage them to reformulate the information, share ideas, and assess the coherence of the explanations.

Most previous studies on cognitive presence also reported significant results with knowledge building. Redmond (2014) found that when online discussions were structured perfectly, students could share and document their thinking. Similarly, Kilis and Yildirim (2019) found that the discussion design activities based on real-life experiences would enhance students' reflections and critical thinking and either help to construct a new or deepen their existing knowledge. Thus, it is hypothesised that

H1: Community of inquiry (social presence, cognitive presence, and teaching presence) significantly influenced knowledge building in online learning during the COVID-19 pandemic among undergraduate students in Malaysian public universities.

Methodology

This study adopted a correlational research design to investigate the possibility of relationships between these variables without any attempt to influence or manipulate them (Fraenkel et al., 2019). This study was conducted at Malaysian public universities under the Ministry of Higher Education. These public universities are categorised into three (3) groups: five (5) research universities, four (4) comprehensive universities, and 11 focused universities. Thus, the selected universities in this study were based on those groups. However, during the COVID-19 pandemic, the universities are implementing online learning initiatives due to the Movement Control Order (MCO). Therefore, geographical and physical location were insignificant to this study. Participating universities conducted fully online learning, and the learning experiences of the students were almost indistinguishable.

The targeted population for this study were undergraduate students who were studying online learning courses at Malaysian public universities during the COVID-19 pandemic. According to the data given by the university administration on the number of active undergraduate students, as of the second semester of 2020/2021, there were a total of approximately 13,701 undergraduate students.

Stratified random sampling was used as the sampling technique The selected universities were contacted via e-mail and phone calls due to the travel restrictions of the COVID-19 pandemic. However, only three (3) universities from research, one (1) university from comprehensive, and four (4) universities from focused universities responded, respectively.

Subsequently, only one (1) faculty was randomly selected from each responding university using the fishbowl technique.

To confirm the sample size, Cochran's formula (1977) for continuous scale was used and the estimated final sample size was 262. Salkind (1997) recommended increasing the sample size by 40% to 50% if the researcher is mailing out the surveys in order to account for lost mail and non-response answers. Therefore, the researcher has decided to add 40% (105 more respondents) to the sample size, making the final total recommended sample size for this study 367. Structural Equation Model (SEM) analysis was used to determine the influence of community of inquiry on knowledge building.

Research Findings

Extent of Knowledge Building

Knowledge building of respondents was measured using the Knowledge Building Environment Scale (KBES) developed by Lin, Hong, and Chai (2014) based on three sub-constructs: working with ideas, assuming agency, and fostering community. As illustrated in Table 1, the results indicated that the mean score for working with ideas was (M = 3.51; SD = 0.452), revealing that respondents are more inclined to work with ideas in online learning. The results showed that, in general, students in public universities have a lot of ideas about the knowledge they are working on. Students can integrate their ideas, thus helping other students advance their knowledge through online learning. On top of that, regarding the assuming agency, the mean score was (M = 3.55; SD = 0.453), indicating that respondents are more inclined to assume agency in online learning. Students feel that they must pursue real-life knowledge. They realise that knowledge is not only used in education but also in real life, especially when they are working later. Therefore, they also realised it was crucial to identify the difficulties that occurred in the learning process. As a student, they recognised that it's not easy to pass with flying colours without facing the challenges and difficulties during the study period.

Table 1
Extent of knowledge building

Construct	Sub-constructs	Mean	Standard Deviation
Knowledge Building	Working with Idea	3.518	0.452
	Assuming Agency	3.505	0.453
	Fostering Community	3.505	0.434
	Overall	**3.509**	**0.376**

Also, respondents expressed that they are more inclined to foster a community (M = 3.55; SD = 0.434), indicating that students actively participate in discussion and know their importance in participating in the learning session. The attribution of all the ideas and contributions of students is crucial to the advancement of community knowledge. Hence, this is reflected in the result, wherein in online learning, students are encouraged to participate actively in the lesson, and every student has equal opportunities to contribute ideas. The overall mean score of the knowledge-building construct was (M = 3.509; SD = 0.376), indicating that students are prone to knowledge-building in online learning.

Extent of Community of Inquiry

The community of inquiry was measured using the Community of Inquiry Instrument developed by (Arbaugh et al., 2008). Hence, this study used 25 confirmed sets of items from the CFA model to evaluate the respondents' preference for community inquiry in online learning. Then, the responses were transferred to a five-point Likert scale. The mean summated community of inquiry was computed as a mean score ranging from 1 to 5. The mean above 3.5 indicates the respondents are more inclined, while below 3.5 indicates the respondents are less inclined.

Table 2 shows that the overall mean score of community of inquiry was M = 3.877 (SD = 0.549), indicating that students are more inclined to community of inquiry in online learning. Among all the presences, teaching presence (M = 4.023; SD = 0.600) was the most inclined presence of the community of inquiry, followed by cognitive presence (M = 3.792; SD = 0.612) and social presence (M = 3.662; SD = 0.691).

Table 2
Extent of community of inquiry

Construct	Sub-constructs	Mean	Standard Deviation
Community of Inquiry	Teaching Presence	4.023	0.600
	Social Presence	3.662	0.691
	Cognitive Presence	3.792	0.612
	Overall	**3.877**	**0.549**

The findings indicated that the presence of a professor in online learning had an impact on pupils. The lecturer communicated important goals to students and provided clear instructions for participating in learning activities. Therefore, the lecturer always encouraged students to explore new concepts in online learning courses, making them more flexible and active. In other words, lecturers were present in every aspect of online learning during the pandemic.

Similarly, the results showed that students were influenced by cognitive presence in online learning. The result reflected teaching presence, whereas if the teaching presence was high, it was parallel to the cognitive presence. When lecturers encourage students to explore new concepts in online learning, they feel motivated to explore content-related questions, and they can utilise the information sources to explore problems posed in the course.

Community of Inquiry and Knowledge Building

H1: Community of inquiry (social presence, cognitive presence, and teaching presence) significantly influenced knowledge building in online learning during the COVID-19 pandemic among undergraduate students in Malaysian public universities.

As illustrated in Table 3, it was found that there was no significant influence of the community of inquiry on knowledge building in online learning (β = 0.072; C.R. = 0.647; p = 0.517). Therefore, based on the structural model, H1 was not supported in this study.

Table 3
The regression weights in the hypothesise direct model on effect of community of inquiry on knowledge building

Hypothesised Relationship	B	S.E.	β	C.R.	p
Community of Inquiry → Knowledge Building	0.055	0.084	0.072	0.647	0.517

Note: B (unstandardized regression weight); S.E. (standard error); β (standardized regression weight); C.R. (critical ratio); p (level of significance)

This study revealed that a community of inquiry has failed to influence knowledge-building in online learning. The findings of this study contradicted those of Ke (2010), who found correlations between various components of cognitive, teaching, social presence, and knowledge building for adult learners. A study by Kumar et al. (2011) also found that 81% of students in online courses reported that they have applied knowledge or skills and have shared the new knowledge with their peers. However, a study by Liu and Yang (2014) found that the topic of constructing knowledge has a significant relationship with cognitive and social presence and no association with teaching presence. However, this could be due to the incapabilities of students to feel some aspects of their presence. From the descriptive findings of this study, the aspect of social presence showed a moderate level due to loneliness and geographical barriers to studying online during the pandemic.

Applying online learning during the pandemic required lecturers to be incessant in online classes. Not only do lecturers need to turn on the camera during online class sessions, but they also need to have the ability to structure it, create a social environment, give instruction, and assess student work. Besides, this complies with the study by Lau et al (2021), which indicated that teachers may need to create chances for group cohesion and collaboration in the class. Consequently, learning communities are created among students to maintain friendships and valuable learning experiences. Contrary to this study, the newest previous studies found a significant relationship between teaching presence and knowledge building. Wang and Liu (2020) compared three courses in their study and found that instructors' design and organisation and facilitating discourse can facilitate students' knowledge building. Meanwhile, Wang et al. (2021) found that assessment and technological support in the whole learning process can facilitate interaction and knowledge building.

Most previous studies on cognitive presence reported significant results with knowledge building, which contradicts this study. Redmond (2014) discovered that students could communicate and record their thinking in online dialogues that were perfectly structured. As a result, when asked to think about a particular case, they can apply new information and find a solution, indicating that they have entered the resolution phase of cognitive presence. Similarly, Kilis and Yildirim (2019) found that the design of discussion activities based on real-life experiences would enhance students' reflections and critical thinking and consequently help them construct new knowledge or deepen their existing knowledge. On the other hand, a study by Sezgin (2020) posited that the brain-storming process in the exploration phase can develop knowledge building, where students discover new information and then construct it.

Discussion and Conclusion

This study affirms that students are more inclined towards knowledge-building through online learning. In such an online learning environment, students are required to share knowledge and generate ideas more often while interacting with and learning from each other. For instance, they need to actively participate in learning sessions, create notes to represent their

ideas and theories and deepen their thinking to generate new understandings. Wargadinata, Maimunah and Rofiq (2020) in their study, found that WhatsApp groups are the most effective way for students to share knowledge and ideas during the COVID-19 pandemic due to their ease, simplicity, and lack of a large data quota. Hence, there will be optimal learning since students and lecturers can actively communicate and share learning resources. It also suggested that students meet in small groups outside the allocated class time to formulate ideas and share knowledge while refining their work and then conveying new knowledge. All these behaviours have a positive influence on their knowledge-building level.

Meanwhile, lecturers should explore new ways of advancing knowledge through engagement within and outside designated classroom time. Lecturers can encourage students to share ideas with the entire class at weekly meetings, before and after team breakout sessions, use supportive technology such as WhatsApp, record the synchronous Zoom sessions and make them available for students to review. Through these meetings, it can develop more interactive online classes. Thus, practising these methods will encourage student presence and improve learning abilities (Mahmood, 2021). The major conclusion from this part of the study is that the openness of sharing between students and the support from lecturers is important to building knowledge in an online learning environment.

This study revealed that the community of inquiry was more inclined. Among the three sub-constructs of community of inquiry in this study, only social presence indicated lees inclined, while the other two indicated more inclined. The results illustrated that student could feel the presence of the lecturer during the online class session, hence increasing their cognitive presence as well. To increase the social presence, especially at the beginning of the semester during the pandemic, it would be helpful if the lecturer could send a welcoming post on the course learning management system or in the WhatsApp group. In addition, this is more welcoming for the students and acknowledges the lecturers' presence from the beginning of the course. Since it is crucial to grab students’ attention during an online class, an interesting induction, an overview of the course outline, and, most importantly, some humorous personality from the lecturer can help accomplish this objective. As found by Nashruddin and Alam (2021) in their study, humorous personalities by lecturers can result in students focusing on learning, stimulating their problem-solving skills, and increasing their self-confidence in online learning during the COVID-19 pandemic.

During the class session, by using Zoom or another platform, the lecturer should encourage students to set up their profile photos and, most importantly, to turn on the camera. Personalised images and cameras help as natural icebreakers, especially at the beginning of the course, which make the students more relaxed. The lecturer can also ask students to share what they like to do in social life instead of course-related subjects and invite other students to comment and interact with their peers earnestly. This is one of the main characteristics of building social networks.

The university or faculty can purposely create a social area in their online space to encourage social presence among students within the course program. As stated by Jaggars et al. (2013), students felt connected when the university or faculty regularly posted in online chat rooms, encouraged students to ask questions, and provided detailed responses on student coursework. Hence, even if students are physically isolated from their faculty and peers, they

can still establish a good relationship with them. Moreover, to increase social presence, it can be suggested through the development of practices and policies, including the design of online courses during the pandemic, classroom instruction, and staff development and training. Such changes might lead to increased learning for students; hence, positive social change could occur as a result of proper development policies and training from the university or faculty.

Recommendations For Future Research

Several recommendations are suggested for future research to overcome the limitations of this study. This study employed a quantitative approach, and the data collection was obtained through an online survey using a questionnaire. Therefore, a comprehensive perspective is achievable if considering a qualitative approach, such as interviews, observations, and recordings in future research. Hence, extensive qualitative research can support and accurately interpret the quantitative data.

The current study focused on knowledge building among undergraduate students in Malaysian public universities. The target population can be further studied at private universities to determine the similarity of the results. More studies could be conducted in similar fields post-COVID-19 to compare the results obtained during the pandemic.

Future research may also need to examine the mediating effect of possible determinants to expand on more empirical findings. Likewise, future research is crucial to explore how communities of inquiry could work together with moderating factors such as motivation and self-efficacy to determine more conclusively the impacts of knowledge-building.

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