Problems and Needs in Experiential Learning in Mathematics: Teachers' and Students' Perspectives From Thailand

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Abstract
This study aimed to explore the teachers' and students' perspectives of problems and needs in Experiential Learning (EL) in Mathematics at secondary education. 31 teachers and 35 grade 11 students from Narathiwat province, Thailand, responded to the questionnaire, which was analyzed for mean and standard deviation (SD). Overall, mathematics teachers had moderate level of problems in EL (mean = 3.21, SD = 0.49). The three major EL problems were: students have not yet developed satisfied metacognitive thinking (mean = 3.65, SD = 0.61), academic achievement (mean = 3.48, SD = 0.77) and mathematical process skills (mean = 3.42, SD = 0.72). Overall, teachers had a high level of needs in EL (mean = 3.98, SD = 0.69). Three major needs were: developing technology skills in EL (mean = 4.16, SD = 0.638), awareness of EL (mean = 4.13, SD = 0.89), and readiness for implementing EL (mean = 4.10, SD = 0.79). The students, overall, had moderate problems of EL (mean = 3.33, SD = 0.58). Three major problems were: 1) students have not yet developed satisfied metacognition (mean = 3.80, SD = 0.83), mathematical process skills (mean = 3.80, SD = 0.99), and academic achievement (mean = 3.77, SD = 1.03). Students had the highest level of needs in EL (mean = 4.24, SD = 0.68). Three major needs were: developing mathematical process skills (mean = 4.49, SD = 0.74), academic achievement (mean = 4.43, SD = 0.70), and readiness for EL (mean = 4.29, SD = 0.67).

Keywords: Problems, Needs, Experiential Learning, Mathematics, Grade 11

Introduction

Thailand emphasizes high-quality and equitable education for all Thai citizens for driving the success of development of the country. As evident in the Article 54 of Section 5 of Constitution of the Kingdom of Thailand B.E. 2560 (2017) specifies that the Thailand government must ensure that every child receives quality education for 12 years for K-12 (Kindergarten to Grade 12) with free of charge. Furthermore, the Second Amendment of National Education Act of B.E. 2545 (2002), in Article 10 Section 2, states that "… Thai children have equal rights and opportunities to receive quality basic education for at least 12 years without any charge" (Office of the National Education Commission, 2002b). In addition, the National Scheme of Education B.E. 2560-2579 (2017-2036) states about education as:

> Education is a fundamental right for every Thai citizen, and the state is obliged to provide quality education to promote the holistic development of all Thai people. This encompasses fostering intellectual assets that are crucial for developing skills, qualities, and competencies needed for pursuing professions and leading a harmonious life within society. (Office of the National Education Commission, 2002a)

The 2008 Core Curriculum for Basic Education stipulates eight learning subject areas including mathematics as one key learning subject area. Mathematics plays a pivotal role in ensuring students' success in the 21st century learning. Mathematics enables individuals to think creatively, logically, systematically, and analytically. In addition, it allows students to comprehend and solve problems comprehensively and accurately. Students with mathematics skills are capable in forecasting, planning, decision-making, and solving everyday-life problems effectively and appropriately. Moreover, mathematics serves as a tool for students in studying science and technology, as well as other discipline. In sum, mathematics is essential in developing human resource to serve the national capability in competing with other countries (Ministry of Education, 2017).

Learning in the 21st century should stimulate students' interest and active engagement and participation. Students should gain maximum experience to practice various skills and competencies through hands-on learning activities. This approach is aligned with Experiential Learning (EL), which emphasizes real-world learning experiences through active and practical training in real-life situations with cooperative work in order to develop students to possess competencies required by professions and development of the country (Rakthai, Cheeprasop, Singhasaem, Suwanwela, & Leartwanawattana, 2021).

EL is rooted in active learning and stemmed from the concept of "Learning by Doing." It emphasizes ultimate experiences that learners should acquire from their ultimate opportunity to actively engage in practical works and learning. EL also influences learners' new ways of thinking and doing (Sreesukong, 2019). In EL atmosphere, a teacher takes a major role in stimulating students' interest and supporting them to learn through practical skills and processes. EL encourages students' analytical thinking, critical thinking and application of knowledge in daily lives. Students learned with EL will be able to use information technology and communication as tools for research, data collection, and construction of new knowledge. The El process inspires students to produce creative works and innovations. In sum, EL helps develop human resources with the competencies demanded by development of the country in this 21st century world (Daosri et al., 2021).

EL is a learning approach that focuses on students learning from various experiences and actions rather than just receiving information through traditional teaching methods that emphasize memorization. This approach effectively promotes students' knowledge and metacognition in mathematics subject. In mathematics classroom, EL utilizes real-world mathematical problems occurred in student everyday life or real-life situations and requires students to solve such problems effectively. So that, EL helps students think critically and practically in applying their mathematical knowledge in real-world situations.

In addition, mathematics teachers should select and appropriately apply technology and computer programs to support more effective mathematics learning. Students should be given opportunities to solve problems, experiment, and test their mathematical knowledge that will lead them to learn mathematics with more effective, engagement and enjoyment. Collaborative activities are also needed in EL. Students should be encouraged to work cooperatively in groups to solve mathematical problems. The EL activities can help foster knowledge creation and idea sharing among students when learning mathematics. Using EL in mathematics can promote students' problem-solving and inquiry skills, critical thinking, and deep understanding of mathematics. However, from the review of relevant literature in the mathematics education context of Thailand, it is evident that there is a lack of research studying the current situation and needs of EL in teaching and learning mathematics. Therefore, the authors are interested in studying the current situation, problems and needs regarding EL from the teachers' and students' perspectives. In addition, the application of Technological Pedagogical Content Knowledge (TPCK) in EL to be a new learning model of EL is proposed.

Research Questions

The research questions for this study are as follows:

a) What are the current practice, problems and needs in teaching mathematics with EL from the teachers' perspectives?
b) What are the current practice, problems and needs in learning mathematics with EL from students' perspectives?

Research Objectives

The research objectives for this study are:

a) to explore the teachers' perspectives on current practice, problems, and needs in teaching with EL in mathematics;
b) to explore the students' perspectives on current practice, problems, and needs in learning with EL in mathematics.

Literature Review

This section presents the literature review about EL, metacognition, and TPCK. The details are as follows.

Experiential Learning (EL)

EL is an educational approach that focuses on the development of knowledge and skills in learners through numerous experiences and real-world practice. It emphasizes active learning, enabling learners to gain deep understanding and effectively apply their knowledge in real-

life situations. EL involves several teaching steps such as stimulating reflection on prior experiences, presenting meaningful content, emphasizing understanding, training learners to analyze and summarize acquired concepts, practical application in real situations, and transferring knowledge to various contexts. Several educators presented teaching steps of EL as follows.

Tittley (1994) outlines six steps of EL as a) Stimulating learners to reflect on past experiences and connect them with new learning experiences while fostering motivation; b) Presenting meaningful content for learners to grasp; c) Analyzing and summarizing experiences using the information provided by the instructor; d) Summarizing concepts after data collection and analysis, leading to the creation of new experiences; e) Practical application of newly acquired concepts and knowledge to verify and confirm learning; and f) Applying gained knowledge to relevant real-life situations. In addition, Burnard (1996) proposed a four-step process of EL as: a) Accepting learning from prior experiences; b) Learning activities focusing on practice and mutual listening; c) Joint reflection; and d) Constructing new knowledge from practical understanding. Furthermore, Chaiyong (2002) developed a seven-step model for EL as: a) Pre-assessment before encountering new experiences, including an exploration of learners' prior experiences; b) Preparing for new experience by specifying learning objectives, tasks, duties and resources; c) Encountering new experience; d) Reporting progress during experiential phase to reveal students' learning progress as well as encountered problems or obstacles; e) Reporting results to summarize what students gained from each experience; f) Summarizing experience by learners and instructors jointly summarizing the results; and g) Post-assessment after the experience. Petch (2019) mentions a five-step process for EL as: a) Collaborating among students and ae teacher to establish objectives, plan activities, teaching methods, and practice; b) Providing advice, guidance, and directions; c) Reflecting on learners' thoughts and experiences; d) Collaborative summarization for future reference; and e) Evaluating progress based on learners' achievements and the joint outcome. The aforementioned teaching steps are crucial in employing EL for effectively teaching mathematics subject. These steps aid mathematics teachers in designing, planning and presenting mathematics content efficiently in order to enhance students' understanding and the application of mathematical knowledge in their daily lives. Furthermore, teaching tools, information and communication technologies, can be used to help deliver mathematical content effectively. Thus, the use of EL approach is essential to foster students' creativity and the 21st century skills to meet the needs of the country.

EL is an effective learning approach to promote students' development of metacognition and mathematical skills. It is a key to help learners gain deeper understanding and improve their ability to apply their mathematics knowledge in real-world situations. The key teaching steps of El include: a) Stimulating learners to reflect on previous experiences and stimulating motivation; b) Presenting content significantly to encourage learners' perception of challenge; c) Analyzing and summarizing concepts after obtaining data and analyzing gained experiences; d) Practically applying acquired knowledge to verify and confirm new learned knowledge; and e) Applying knowledge in various real-life situations to create new experiences. In common, educators support the review of students' prior knowledge and experiences and the practical application of new knowledge both in the classroom and in real-world situations. EL includes summarization and assessment of students' learning progress. It enhances the value of EL education in promoting students' critical and analytical thinking skills, particularly in the field of mathematics at various educational levels (Tittley, 1994; Burnard, 1996; Chaiyong, 2002; Petch, 2019).

Metacognition

In the field of mathematics, metacognition is essential for students in learning and applying mathematics in their daily lives. Students with metacognition will be able to develop analytical thinking skills, problem-solving abilities, and rational analysis in mathematics. Metacognition can help learners acquire an understanding of fundamental mathematical principles and theories, such as addition, subtraction, multiplication, and division, which lead to a deeper comprehension and application of mathematical knowledge in real-life situations. Metacognition in mathematics enables learners to establish a connection between everyday life situations and knowledge in mathematics. It empowers learners to efficiently apply their mathematical knowledge to solve real-life problems. With metacognition, learners can think critically and appropriately in mathematics and develop strong mathematical skills and the ability to effectively tackle mathematical problems. Metacognition can advance students' abilities in learning mathematics or other related disciplines.

However, developing metacognition in mathematics requires continuous effort and practice from learners. The development of metacognition requires proper and suitable steps. Metacognition in mathematics involves logical, analytic and synthetic thinking of knowledge to address mathematical problems. Learners must be able to recognize the fundamental concepts of mathematics and effectively utilize mathematical knowledge in problem-solving and creating mathematical models. Teaching metacognition in mathematics also involves instructing learners to learn how to present and explain mathematical concepts clearly. Learners should be able to communicate and express their thoughts about mathematical problems in an organized manner, which helps them understand and follow the problem-solving process correctly and appropriately. Therefore, metacognition in mathematics is crucial for developing mathematical skills and solving mathematical problems effectively. Learners should value and invest time in practicing metacognition in mathematics continuously for efficient application of mathematics in daily life (Nirand & Somchat, 2022; Santawan, 2010; Kru With, 2014; Wipada, 2014).

Technological Pedagogical Content Knowledge (TPCK)

In 2008, Koehler and Mishra proposed the conception of Technological Pedagogical Content Knowledge (TPCK), which originally rooted in the conception of Pedagogical Content Knowledge (PCK) being introduced by Shulman in 1986. What is new in is the incorporation of knowledge related to technology, known as Technological Knowledge (TK) in existing PCK. TPCK is originated from the increasing development of technology in the 21st century that significantly impacts teaching and learning in all subjects including mathematics. Subsequently, Thomson and Mishra (2008) named this new construct as Technological Pedagogical Content Knowledge or TPCK. TPCK represents the holistic alignment and integration of three knowledge components i.e., Content Knowledge (CK), Pedagogical Knowledge (PK) and Technological Knowledge (TK) (Srisukong & Buaraphan, 2021).

TPCK, then, is the understanding of how these three forms of knowledge intersect and interact. In practice, TPCK does not mean that educators possess three kinds of understanding i.e., technology, teaching methods, and subject matter, individually. It refers to a teacher's understanding how to blend three knowledge components effectively. In sum, TPCK refers to teachers' ability to apply specific technology appropriately and effectively in teaching specific subject content with specific teaching method.

TPCK highly influences teacher education and professional development. It helps educators make informed decisions about how and when to use technology in the classroom. It emphasizes the importance of balancing three different types of knowledge to ensure that technology serves as a tool for enhancing teaching and learning, rather than just being used for its own sake. TPCK integrates a teacher's knowledge of content, pedagogy, and technology in an integrative manner. Teachers with CK will have strong understanding of the subject matter content that align with the curriculum of the educational institution. Teachers with PK will have strong understanding of the principles of instructional design and be able to employ diverse teaching methods within their subject area. Teachers with TK will understand several technologies (including both hardware e.g., iPads, smart TVs, projectors, and telephones; and software e.g., Microsoft, Google Classroom, and various applications) and be able to select, design and create technology to suit the chosen teaching method, learning process. Then, teachers with TPCK must be able to integrate the mentioned three knowledge components into a single knowledge construct as Figure 1.

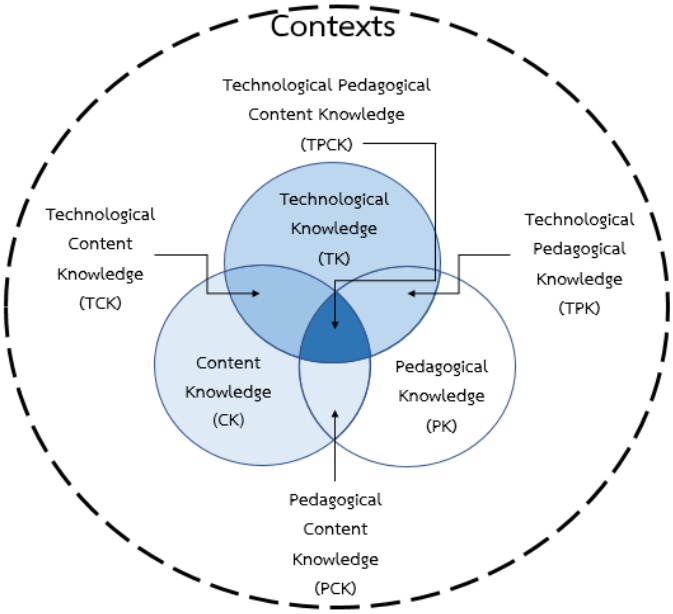

Figure 1: TPCK Framework (Koehler & Mishra, 2008)

In conclusion, a profound understanding of TPCK is paramount in today's educational landscape. TPCK represents the intricate interplay of technological knowledge, pedagogical skills, and content expertise. Educators who master this dynamic framework are better equipped to design and deliver effective, technology-enhanced lessons. They can seamlessly integrate digital tools into the curriculum, enhancing the learning experience and preparing students for the digital age. TPCK empowers teachers to apply technology to tailor their instruction to the unique needs of their students. It bridges the gap between teachers' subject matter expertise and pedagogical strategies, resulting in more engaging, interactive, and impactful teaching.

Research Methodology

This research employs a mixed-method approach, which combines quantitative research and qualitative research methodologies. The quantitative research utilizes survey research, while the qualitative research involves focus group discussions (FGD). This mixed-method

approach will provide more comprehensive understanding to answer research questions. The details of mixed-method research design and data collection are as follows:

Quantitative Research: Survey Research

The population for this research can be divided into two groups: teachers and students. There were 31 teachers participated in the survey research. They all were teachers under the Narathiwat Secondary Education Service Area Office, who experienced in teaching by EL. Data was collected from the entire population. In addition, there were 35 grade 12 students, who already learned in grade 11 and experienced learning with EL with the first author. They all were students in one school under the Narathiwat Secondary Education Service Area Office and data was collected from the entire population.

Data Collection

For collecting quantitative data, the researchers employed two questionnaires: The Problems and Needs in Teaching with EL in Mathematics Questionnaire and The Problems and Needs in Learning with EL in Mathematics Questionnaire. The former was for teachers and the latter was for students. Both questionnaires aimed to explore the respondents' perspectives on problems and needs in teaching or learning with EL in mathematics.

The Problems and Needs in Teaching with EL in Mathematics Questionnaire (for teachers) employed a 5-level rating scale (5 = Very high, 4 = High, 3 = Moderate, 2 = Low and 1 = Very low) and consisted of three parts:

Part 1: Basic information of respondents (5 items);
Part 2: Problems and needs in EL, that was divided into two aspects: Problems related to EL (10 items) and Needs related to EL (10 items); and
Part 3: Suggestions for developing EL (1 item).

The Problems and Needs in Learning with EL in Mathematics Questionnaire (for students) employed a 5-level rating scale and consisted of three parts:

Part 1: Basic information of respondents (2 items);
Part 2: Problems and needs in EL, that was divided into two aspects: Problems related to EL (10 items) and Needs related to EL (10 items); and
Part 3: Suggestions for developing EL (1 item).

Data Analysis

The researchers analyzed data collected from Part 1 of the questionnaire (basic information of the respondents) by counting frequency and calculating for percentage. The researchers calculated the Mean and Standard Deviation (SD) of the data obtained from Part 2 of the questionnaires. The interpretation of the average values was as: 4.21 - 5.00 being interpreted as Very High level and 3.41 - 4.20, 2.61 - 3.40, 1.81 - 2.60, and 1.00 - 1.80 being interpreted as High, Moderate, Low, Very Low levels, respectively. Then, the researcher analyzed data from Part 3 of the questionnaire by content analysis.

Results and Discussion

The results and discussion will be presented according to the research questions and the details are as follows.

Teachers' Perspectives on Problems and Needs in EL

The majority of respondents were female (74.20%). In terms of age, the majority falls within the 31-35 age group (25.80%) followed by the 25-30 age group (22.60%) and the 36-40 age group (19.40%). Regarding their positions, the majority are Senior Professional Level (K3) and others (29.00%) followed by Professional Level (K2) (25.80%) and Practitioner Level (K1) (16.10%). In terms of teaching experience, the majority have less than 6 years of teaching experience (32.30%) followed by 11-15 years of teaching experience (22.60%) and 6-10 years of experience (19.40%). The teachers' perspectives on problems and needs in EL can be presented as Table 1.

	Statement	Mean	SD	Interpretation
Problems in EL				
1.	A school is not yet ready for EL	2.81	0.75	Moderate
2.	Teachers are not yet ready for EL	2.97	0.80	Moderate
3.	Teachers lack knowledge and understanding of EL	3.29	0.82	Moderate
4.	Teachers lack awareness of the importance of EL	3.00	0.82	Moderate
5.	Teachers lack skills in teaching with EL	3.35	0.88	Moderate
6.	Teachers have not yet used technology in EL	3.10	0.98	Moderate
7.	Students are not yet ready for EL	3.06	0.73	Moderate
8.	Students have not yet achieved academic performance at a satisfactory level	3.48	0.77	High
9.	Students have not yet developed mathematics skills and processes at a satisfactory level	3.42	0.72	High
10.	Students have not yet developed metacognition at a satisfactory level	3.65	0.61	High
	Overall Problems	**3.21**	**0.49**	**Moderate**
Needs in EL				
11.	A school needs to be developed the readiness for EL	3.74	0.93	High
12.	Teachers need to be developed their readiness in teaching with EL	4.10	0.79	High
13.	Teachers need to be developed their knowledge and understanding of EL	4.06	0.85	High
14.	Teachers need to be developed their awareness of the importance of EL	4.13	0.89	High
15.	Teachers need to be developed their skills in teaching with EL	4.06	0.89	High
16.	Teachers need to be developed their skills in using technology in EL	4.16	0.64	High
17.	Students need to be developed their readiness for EL	3.81	0.83	High
18.	Students need to be developed their academic performance to a satisfactory level	4.03	0.75	High
19.	Students need to be developed their mathematics skills and processes to a satisfactory level	3.90	0.83	High
20.	Students need to be developed their metacognition to a satisfactory level	3.84	0.93	High
	Overall Needs	**3.98**	**0.69**	**High**

Table 1: Teachers' perspectives on problems and needs in EL

The responding teachers reflected the problems in EL at a Moderate level (mean = 3.21, SD = 0.49). The top three problems in teaching with EL were: Students have not yet developed metacognition at a satisfactory level (mean = 3.65, SD = 0.61); students have not yet developed academic performance at a satisfactory level (mean = 3.48, SD = 0.77); and Students have not yet developed mathematics skills and processes at a satisfactory level (mean = 3.42, SD = 0.72).

The responding teachers reflected a High level of needs in EL (mean = 3.98, SD = 0.69). The top three needs in EL were: Teachers need to be developed their skills in teaching with EL (mean = 4.16, SD = 0.64); Teachers need to be developed their awareness of the importance of EL (mean = 4.13, SD = 0.89); and Teachers need to be developed their readiness in teaching with EL (mean = 4.10, SD = 0.79).

Students' Perspectives on Problems and Needs in EL

There were 35 students responded to the questionnaire. A majority of them were female (60.00%) with 18 years old (77.10%) followed by 17 years old (22.90%). The students reflected their problems and needs in EL as Table 2.

	Statement	Mean	SD	Interpretation
Problems in EL				
1.	A school is not yet ready for EL	3.09	0.89	Moderate
2.	Teachers are not yet ready for EL	3.09	0.74	Moderate
3.	Teachers lack knowledge and understanding of EL	3.09	0.91	Moderate
4.	Teachers lack awareness of the importance of EL	3.63	0.94	Moderate
5.	Teachers lack skills in teaching with EL	3.31	0.99	Moderate
6.	Teachers have not yet used technology in EL	3.14	1.06	Moderate
7.	Students are not yet ready for EL	2.63	1.03	Moderate
8.	Students have not yet achieved academic performance at a satisfactory level	3.77	1.03	High
9.	Students have not yet developed mathematics skills and processes at a satisfactory level	3.80	0.99	High
10.	Students have not yet developed metacognition at a satisfactory level	3.80	0.83	High
	Overall Problems	**3.33**	**0.58**	**Moderate**
Needs in EL				
11.	A school needs to be developed the readiness for EL	3.94	0.94	High
12.	Teachers need to be developed their readiness in teaching with EL	4.17	0.92	High
13.	Teachers need to be developed their knowledge and understanding of EL	4.26	0.85	Very High
14.	Teachers need to be developed their awareness of the importance of EL	4.20	0.96	High
15.	Teachers need to be developed their skills in teaching with EL	4.17	0.92	High
16.	Teachers need to be developed their skills in using technology in EL	4.20	0.87	High

17.	Students need to be developed their readiness for EL	4.29	0.67	Very High
18.	Students need to be developed their academic performance to a satisfactory level	4.43	0.70	Very High
19.	Students need to be developed their mathematics skills and processes to a satisfactory level	4.49	0.74	Very High
20.	Students need to be developed their metacognition to a satisfactory level	4.26	0.74	Very High
	Overall Needs	**4.24**	**0.68**	**Very High**

Table 2: Students perspectives on problems and needs in EL

In overall, students expressed their perspectives on problems in EL at a Moderate level (mean = 3.33, SD = 0.58). The top three problems in learning with EL were: Students have not yet developed metacognition at a satisfactory level (mean = 3.80, SD = 0.83)), followed by Students have not yet developed mathematics skills and processes at a satisfactory level (mean = 3.80, SD = 0.99); and Students have not yet achieved academic performance at a satisfactory level (mean = 3.77, SD = 1.03).

Regarding needs in EL, in overall, students expressed a Very High needs in (mean = 4.24, SD = 0.68). The top three needs were: Students need to be developed their mathematics skills and processes to a satisfactory level (mean = 4.49, SD = 0.74), followed by Students need to be developed their academic performance to a satisfactory level (mean = 4.43, SD = 0.70); and Students need to be developed their readiness for EL (mean = 4.29, SD = 0.67).

The teachers in this study express a moderate level of problems and a high level of needs to teach mathematics with EL; while the students expressed a moderate level of problems and a very high level of needs to learn mathematics with EL. In addition, this study urges for the integration of TPCK and metacognition into existing EL model in order to improve for more effective EL.

Implications

EL is needed in teaching mathematics for students in the 21st century because it yields several benefits for students. However, there are some problems in teaching and learning with EL arisen from this study that mathematics educators need to pay more attention to and be concern about. Such problems need to be solved or released in order to gain better performance in implementing EL in mathematics subjects. In addition, teachers' and students' voices on needs in teaching and learning with EL should be taken into consideration before adjusting the existing EL model or creating a new EL model that better suits the teaching and learning situations. Other additional components such as metacognition and/or TPCK may be needed to be added into an existing EL model in order to enhance students' metacognition and apply technologies to enhance teaching and learning in mathematics. In future research, a larger sample may be needed for more complete picture of the EL teaching and learning situation in Thailand.

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