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The iSpring learning media integrated with the KWL learning model: Impact on Students' self-directed learning in momentum and impulse

Nadya Damayanti[1*], Mundilarto[1]

[1]Postgraduate Program of Physics Education, Universitas Negeri Yogyakarta, Indonesia

**Corresponding Address: nadyadamayanti.2020@student.uny.ac.id*

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ABSTRACT

In this pandemic era, learning style transformation required students to change their learning style to self-directed learning. However, a lack of student initiation led to sub-optimality of education, particularly for some materials such as momentum and impulse, which are classified as complex concepts in physics. This study aimed to examine the impact of iSpring learning media in conjunction with the Know-Want-Learn (KWL) learning model on students' self-directed learning. The data analysis used in this study was an independent t-test to analyze the difference in self-directed learning between students in the control and experiment groups. Furthermore, this study was intended to investigate students' self-directed learning during the implementation of iSpring learning media integrated with the KWL learning model. This study included 31 students divided into the control group and the experiment group, which was chosen using purposive sampling. The difference in students' learning independence between the control and experiment groups was examined using a post-test-only research design. Students in the experimental group demonstrated greater learning independence than students in the control group, which did not use the iSpring integrated with the KWL learning model. This result also implies that after implementing iSpring as the learning media integrated with KWL as the learning model, students' self-directed learning differed in the experiment and control groups.

INTRODUCTION

Some physics teachers face difficulties when teaching physics to high school students. Some challenges include: (1) some physics materials are not given conceptually and are given primarily by remembering and are too mathematically (Samudra et al., 2014); (2) some students believe their teachers are not fully paying attention to them (Basar, 2021); (3) they believe they are wrong and scarred of physics (Supardi et al., 2015); (4) their stigma towards physics remains negative, making them feel unmotivated to learn physics (Kurniawan & Sumadi, 2016; Samudra et al., 2014). Meanwhile, teachers' most difficult challenge is that it is difficult to teach materials without students' group discussions and their intention to learn independently at home (Insani, 2016). Some examples of problematic concepts include momentum and impulse. This classification is based on the fact that most students analyze momentum and impulse material with a scalar quantity rather than a vector quantity, making them unable to connect the mathematical equations of momentum in the case of collisions with the motion phenomena they observe (Azizah & Yuliati, Lia, 2015; Karim et al., 2015). As a result, teachers require a new solution to teach momentum and impulse material without

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difficulty and to motivate students to learn at home.

Implementing a learning method that can develop students' learning independence is one of the methods that can build their intention and capability to learn by themselves at home. Nowadays, learning independence is the primary issue confronting the educational sector (Widiartini & Sudirtha, 2019). The students' low learning mastery rate, passive attitude in class, unenthusiastic, learning distortions, and students' mindset toward learning physics all contributed to their learning independency issues (Junissetiawati et al., 2022; Sanita et al., 2021; Suharto, 2021). Furthermore, it was discovered that students have a low emotional independence rate in learning due to the transition from offline to online learning, which impacts their academic output (Maylisa et al., 2022; Zahro & Amalia, 2021). This inadequacy in self-directed learning is caused by learning limitations, adjusting to a new learning environment, and less interaction between students as well as between students and the teacher (Makur et al., 2021; Zahro & Amalia, 2021).

However, through self-directed learning the teacher can organize students to be independently active in their learning process, initiate, be responsible for, and solve problems based on information, data, and knowledge provided in their online class (Herwanto et al., 2020). Self-directed learning is a learning process influenced by self-thought, feelings, strategy, and behavior to achieve specific goals (Wahyuni & Harfad, 2020). Students with strong self-directed learning abilities will be able to solve problems or issues during or outside of class activities. The ability to solve problems determines a student's level of independent learning. Low learning independence affects students' ability to solve issues and problems encountered during learning activities, resulting in disorganization of students' learning and poor learning output (Ambiyar et al., 2020). Distance learning relies heavily on students' ability to learn on their own. At the same time, the intention and willingness to learn at home are only triggered by the need to complete an assignment (Cahyani et al., 2020).

Furthermore, based on their psychologies, students quickly become bored, stressed, and sad while learning online (Kusumaningrum et al., 2020). As a result, it has become yet another challenge for teachers to shift their perspectives and give more consideration to students' independent learning levels to understand their problems and enable them to learn more independently (Harisuddin, 2021). As a result, students' self-directed learning may be the solution to developing students' initiation in learning and assisting them in learning physics independently; to develop this ability, teachers must also find the appropriate media and learning method to implement.

Aside from the issue of students' learning independence, the demand for online learning is posing a challenge to the educational sector these days. In this pandemic era, the directive provides students with learning activities and impacts the rapid development of technology in the twenty-first century. These issues necessitate the use of technology-based teaching by teachers. One of the consequences of this Information Communication Technology (ICT)-based learning is that teachers must use technology-based media and modify their teaching methods to create effective, efficient, and enjoyable learning environments (Novaliendry et al., 2020). To facilitate students' learning activities, technological advancements provide various paperless learning media such as e-learning, video conferencing, electronic books, and personal gadgets such as computers, laptops, and smartphones (Syarlisjiswan et al., 2021). This challenge requires teachers to be more creative in finding appropriate media and learning methods, particularly in making students learn independently and not rely on the teacher in an online class.

KWL (Know Want Learn) is a learning model that can increase students' learning independence by having them fill in three blank pages with what they know, want, and learn. Collecting and recognizing students' initial knowledge; investigating and organizing students' curiosity about the learning materials; guiding, developing, and presenting individual and group work; and collecting, analyzing, and concluding students' understanding are all components of KWL learning syntax (Farida et al., 2019). KWL stands for Know-Want-Learn in learning, and K defines what students knew before reading about the learning material and connects the previous concepts. W describes what students want to know, and L describes what students learn as novel concepts after reading the material (Nisa & Susantini, 2021). This learning model was created to assist teachers in understanding the students' interest in the learning topic they will be learning (Syafniwati et al., 2020). The KWL benefits students by helping them set goals and initiate learning on their own by activating prior knowledge, tracking their learning progress, and assessing and developing their ideas about the materials they learn (Vy & Ha, 2020). KWL could be one solution that integrates with the teacher's media, allowing students to begin learning at home with the columns provided by the teacher. During the online learning period, teachers could collect the KWL columns via the Google form provided to students.

On the other hand, physics learning should focus on recalling theories and formulas and analyzing the information provided through knowledge and understanding of concepts; thus, students require appropriate learning media and methods to assist them (Rahmawati et al., 2020). The iSpring Suite is one learning medium that could pique students' interest and motivation and be used as an independent learning source. iSpring Suite is a tool that integrates with Microsoft PowerPoint and can be uploaded to Hypertext Markup Language (HTML) web pages and converted into Android application format (Dasmo et al., 2020). iSpring Suite is simple to use, especially when creating online or offline interactive quizzes, and it can be used directly to assess students' learning achievements (Ariyanti et al., 2020).

Several studies on the use of the Ispring Suite as a learning media have been conducted, including research by Sulistyorini & Listiadi (2022), Ariyanti et al. (2020), Firdha & Zulyusri (2022), Nurjanah & Erita (2021), Larasati et al. (2022), Nuraini et al. (2020). So far, no one has used iSpring as a learning media integrated with the KWL learning model; additionally, the use of iSpring media is intended as a learning model effort toward students' self-directed learning in momentum and momentum impulse material. The use of iSpring as a learning media integrated with the KWL learning model towards students' self-directed learning in momentum and impulse is novel in this study. iSpring, as a learning media integrated with the KWL learning method used in momentum and impulse instruction, is hoped to be a solution for increasing students' willingness to learn and developing students' self-directed learning. On the other hand, the integration of iSpring and KWL is expected to provide some simulation to make the learning activities more interactive while also triggering students' self-directed learning. As a result, the purpose of this study is to examine the impact on students' self-directed learning caused by the implementation of iSpring integrated with the KWL learning model, as well as to compare the results between the experiment and the control group with the following research question in mind: how does the iSpring integrate with the KWL learning model impact students' self-directed learning?

METHOD

In this study, a questionnaire containing 25 questions about students' self-directed learning was distributed to two groups, one of which was implementing the iSpring

integrated with the KWL learning model and using Google meet as learning activities integrated with the KWL learning model, and the other which was using the PowerPoint given by the teacher with the lecture learning model as their usual learning activities.

An independent t-test was used to analyze the difference in self-directed learning between students in the control and experiment groups in this study's post-test-only control group research design. This analysis will be used to determine the difference in self-directed learning between students in the control and experiment groups and to assess both groups' outcomes following the intervention (Almas et al., 2020; Chacón et al., 2013). As a result, before being distributed to students, the self-directed learning instrument in the form of a questionnaire about self-directed learning must be reviewed by an expert and a practitioner. The questionnaire review is used to validate the indicators that have been implemented and modified to measure students' self-directed learning (Sanjayanti et al., 2015).

Prof. Dr. Jumadi, M.Pd., lecturer in the Physics Education Department at a master's program in Universitas Negeri Yogyakarta, acted as an expert, and Eko Prasetyo, S.Pd., a teacher in Public Senior High School in Warureja as a practitioner validated the self-directed learning instrument. Material, construction, and linguistic aspects are all considered in the validation (Istiyono, 2020). The content element is related to instrument suitability concerning students' indicators of learning independence. Before product assessment development, the expert and practitioner validate the self-directed learning instrument. The validation sheet was given to the validators, who were then asked to fill out a questionnaire by checking off the categories listed by the researcher on a 4-Likert scale, as shown in Table 2.

Table 1. Questionnaire Validation Scores by the Expert

Score	Category
1	Very Valid
2	Quite Valid
3	Less Valid
4	Invalid

Furthermore, the validation results were calculated using validation sheets created through two steps of descriptive analysis: tabulating the scores of the item's components from each validation sheet and calculating the validation criteria using the formula below:

$$Criteria(\%) = \frac{A}{B} \times 100\% \quad (1)$$

A is the total score, and B is the maximum score (Azkiya et al., 2019).

Furthermore, the result of the validation score could be interpreted based on the criteria listed in Table 3.

Table 2. Score Interpretation Criteria

Validation Percentage (%)	Categorization
< 21	Invalid
21 - 40	Less valid
41 – 60	Quite valid
61 - 80	Valid
81 - 100	Very valid

The research procedure is explained through the flowchart in Figure 1.

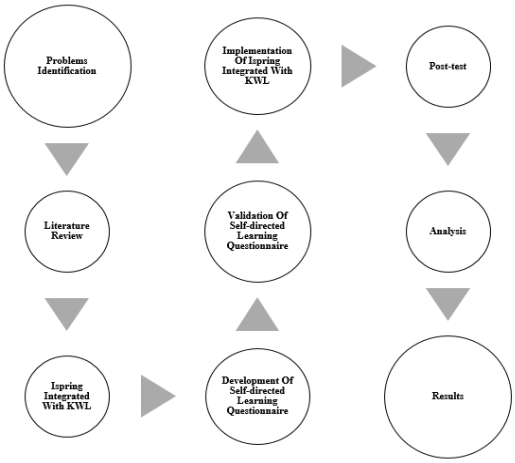


Figure 1. The Research Process Flowchart

The subjects of this study are 13 students for the control group and 18 students for the experiment group, who were chosen using purposive sampling based on their midterm exam results. The subjects for the control group were drawn from 10th-grade science classes 1 (MIPA 1) and 3 (MIPA 3). On the other hand, the subjects for the experiment group were drawn from the 10th-grade science class 2 (MIPA 2) and science class 4 (MIPA 4). Data was collected using a Google Form, which was then shared via Google Classroom. Students' self-confidence, discipline, initiative, and responsible attitude are measured as indicators of learning independence (Sanjayanti et al., 2015). These indicators are comprised of 25 questions. Table 3 shows student indicators of self-directed learning.

Table 3. Modified Independent Learning Ability Indicators

Indicator	Indicator Panel Component	Item Number
Self-confidence	a) Student learns independently	13, 24
	b) The student believes within themselves	15, 21, 25
Discipline	a) The student does their utmost while studying	8, 9, 10
	b) The student does not procrastinate on the assignments that are given	11, 14, 16, 17
Initiate	a) The student has a willingness to study	1, 5
	b) The student never postpones the task that is given.	19, 20
	c) The students initiate to find other learning sources	6, 7, 18
Responsible	a) The student wittingly study	2, 22
	b) The students actively the study	3, 4, 12, 23

According to the study by (Assidiqi & Sumarni, 2020), when technology is used as a learning media that corresponds to the teacher's teaching method, it can increase students' self-directed learning. This study predicted that integrating iSpring learning media with the KWL learning method would improve students' self-directed learning. iSpring learning media, such as the Android application, and implementing KWL learning can alleviate the pressure on online learning during the pandemic. Furthermore, it can help students learn at home by using the materials provided in the iSpring application in momentum and impulse to help their studies and improve their class performance and motivation to learn independently. Thus, it can be hypothesized that students' self-directed learning increased after implementing iSpring as the learning media that integrated with the KWL learning method in momentum and impulse.

RESULTS AND DISCUSSION

This study began by validating students' self-directed learning instruments, which included a post-test questionnaire to be administered to students after they used iSpring, which was integrated with the KWL learning model while learning momentum and impulse. Following that, this study presented the analysis results of the implementation of the iSpring with KWL learning model in momentum and impulse teaching towards students' self-directed learning, as well as the difference in students' self-directed learning between the control and experiment groups.

Instrument Validation

The expert's criteria score in percentage was 95 percent, which was considered very valid. The percentage criteria provided by the practitioner as validator 2 was 98.3 percent, which was also classified as very valid. Thus, the self-directed learning questionnaire used in this study was valid and could be used to determine students' learning independence while using iSpring, which was integrated

with KWL learning in momentum and impulse material. However, some feedback in the linguistic aspect should be revised for the students to understand the linguistic structure. Furthermore, from a construction standpoint, the questionnaire order must be organized based on its indicators. The instrument validity is critical for researchers to present the appropriate research instrument in their studies (Mohajan, 2017). When an instrument accurately measures what is supposed to be measured, such as the prescribed variables, it is said to be valid (Md Ghazali, 2016).

Students' Self-Directed Learning

The difference in self-directed learning between students in the control and experiment groups was analyzed using an independent t-test. It is a parametric test used to compare the statistical significance of two groups with normal distributions who perform in two different conditions (Hole, 2009; Warner, 2007). Furthermore, a post-test-only design was used because data on student learning independence was obtained only after the research was completed (Chacón et al., 2013; Hastjarjo, 2019). This research design was also used to analyze students' knowledge acquisition and retention based on post-test results (Moazami et al., 2014). Because the independent t-test is a parametric statistic test, the data's normality and homogeneity should be tested before implementing the independent t-test. The post-test responses of the students were used to collect this data. The results of the independent t-test are shown in Table 4.

Table 4. The Results of Normality, Homogeneity, and Independent Sample t-test

Significances Score Normality Test		Levene's Test for Equality of Variances	t-test for Equality of Means	
Control Group	Experiment Group	Sig.	Sig. (2-tailed)	Mean Difference
0.714	0.886	0.104	0.000	-14.440

Table 4, displays the significance score in the Shapiro-Wilk normality test, which can be used to determine whether the data were normally distributed or not. In most statistical procedures, the assumption of data normality must be evaluated (Bee Wah & Mohd Razali, 2011). The normality test has significant power to reject the null or default hypothesis measured by zero in small samples (Ghasemi & Zahediasl, 2012). If the p-value is greater than the predetermined critical value (=0.05), the null hypothesis is accepted, and it can be concluded that the data is normally distributed (Ahad et al., 2011). Table 4 shows that the significance scores from both groups are greater than 0.05, implying that the data in this study were normally distributed. Only if the data is normally distributed is t-test research valid (Lumley et al., 2002). The Shapiro-Wilk tests are used because they are two of the 18 most potent normality tests for the modified standard distribution group with a sample size of less than 50 (Arnastauskaitė et al., 2021). Furthermore, Table 4 shows that Levene's Test significances are more significant than 0.05, implying that the data is homogeneous and can be analyzed using an independent t-test.

Homogeneity is commonly used in research where equal population variance is required. Meanwhile, in small sample research, Levene's test is commonly used as the homogeneity test (Gastwirth et al., 2009; J. Kim & Cribbie, 2018). The Levene test was used to test the homogeneity of variance in the t-test with equality of means (Lee et al., 2010). According to the independent t-test results in Table 4, there is a significant difference in learning independence between students in the control group and the experiment group, with a significance 2-tailed score of 0.000. If the p-value is less than 0.001 and there is strong evidence of a difference between the two groups, the null hypothesis is rejected with a 99.9 percent confidence (Gilchrist & Samuels, 2010).

Furthermore, the mean difference in the experiment class's students' learning independence is 14.440. When comparing

two groups with different conditions, the mean plays an important role (H.-Y. Kim, 2014). Mean scores were also used to calculate the standard deviations of two different scores, and they were chosen from the scores contributed by subjects or samples for each group (Schagen & Hodgen, 2013). The 14.440 mean scores in this study show differences between the student's scores in the control and experimental groups.

The questionnaire used to assess students' self-directed learning contains 25 questions with four scales converted into quantitative numbers: 4 for strongly agree, 3 for agree, 2 for disagree, and 1 for strongly disagree. These 25 questions are divided into four self-directed learning indicators: self-confidence (five questions), discipline (seven questions), initiate (seven questions), and responsible (six questions). Table 5 shows how the score for each question is conversed and calculated to determine the lowest, highest, total, and mean scores for both groups.

Table 5. Comparison between Control and Experiment Group Results for Students' Self-Directed Learning

Score	Group	
	Control	**Experiment**
Lowest score	58.00	60.00
Highest score	85.00	91.00
Total score	924.00	1285.00
Mean score	36.96	51.40

Table 5 compares the self-directed learning scores of the control and experiment groups. It demonstrates that the control group has a lower score than the lowest scoring student in the experiment group. The highest score in the control group for students' self-directed learning is also lower than the highest score in the experiment group. These affect the total and mean scores, as shown by the fact that the total and mean scores of the control group are lower than those of the experiment group. Meanwhile, the students in the experiment class demonstrate better self-directed learning performance than Figure 2 for each indicator's total score.

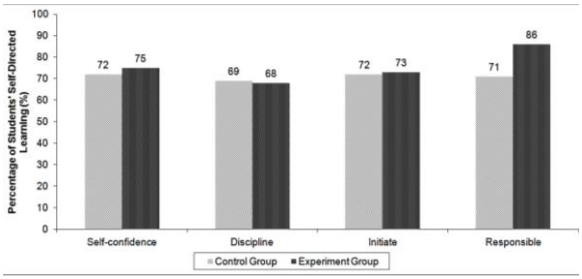


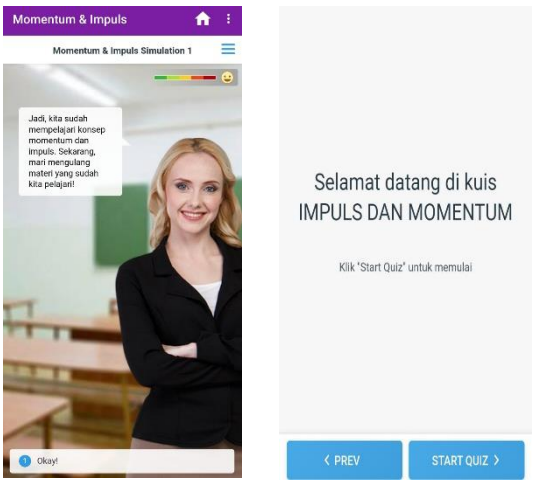
Figure 2. The Differences in Students' Self-Directed Learning between the Control and Experiment Groups

Figure 2 depicts a slight difference in self-confidence, discipline, and initiative between the control and experiment classes. Meanwhile, the difference in responsibility scores between the control and experiment groups is wider. This graph is related to statistical findings that demonstrated differences in students' self-directed learning between two groups under different conditions while studying momentum and impulse. Students' learning independence was affected differently by iSpring media learning integrated with the KWL learning model than by studying the teacher's material. Momentum and impulse appear simple, but they cause students problems when evaluating learning activities later on. Students find it challenging to understand and relate to their learning concepts (Karim et al., 2015).

Furthermore, in online learning, students' facilitation is limited, making it more challenging to discuss and obtain an interactive conceptual sample from their teacher (Kurniawan & Sumadi, 2016). This suboptimal learning results in students' lack of motivation and initiative to learn the momentum and impulse concepts, limiting their ability to develop their full potential (Triana et al., 2018). This result also implies that after implementing iSpring as the learning media integrated with KWL as the learning model, students' self-directed learning differed in the experiment and control groups.

This study examines how interactive learning with iSpring as the learning media integrated with KWL learning in momentum and impulse affects students' self-directed learning. Interactive learning results in different self-directed learning outcomes between control and experiment groups with material that includes sample and practice questions, simulations and animations, videos, interactive quizzes, and pictures, among other features provided by iSpring (Dasmo et al., 2020; Suprapto et al., 2021). In this study, the media provided to students via iSpring with animations, simulations, videos, and quizzes increased students' motivation to independently initiate their learning progress at home, as shown in figures 3 and 4.

Figure 3. Information about Momentum with Animation



(a) (b)

Figure 4. (a) The Simulation Section with Question and Answer to Recall the Material; (b) The quiz Section to Evaluate Students' Understanding

The iSpring also assists students in developing critical and higher-order thinking abilities (Wulandari, 2020). Students could learn about momentum and impulse materials by watching conceptual animations, simulations, and videos that explain the phenomenon in their everyday lives. This media learning usage assists students with self-motivational belief, self-observation, and self-control as they learn, recall, and evaluate material (Jazeel et al., 2020).

Furthermore, the Know, Want, and Learned phases of the KWL learning model can assist students in task analysis, self-judgment, and self-reaction (Agustin & Rahayu, 2021; Jazeel et al., 2020). The KWL learning model also assists students in sorting, selecting, assimilating, and synthesizing information, planning, identifying, applying, and evaluating the learning process that requires them to learn independently (Kleden, 2015; Sulasiwi et al., 2019). The difference in results between students who used the KWL learning model and those who only received the material is related to the self-assessment built with this learning model, which emphasized students' active participation in their studies (Widiartini & Sudirtha, 2019). Considering the findings from previous research related to the implementation of iSpring as the learning media for students' self-directed learning, it could make integration and help the students better if combined with the KWL learning model that helps students' self-directed learning. That is why the approach taken in this report is unique in that it shows the analyses performed to examine the impact of the combination of iSpring as a learning media and KWL as a learning model. This method is required if the analyses show a specific effect on students' self-directed learning.

There are several limitations to this study. This study only analyzed and compared the experiment class and control class using post-test results related to students' self-directed learning without

having a pre-test to compare with students' initial self-directed learning, and further research on the external factors of students' self-directed learning is needed to measure throughout the students' self-directed learning. Second, the impact of iSpring learning media integrated with the KWL learning method is investigated in this study.

The learning activities were conducted using Google Classroom, Google Meet, and Google Form to supplement the learning media and model. These applications may have an impact on students' self-directed learning. However, students' self-directed learning results may not differ between the experiment and the control group results without engaging learning media and an appropriate learning method.

Furthermore, depending on the student's circumstances, this implementation must be carefully chosen because they may have low bandwidth internet and have difficulty accessing the synchronous class. The android application based on iSpring must also be small to be easily downloaded and not cause the students' phones to lag. This issue must also be considered because not all students have laptop computers in addition to their phones. As a result, it is difficult to implement this in all schools. Finally, online learning was used because this study was conducted during the Covid-19 pandemic. However, offline and blended learning are being re-implemented, which may impact using the iSpring that integrates with the KWL learning model. However, physics teachers can use this study's findings as an alternative for learning media and learning models that use iSpring and are integrated with the KWL learning model.

CONCLUSIONS

Considering everything, this study discovered a significant impact associated with implementing iSpring learning media integrated with the KWL learning model on students' learning independence for the Impulse and Momentum concept. The independent T-test result demonstrates the difference in results between the experiment and control groups and the experiment group's improved development of self-directed learning. The interactive media may be responsible for students' results from iSpring, which integrates with the KWL learning model and allows them to better manage their learning progress. In future research, the researcher suggests interviewing students to better understand the impact of integrating iSpring learning media with the KWL learning model. Furthermore, the researchers propose using a pre-test post-test experiment design to determine the difference between pre and post-media implementation for self-directed learning.

AUTHORS CONTRIBUTIONS

ND designed the study, conducted the experiments, analyzed the data, and wrote the paper. MM provided writing assistance and supervised it critically for the important intellectual content.

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