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Is the use of the Problem-Based Learning Model through Instagram effective? A Review

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ABSTRACT: Chemistry is still considered a difficult subject for students due to a lack of motivation and understanding. Implementing a problem-based learning (PBL) model with the media of Instagram can help students expand their critical thinking and problem-solving skills. To this end, 20 empirical research articles from inside and outside Indonesia were examined using the bibliometric analysis method to find research gaps and novelties as a basis for future research. The review shows various difficulties faced by students in studying chemistry. Instagram-based chemistry learning can help the learning process to be fun, innovative, easy to understand and not boring. Applying the PBL model to learning can help students develop critical thinking and problem-solving skills. The results of this analysis offer perspectives and innovations for teachers to deal with the problems faced by students, presenting innovations in learning, such as the use of Instagram and PBL models.

CONTENTS

Eclética Química, vol. 48, n. 4, 2023, 17-26
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1. Introduction

Essentially, as time progresses, continuous development is inevitable. In light of this circumstance, it is necessary to improve the quality of human resources that can withstand the age of globalization. One of the efforts to improve the quality of human resources is education. In order to achieve the educational goals, it is necessary for the student to really pay attention to the study process in accordance with the applicable curriculum. In Indonesia, the 2013 curriculum is based on a scientific approach with four learning models, including discovery, inquiry, problem-based and project-based learning. What teachers need to do when implementing the 2013 curriculum is to help students develop habits so that they can always increase their awareness of learning, because the 2013 curriculum is applied based on existing problems. For this reason, students are expected to actively participate in the learning process (Sariono, 2013).

Problem solving is part of the reasoning process. This process is generally considered to be the most complex of all the characteristics of intelligence and can be interpreted as a higher-order cognitive process that requires more coordination and control of routines or other basic skills. Problem-solving skills include critical, logical and systematic thinking. An integrated teaching process can help students develop the ability to express and execute them in real life and relate what they have learned to life experiences. Thus, education should focus on improving skills and unleashing students' creativity to solve problems. The problem presented is usually taken from the real world, as a context for students to practice critical thinking and problem solving (Amir, 2009).

Memnun *et al.* (2012) found that the main goal and priority in education today is to train students to be more flexible in solving problems and to deal with all the problems they face. This shows that problem-solving skills play a very important role in the world of education. Hamiyah and Jauhar (2014) suggested that the indicators of problem-solving skills are divided into four parts: understanding the problem, planning the solution, dealing with the problem according to the plan created and re-examining all the steps.

Chemistry presents itself as a complex scientific discipline encompassing the examination of matter's structure, composition, properties, and the alterations it undergoes, often involving energy transformations. The difficulties experienced by students in studying chemistry can be attributed to the inherent complexities of this field. Prilianti (2012) suggested that chemistry has characteristics that are mostly abstract, sequential, and fast-developing concepts. He also proposed that difficulties in understanding the subject are rooted in problems understanding chemical concepts.

One of the chemistry subjects studied in Indonesian high schools is reaction rate. Sudarsana (2010) stated that the reaction rate subject taught there is still taught through lectures or memorization of most reaction rate concepts. This encourages teachers to apply the problem-based learning (PBL) model to the concept of reaction rate, because the material factors that affect reaction rate are closely related to the real world. In addition, the PBL model can also involve students in being active in the classroom, collaborating and finding solutions to the problems being studied. It is expected that the active participation of all students in their learning and the enhancement of their critical thinking skills will improve their learning outcomes, especially cognitive learning outcomes.

While learning and teaching chemistry, the usefulness of a teaching model determines student interest and success. The use of an inappropriate teaching model is a factor that makes learning chemistry difficult for students. They feel that what they learn is not related to their everyday lives. Chemistry is abstract and requires student activity to solve various chemistry-related problems.

A PBL strategy encompasses a series of learning activities. In short, it requires students to learn through PBL, rather than simply listening, taking notes, and memorizing information. With such strategies, they are proactive in thinking, communicating, researching, and reprocessing, entering data and finally completing it. In addition, problem-solving is done by applying scientific approaches. Thinking scientifically is a deductive and inductive thought process. The fact that the thinking process is carried out systematically means that scientific thinking is performed at a specific stage, and empirically means that the problem-solving process is performed with clear data.

Based on the characteristics of the reaction rate subject, Instagram-assisted PBL can be carried out. The number of Instagram users in Indonesia in 2020 reached 99.9 million people (Siahaan *et al.*, 2022). The most important reason for using Instagram as a learning medium is that students are familiar with its use. Since almost all students already have laptops and gadgets and still use Instagram, more educators do not have to pay much to apply it. It is also easy to apply, as it is an app that can be used anywhere. It is also easy to use, as it does not require any special training.

Furthermore, there are several reasons to consider Instagram as a learning medium: 1) Instagram can be used at all levels of education; 2) Instagram gives

Eclética Química, vol. 48, n. 4, 2023, 17-26
ISSN: 1678-4618
DOI: 10.26850/1678-4618eqj.v48.4.2023.p17-26

students the authority to create digital content on their own and publish it online, which can stimulate student and educator activity in teaching; and 3) Instagram allows collaboration between students and educators on a specific project or task to achieve learning objectives.

Structured learning based on PBL syntax, whose content consists of text, images, or videos or all three, is accompanied by instructions that students can use independently in their learning, without being limited by space and time. Indah (2021) proposed that, in relation to students' needs and characteristics, 94.4% of them use the Internet frequently to do tasks and understand content. Based on the results obtained in this study, the same percentage of students often use and like the social media Instagram.

Sujiono and Widiyatmoko (2014) suggested that PBL is very effective in expanding students' ability to think critically. The subject of reaction rate is closely related to counting. Jayadiningrat and Ati (2018) used a PBL model in chemistry learning and found that the application of this PBL can improve problem-solving skills in chemistry subjects, recognizing and formulating the problem, exploring alternative solutions, choosing the best solution and solving problems smoothly.

Oktaviani *et al.* (2017) found that using PBL as a learning model on the concept of reaction rate has a very good effect on the creativity aspects of students. Through PBL activities, students who acquire knowledge from discoveries made in the problem observation phase in the form of practical images and videos gradually begin to construct all the information found and obtained into their thinking patterns.

Social media has not been widely used for learning purposes, but this is an effort to make learning activities more fun and learning objectives achievable. The use of Instagram can have a positive impact on improving students' learning skills and understanding. Uploads made on Instagram can be visualized and displayed in feeds that can be viewed by Instagram followers and researchers in general. Instagram users can interact and chat with each other by commenting on or liking the uploaded photos and videos that have been published. Meanwhile, to interact privately, Instagram also offers a chat feature that is commonly referred to as a direct message or DM. Instagram can be used on various devices, such as smartphones, laptops and so on (Ambarsari, 2021).

The features available on Instagram really support the learning process: such as the TV function, which can deliver materials from 1 to 60 minutes; the Feed Post function, which can publish an overview of the material to be delivered; there is a background sound option that can be used to increase students' enthusiasm; the live feature, which is used by users who are doing activities and want to interact with their followers, as if they were talking directly to them and the audience that can be answered via chat (Al Mardhiah *et al.*, 2021).

Instagram's Stories feature consists of a 15-second photo or video upload that will automatically disappear within 24 hours, unless the upload is inserted into the Highlights on the Instagram account profile. In Instagram's Highlights feature, it is possible to create groups of Stories according to their categories. This makes it easier for students to review learning materials. Instagram also offers a variety of interesting music that can be used as a background. The use of such music can also increase students' interest in learning (Al Mardhiah *et al.*, 2021).

This is in line with the research on Instagram as a learning medium, which shows that the use of Instagram-based learning can increase student motivation, as the features of Instagram are diverse and interesting, which makes it easier for students to understand (Fidian, 2017). Irwandani and Juariyah (2016) suggested that those who use Instagram in their research show that developing products with the help of this social network is feasible, effective and can be used as an alternative for learning, as it can be accessed anytime and anywhere. Therefore, this study aims to provide a literature review to analyze the use of Instagram for learning purposes, including PBL models. The following is the main research question that this study seeks to answer: Is the use of the PBL model using Instagram effective for use in the chemistry learning process?

2. Experimental

The method used to complete this article using the bibliometric literature or article review method. The use of bibliometric analysis techniques can provide an accurate and objective way of measuring an article's contribution to the advancement of knowledge and is a commonly used tool for analyzing trends and performance on a particular subject (Yang *et al.*, 2013). Bibliometric analysis is a common method for investigating and analyzing large amounts of scientific data. Bibliometric analysis is used in the hope of finding research gaps and novelties as the basis for further research.

The bibliometric method of literature review was used to prepare this article. Bibliometric analysis techniques can provide an accurate and objective way of measuring an article's contribution to the advancement of knowledge and are commonly used tools for analyzing

Eclética Química, vol. 48, n. 4, 2023, 17-26
ISSN: 1678-4618
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trends and the performance of a given subject. Bibliometric analysis is a common method for investigating and analyzing large amounts of scientific data and is used in the hope of finding research gaps and novelties that serve as a basis for new research (Yang *et al.*, 2013).

The researchers investigated journal articles on the effectiveness of learning through Instagram on the grounds of a PBL approach in the context of reaction rate. This research used 20 national and international articles through a search on the Google Scholar platform. The articles used have undergone similar research and were analyzed and summarized. The results of the research are summarized in this article for discussion.

According to Tranfield *et al.* (2003), the method used in this study consisted of five steps, namely.

2.1 Determine the keyword

In this study, the keywords used to search for related literature in Google Scholar using Publish or Perish 7 software were "the application of Instagram media in learning," "the effectiveness of Instagram media in learning," and "Problem-Based Learning (PBL) on reaction rate material."

2.2 Literature data selection

This was done by reading the title of each article on the research topic when selecting the bibliographic data. As a result, there were references that did not correspond to the research topic, so the inappropriate articles were excluded and the appropriate results were returned: "the use of Instagram media in learning" as many as 60 articles, "the effectiveness of Instagram media in learning" as many as 14 articles, and "Problem-Based Learning (PBL) based on the reaction rate material" as many as 40 articles.

2.3 Literature data extraction and analysis

Bibliometric analysis was performed using VOSviewer software. Obtain around 20 journal articles related to the theme, which are then analyzed for the content and intent of these articles.

3. Results and discussion

The results of the research data contained in this literature review are an analysis and summary of the articles on PBL in the application of Instagram in learning, the effectiveness of this social media (Tables 1, 2 and 3).

Table 1. Research results related to the application or implementation of Instagram media in learning.

Researcher	Research Title	Research result
Muhtar *et al.* (2017)	The two blended learning model designs (Moodle and Instagram): A comparative study in university level	This can improve students' skills, self-control, and motivation
Salehudin *et al.* (2017)	Using Instagram to support creative learning and project-based learning	Can be freely used to improve students' creative and high order thinking skills
Ambarsari (2021)	The use of Instagram as a media for learning Indonesian language and literature in Era 4.0	Learning with Instagram becomes easier for teachers and students, so students can interact freely remotely, but the materials they share with them can be properly delivered
Qisthi and Arifani (2020)	The application of project-based learning via Instagram to improve EFL students' speaking skill	Can improve students' declaring, speaking, or pronouncing skills
Astuti (2021)	Distance learning media using Instagram as a learning tool to express students' opinions	Instagram is quite effective to be used as an alternative media for learning at all levels
Dewi *et al.* (2021)	Implementation of the utilization of Google Classroom, Google Meet, and Instagram in the online learning process towards the 21st century	It can make online learning activities easier for teachers and students. Learning that integrates the three media can provide character education for discipline, activeness, achievement of creativity, information literacy, collaboration, and responsibility
Sari (2021)	Utilization of learning media using the "Instagram Reels" feature in Indonesian language and literature learning during the COVID-19 pandemic	It helped educators or teachers to conduct online (online) learning. Because the features offered by Instagram Reel meet their learning needs

Eclética Química, vol. 48, n. 4, 2023, 17-26
ISSN: 1678-4618
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Table 2. Research on the effectiveness of Instagram media in learning.

Researcher	Research title	Research result
Irwandani *et al.* (2020)	Effectiveness of physics learning media course assisted by Instagram on student's creative thinking skill	Learning with social media, especially Instagram, is said to be effective for students' creative thinking skills. This result is also consistent with responses from students who were rated "good" for studying Physical Learning Media (PLM) courses using social media Instagram
Pratiwi (2019)	The effectiveness of media Instagram toward the students' speaking skills of 10th Grade State Senior High School 4 Malang	State Senior High School 4 Malang's X-Class students have a significant impact on Instagram media's speaking skills, which is indicated by pre- and post-test scores
Lubis *et al.* (2020)	The effectiveness of using Instagram as teaching tools in learning process of 3rd semester of English Department students	Instagram is one of the most effective social media that can be used as a platform for educational and learning processes. Instagram was also effectively used as a means of student interaction, especially in discussions related to task activities and explanations
Sinatrya and Aji (2020)	The effectiveness of the online flipped classroom learning model using Instagram in Class X Vocational High School	Instagram in the learning process can be effective using the flipped classroom method. Using Instagram as a learning model is a new experience for students, and it is easy for them to access and use

Table 3. Research results related to PBL on reaction rate material.

Researcher	Research title	Research result
Oktaviani *et al.* (2017)	Implementation of the problem-based learning model on the creativity of students in the material of reaction rates at State Senior High School 4 Banda Aceh	The application of the PBL learning model can improve and develop the creativity of students
Zahrah *et al.* (2017)	Application of practicum with problem-based learning (PBL) Model on reaction rate material at State Senior High School 1 Lembah Selawah	PBL model with practicum method can improve students' high order thinking skills on the concept of reaction rate chapter and improve students' scientific attitude
Utami *et al.* (2018)	The influence of problem-based learning (PBL) learning model on cognitive learning outcomes of Class XI Students of State Vocational High school 02 Manokwari (study on the main material of the reaction rate concept)	The percentage of the effect by implementing PBL has a 30% effect on student cognitive learning outcomes
Dakabesi and Luoise (2019)	Effects of problem-based learning models on critical thinking skills in the context of reaction rate	This can improve students' critical thinking skills and academic ability
Mayasari *et al.* (2019)	Comparison of problem-based learning and guided inquiry learning models on critical thinking ability in reaction rate materials	Learning with these PBL models has shown that students have higher critical thinking skills than with guided query learning models
Nangku and Rohaeti (2019)	The effect of problem-based learning model toward students conceptual understanding and verbal communication skills in reaction rate learning	PBL models have a positive impact on student learning outcomes in terms of conceptual comprehension and language communication skills
Redhana *et al.* (2019)	Development of scientific learning devices with problem-based learning models through inductive reasoning on the topic of reaction rate	The PBL model, in addition to improving problem-solving skills, helps students in constructing various existing problems into new knowledge, that is easily understood by students
Suarningtyas and Hidayah (2022)	Development of student e-worksheet based on problem-based learning to practice metacognitive abilities of high school student on reaction rate material	PBL students can train metacognitive abilities on the reaction rate material

Eclética Química, vol. 48, n. 4, 2023, 17-26
ISSN: 1678-4618
DOI: 10.26850/1678-4618eqj.v48.4.2023.p17-26

3.1 Application and effectiveness of using Instagram media in learning

Atmoko (2012) suggests that Instagram is a popular social media application for the public, including students. Instagram can inspire and develop creativity for its users because it has photo and video editing features that make it better and more attractive. The media used by the teacher is limited to textbooks, which is less interesting for students so that their motivation in reading the subject matter is very low. Therefore, we need media that can increase interest in learning so that students can improve their problem-solving skills.

The popularity of Instagram makes it effective to be used as a studying platform. That advantage of Instagram as a learning-based media, compared to other ones, is that it is more interesting, it is accompanied by illustrations, pictures, it is accessible anytime and anywhere, easy to use, and has no limit on the number of users. Nastiti (2019) proposed that Instagram can help teachers delivering subject matter, improving learning outcomes, helping students understand the material, and attracting students' attention—so that this platform is suitable for use as a learning medium.

Based on the findings in Tables 1 and 2, the surveys conducted received positive feedback from students. But despite that, Instagram has also its drawbacks. The disadvantages are: (i) too free to access, so students would need parental supervision; (ii) need for a stable Internet network, because if there is an Internet failure, the learning process will slow down a bit.

Based on the results contained in Table 1, the findings on implementation of this application were called effective. Muhtar *et al.* (2017) have shown its support in teaching and learning activities. In this case, students could improve their language proficiency, skills, self-discipline, and motivation. Their study aimed to determine the effectiveness of blended learning using two different media (i.e., Instagram and Moodle) for two different subjects (Mathematics and English Expression). Salehudin *et al.* (2017) discovered, by implementing Instagram media, that students improved creative and critical thinking skills. Their study aimed to examine this effect through the interaction of study models aided by Instagram and user experience related to conceptual understanding.

Ambarsari (2021) proposed that Instagram can be used as a learning medium, especially in learning Indonesian language and literature. Instagram makes it easier for teachers and students to interact remotely, with study material being properly notified and communicated. This study aimed to establish the viability of the Instagram app as a medium for language and literature learning. For Qisthi and Arifani (2020), Instagram can be a fun and effective tool for learning language skills. This study aimed to examine the impact of using Instagram on improving students' speaking skills.

Astuti (2021) proposed that the use of Instagram in learning is quite effective as an alternative learning media at all levels. This study aimed to determine freedom of expression in social media and examine the use of Instagram for learning by students in class XI Vocational School in Padang. Dewi *et al.* (2021) found that Instagram can be convenient for teachers and students in remote learning activities. Learning that integrates Google Classroom, Google Meet and Instagram can provide character building for discipline, activity, the achievement of creativity, information literacy, collaboration, and responsibility. This study aimed to propose innovations during learning methods to achieve students' cognitive, psychomotor and character traits based on information and communications technology.

Sari (2021) proposed that the Instagram Reels feature in Indonesian language and literature learning can help educators develop online learning resources that are in line with Indonesian language and literature learning needs. The advantages of the Instagram Reels feature are also considered to be more dominant than its weaknesses. This study aimed to find out whether the Instagram Reels feature in Indonesian language and literature learning can help online learning.

Irwandani *et al.* (2020) found that learning physics lessons supported by Instagram were effective for students' creative thinking skills. This result is also consistent with the response of the student who rated her Physical Learning Media (PLM) course as "good" through Instagram. The aim of this study was to determine the effectiveness of Instagram-enabled PLM learning and to determine the impact on students' creative thinking skills.

Pratiwi (2019) suggested that Instagram had a significant impact on the speaking skills of Class X students at Malang State High School 4, as evidenced by the pre- and post-test results. The aim of this study was to determine the effectiveness of using Instagram for these students' speaking skills. Lubis *et al.* (2020) found that Instagram is also used effectively as a means of student interaction, especially in activity-related discussions and task explanations. In addition, almost all students use this app, so they find it easier to use. The aim of this study was to examine the effectiveness of implementing Instagram in distance teaching and learning. Sinatrya and Aji (2020) proposed using this

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flipped classroom learning model to determine the effect of implementing Instagram on the learning process. This was evidenced by the significant increase before and after the test. The authors considered that using Instagram as a learning tool is a new experience that is easy for students to access and use.

The aspects that need to be considered in the effectiveness of Instagram learning are: (i) Instagram should contain useful content with high creativity; (ii) the content contained makes it easier for students to capture abstract ideas or formulations; (iii) it develops students' interest in reading and other fields of study; (iv) it helps students understand a subject considered difficult by creating content with easy-to-understand vocabulary. There are several reasons to use Instagram for research, education and study, including: (i) easy access (it can be accessed anywhere and at any time); (ii) most people, especially students and university students, have Instagram; (iii) the resources available are diverse; (iv) the duration of some resources is long enough, so it can be used to transmit material; (v) it can facilitate the interaction of educators and students.

3.2 PBL on reaction rate material

PBL is a learning approach in which students are presented with practical problems. The PBL model has been shown to explain the improvement of students' problem-solving and critical thinking skills. Students learning this approach observe the expertise present or try to discover the expertise they want in order to solve the problems they discover. Mahyana (2018) proposed that PBL be used as a learning model that can activate learning activities even when students are faced with problems that can stimulate critical thinking skills. Learning can be more meaningful and enhanced when students are presented with situations in which the concept applies.

In PBL, higher-order thinking skills are more required, because students are faced with a problem that requires them to solve it based on their ability to organize all their knowledge and experience, as well as the external conditions that are available or accessible. Rusman *et al.* (2010) proposed the following characteristics of the PBL model: (i) The problem is the starting point for learning; (ii) The problem posed exists in the real world and is unstructured; (iii) The problem increasingly requires multiple perspectives; (iv) The problems challenge the students' knowledge, attitudes and skills, which requires the identification of new areas of learning, mainly self-directed learning (v) Use of multiple sources of knowledge and information; (vi) Learning is collaborative, communicative and collaborative; (vii) The development of research and problem-solving skills is identical to the acquisition of knowledge to find solutions to problems; (viii) Integration of the learning process; (ix) PBL includes evaluation and review of the student and user experience of the learning process.

Based on the survey results shown in Table 1, the data from the survey conducted shows positive feedback from the students. The implementation of PBL models in the learning of kinetic chemistry of materials is very effective in applications. Oktaviani *et al.* (2017) found positive results with the implementation of the PBL model in the subject of reaction rate, in which the students' creativity obtained an average value of 92, which is categorized as very good, which shows that the students' creativity developed well after the implementation of PBL models in a chemical kinetics class. The aim of this study was to explain the students' creativity after implementing the PBL model in the reaction rate subject material.

Utami *et al.* (2018) showed that 30% of the results came from implementing PBL models in experimental classes. The objectives of this study were to find differences in cognitive learning outcomes between students taught through PBL and conventional learning and to find out how much the PBL model affects the cognitive learning outcomes of Class XI grader State Vocational High School 02 Manokwari.

Zahrah *et al.* (2017) found that PBL, as a model that uses practical techniques, can enhance students' critical thinking about this reaction rate concept and improve their scientific attitudes. This study aimed to determine the effectiveness of PBL models with practical techniques in improving students' critical thinking.

Dakabesi and Luoise (2019) suggested that students who learned in experiential classes were better at critical thinking than those who learned using traditional models. This study aimed to measure the effectiveness of improving students' critical thinking skills using PBL models. Mayasari *et al.* (2019) suggested that learning using the PBL model resulted in students' higher critical thinking skills than using the guided exploratory learning model. The aim of this study was to investigate learning models between PBL and guided questions that would best serve as response rate features in students' critical thinking skills.

Nangku and Rohaeti (2019) suggested that the implementation of a PBL model positively affects students' learning outcomes in terms of conceptual understanding and verbal communication skills. The aim of the article was to determine the impact of applying a project-based learning model on students' conceptual understanding and language skills when learning about

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reaction rate. Redhana *et al.* (2019) found that the PBL model, in addition to improving problem-solving skills, also helped students transform various existing problems into new knowledge that was easily understood by them. The aim of this research was to advance and represent the characteristics of learning devices that communicate with PBL models through prolegomenon reasoning on the topic of reaction rate.

Suarningtyas and Hidayah (2022) suggested that the Student E-Worksheet Based on PBL could train students' metacognitive skills in reaction rate material. Arends (2008) proposed three learning outcomes achieved by students taught with PBL: (i) research and problem-solving skills; (ii) learning adult role behavior; and (iii) suggested independent learning skills. Through problem-solving, students are empowered to use their logical reasoning, problem-solving and higher intellectual skills. Ultimately, PBL educates students to become independent learners. Improving their problem-solving skills can be very useful in life, as they develop the ability to deal with any problem in the environment.

There are certainly advantages and disadvantages to implementing PBL in the learning process. The benefits of PBL include: (i) problem solving can be a very effective and excellent technique for improving students' understanding; (ii) it can also be satisfactory for improving students' skills and expanding their knowledge; (iii) PBL can bring joy to students when solving problems; (iv) it can give students the opportunity to apply their knowledge in the real world. On the other hand, the weak points of applying problem-solving learning are: (i) that even when students are not interested or believe that the problem, they are studying is difficult to solve; (ii) they do not understand why they are trying to solve the problem; (iii) there is reluctance to solve problems when they are not at hand; and (iv) when they study, they do not learn what they want to learn.

4. Conclusions

Based on the results of the observations and discussions presented, it can be concluded that applying the PBL model to Instagram-based chemistry learning is effective. Observations from various studies on the use of PBL models show that it can improve critical thinking skills, solve provided problems and help students understand material more easily, because students do not just record, visualize, and memorize, but are required to actively form new knowledge through the problem-solving process. In addition, the use of Instagram in learning can also have a positive influence, increasing creativity and helping students to communicate the subject matter in a concise and easy-to-understand way using the resources provided. However, the application of a PBL model using Instagram also has several weaknesses, such as the need for a stable internet connection and, if students find it difficult to understand the problems presented, they tend to be lazy about finding solutions to these problems.

Authors' contribution

Conceptualization: Widarti, H. R.; Rokhim, D. A.
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Eclética Química, vol. 48, n. 4, 2023, 17-26
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