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THE EFFECTS OF INSTAGRAM MEDIA WITH INQUIRY ON CRITICAL THINKING SKILLS IN THE TOPIC REACTION RATES

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ABSTRACT

In the 21st century, social media has emerged as a potential educational tool to enhance learning outcomes and critical thinking skills. To explore this, a study assessed whether Instagram, employed as a learning media for inquiry-based chemistry learning, influences students' critical thinking abilities. The research adopted a quasi-experimental design, utilizing a pretest-posttest nonequivalent control group approach in eleventh-grade science classes across Senior High Schools in Surakarta. The research focused on reaction rates due to its abstract nature and visualization challenges. Random sampling was employed to select 72 students aged 16 to 18, divided into experimental and control groups. The research instrument encompassed 24 questions in pretest and posttest formats, comprising multiple-choice and essay-type questions. N-Gain analysis revealed a noteworthy increase in learning outcomes within the experimental group, registering a value of 0.79, surpassing the control group's value of 0.69. This underscores Instagram's efficacy as a learning tool, outperforming conventional teaching methods. Regarding critical thinking skills, the experimental group displayed the highest competence in indicators such as explanation, self-regulation, evaluation, analysis, and conclusion. The study establishes that when integrated into chemistry education with an inquiry-based model, Instagram positively impacts students' critical thinking skills, specifically about reaction rates. This research contributes novel insights into the application of Instagram for chemistry education and pioneers the examination of critical thinking skills within this context, enriching the domain of chemistry learning.

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INTRODUCTION

Chemistry plays a significant role in promoting sustainable development and contributing to achieving sustainability goals [1]. These goals are supported by four key indicators: policy, technology, industry, and education [2]. Education continues to evolve to equip students with the skills needed to make informed decisions, understand the consequences of their actions, and connect these insights with their knowledge and abilities [3]. In today's educational landscape, schools are tasked with designing learning experiences that align with essential competencies and keep up with contemporary trends [4]. Modern learning involves the integration of technological proficiency and practical skills [5]. Additionally, education in the 21st century is

marked by the rapid spread of information through digital media and technology, enhancing knowledge and skills [6]. The vital competencies required in the 21st century are often called the 4Cs: communication, collaboration, creativity, and critical thinking skills [7]. The crucial role of critical thinking skills is not only due to the demands of the 21st century but also for enhancing competitiveness and problem-solving abilities in the future [8]. In this context, 21st-century critical thinking skills entail effective problem-solving and analytical capabilities, ensuring the accuracy of acquired information [9].

The aptitude for critical thinking encompasses six core dimensions: elucidation, deduction, interpretation, analysis, assessment, and self-regulation [10]. Enhancing essential capabilities of thinking can be facilitated through Instagram [11]. Furthermore, these skills emphasize an active learning approach beyond the mere accumulation of information in the classroom setting. Critical thinking involves dissecting, integrating, and applying knowledge to practical, real-world contexts [12]. Pragmatic predicaments can be effectively resolved through the utilization of critical thinking skills, encompassing the compilation, application, scrutiny, and evaluation of acquired information [13]. The assertion is made that science offers a viable avenue for addressing practical challenges by accessing information, and social media serves as a swift and easily accessible repository of information for this purpose [14]. The value of social media as an information hub is underscored, providing a foundation for informed decision-making based on verifiable facts throughout the journey of critical thinking [15].

Social media is an online platform to construct and interchange content, exemplified by platforms like Twitter, YouTube, Facebook, and Instagram [16]. Instagram is a social media platform predominantly embraced by individuals aged 15-34, with 59% of users falling within the 15-20 age bracket, aligning with junior high school student demographics [17]. Most Instagram users are students, so it holds promise as an alternative educational tool [18]. The accessibility of Instagram learning media anytime and anywhere has been highlighted [19]. Various scholarly efforts have delved into social media's academic potential, including using Instagram as a conduit for digital learning [20]. Furthermore, the efficacy of Instagram as a valuable learning resource has been empirically substantiated [21]. The aptitude of Instagram learning media to cultivate critical thinking skills has been suggested [11]. Insights underscore the value of Instagram's features, such as captivating imagery, flexible scheduling, and user-friendliness, to facilitate classroom collaborative learning endeavors [22]. The feasibility of Instagram as a viable alternative for chemistry education, contributing to favorable learning outcomes, has been affirmed [23]. Consequently, Instagram emerges as a potential catalyst for enhancing critical thinking skills within chemistry education, contingent upon implementing an appropriate pedagogical approach.

Applying appropriate learning models through social media platforms promises skill enhancement [24]. Consequently, the learning models must be selected according to the utilized learning media [25]. The efficacy of the inquiry learning model in bolstering student learning achievements is well-documented [26]. Lai's investigation underpins the positive impact of the inquiry learning model on student accomplishments [27]. The inquiry learning model's potential as an alternative strategy for enhancing learning outcomes [28]. This model, fostering active student participation, aligns with promoting critical thinking skills and can synergistically integrate with social media for learning purposes [29,30]. They are implementing the inquiry learning model within Indonesian education, specifically employing Instagram as a supportive learning media. The outcomes reveal students' favorable responses to this classroom approach [31]. While the empirical validation of applying the inquiry model via Instagram in the context of chemistry education remains limited, this approach holds particular promise for subjects like reaction rates. This topic's complexity and need for visualizability [32]. A potentially effective strategy to address this challenge involves employing the inquiry model with Instagram, fostering a more productive learning environment.

The primary objective of this study is to investigate whether Instagram, when employed as a chemistry learning medium within the inquiry learning model framework, impacts students' critical thinking skills about the subject of reaction rate. This research endeavors to significantly contribute to education and chemistry by introducing an innovative avenue for educators to enhance critical thinking. By utilizing Instagram as a learning platform, coupled with the inquiry model, this study aims to offer empirical substantiation for the positive influence of this amalgamation on students' critical thinking capabilities, specifically in the context of understanding reaction rate concepts within chemistry education. Such findings could play a pivotal role in enabling students to swiftly and accurately solve problems and make informed decisions within chemistry education.

METHOD

This study employs a quantitative approach and quasi-experimental methods featuring a pretest-posttest nonequivalent control group design. The selection of this methodology stems from the study's intention to gauge the impact of Instagram as a learning medium for chemistry within the framework of the inquiry learning model. This investigation is specifically geared toward evaluating its influence on enhancing critical thinking skills among students in both control and experimental classes. The quantitative approach is chosen since the study primarily hinges on collecting and analyzing pretest and posttest data. The research was conducted within the premises of Senior High Schools in Surakarta, encompassing two classes of the eleventh-grade science program. This endeavor comprised five sessions, each lasting 90 minutes, incorporating three treatment sessions and two pretest and posttest assessments. The application of the inquiry model within this

research was centered on the instruction of topic reaction rate through the inquiry method. Commencing with orientation, the learning process advances by formulating a problem rooted in prior issues. Subsequently, students engage in data collection to delve into the topic comprehensively. The hypothesis is then tested, followed by the formulation of a concluding inference [33].

1. Research Procedure

The research procedure begins by administering a pretest to the experimental and control classes. After this, the core learning activities embedded in the inquiry model are conducted. This includes orientation, problem formulation, hypothesis formulation, data collection, hypothesis testing, and concluding [54]. The teaching content is sourced from an Instagram account designated for this purpose (@chemsquad.chemistry) in the experimental class. This account offers a variety of resources, such as images, questions, videos, and explanatory content aligned with the research topic. Conversely, the control class relies on conventional learning methods, utilizing sources available on the internet or chemistry textbooks. At the culmination of the research, a posttest is administered to assess the impact of Instagram as a chemistry learning medium within the inquiry learning model on students' critical thinking skills.

2. Participants

The study population comprises five classes of the eleventh-grade science program in a senior high school, with students aged between 16 and 18 years. Having assessed their performance in daily tests related to the previous topic, thermodynamics, it was determined that 79.16% of students had achieved scores falling below the threshold of the Learning Content Criteria. It is noteworthy that, before the initiation of the research, students willingly and voluntarily consented to partake in the study. The research class was selected using random sampling, resulting in 72 students. Ethical considerations were followed, including obtaining permission from the school authorities and securing consent from the participating students. The participants' demographic data is presented in Table 1.

Table 1. Data of research participants

Gender	Experimental class	Control class
Female	24	24
Male	12	12
Total	36	36

3. Research Instrument

The research tools utilized in this study encompass pretest and posttest questionnaires, which have been adapted from previous studies. These questionnaires have undergone validation by two experts in the field, both of whom are chemistry education lecturers at Universitas Sebelas Maret. The validation process evaluates the content and language employed in crafting the instruments. Following the validity assessment using the Gregory formula, the pretest questionnaire achieved a validity score of 0.92, signifying high validity. Meanwhile, the posttest questionnaire attained a validity score of 0.75, categorizing it as highly valid, thus rendering both

instruments suitable for research employment. This validation outcome is further bolstered by a reliability examination conducted via the Cronbach Alpha formula, which yielded a reliability coefficient of 0.77 for multiple-choice questions and 0.72 for essay questions. The comprehensive research instrument comprises 24 questions, encompassing pretest and posttest inquiries, as illustrated in Table 2.

Table 2. Research instrument Pretest and Posttest for Critical Thinking Indicators on Essay and Multiple-Choice Questions

Critical Thinking Indicator	Number and Type of Questions in the Pretest	Number and Type of Questions in the Posttest
Analysis	1 Essay, 4 Multiple choice	1 Essay, 4 Multiple choice
Interpretation	2 Essay, 5 Multiple choice	2 Essay, 5 Multiple choice
Evaluation	3 Essay, 2 Multiple choice	3 Essay, 2 Multiple choice
Conclusion	4 Essay, 3 Multiple choice	4 Essay, 3 Multiple choice
Explanation	5 Essay, 1 Multiple choice	5 Essay, 1 Multiple choice
Self-regulation	6 Essay, 6 Multiple choice	6 Essay, 6 Multiple choice
Total	12 Questions	12 Questions

4. Data Analysis Techniques

Pretest a posttest data processing techniques carried out with this

$$t = \frac{\text{posttest score} - \text{pretest score}}{ideal\ score - pretest\ score} \quad \text{.....(1)}$$

to measure the improvement of student learning outcome analysis of the achievement of percentage (%) of critical thinking skills with the formula of critical thinking

$$\text{percent value} = \frac{scores\ obtained\ by\ students}{maximum\ score\ of\ the\ test} \text{ X } 100\% \text{..(2)}$$

to find out which critical thinking indicators have the highest and lowest percentages and the ANOVA test with SPSS for knowing the influence of Instagram as a chemistry learning medium on inquiry learning models on students' critical thinking skills in control and experimental classes.

RESULTS AND DISCUSSION

During the initial session, students underwent an initial assessment through a pretest to gauge their preliminary learning outcomes. Subsequently, across three subsequent sessions, students in the experimental group engaged in learning activities involving Instagram media and the inquiry model. Conversely, the control group exclusively experienced the inquiry learning model without incorporating Instagram media. Concluding the instructional phase, a posttest was administered to ascertain the ultimate learning outcomes. Within critical thinking skills evaluation, the dimensions encompass explanation, inference, interpretation, analysis, evaluation, and self-regulation [34].

1. N-Gain Test Results

Based on the data extracted from the study outcomes presented in Table 3, it becomes evident that the N-Gain test results in the experimental group utilizing Instagram as a learning medium surpass those of the control group that did not incorporate Instagram into their learning process. This suggests that the integration of Instagram

into learning has the potential to elevate student learning outcomes. Notably, discrepancies in learning interest between the two groups emerged. The experimental group displayed heightened engagement and enthusiasm, particularly when leveraging Instagram as a learning tool [35]. This aligns with findings by Ortiz, who expounds on Instagram's capacity to bolster motivation through captivating visual elements [36]. Adopting Instagram as a learning platform can captivate students, facilitating enhanced comprehension of the presented topic [37]. N-Gain test results are presented in Table 3.

Table 3. N-Gain Score Analysis Data

Class	Average		<g>	Criteria
	Pretest	Pretest		
With Instagram Learning Media	19,02222	82,96944	0,79	High
Without Instagram, Learning Media	19,16944	75,43333	0,69	Currently

2. Impact on Student Engagement

A disparity emerges in student interest and enthusiasm for learning, distinguishing the experimental class from the control group. A noticeable upsurge in students' enthusiasm and engagement during the learning process is apparent within the experimental context. This heightened involvement can be attributed to the incorporation of visual elements within the Instagram learning medium. These visual components encompass images, inquiries, explanatory videos, and practical lab demonstrations. Visual aids have the potential to streamline the delivery of learning content, making it more understandable, capturing students' attention, and facilitating easy connections with real-world phenomena [38]. Consequently, using the Instagram learning medium amplifies student participation and attentiveness throughout the learning experience. Active engagement by students in the classroom setting translates into an improved grasp of the subject matter. A profound comprehension of the content empowers students to effectively address posed questions, resulting in an overall enhancement of their learning outcomes. The application of Instagram as a digital learning medium positively impacts student learning achievements [39], and the incorporation of the Instagram application enhances learning outcomes by simplifying student information acquisition activities [40].

The Instagram learning medium introduces conceptual, diversified, and highly practical content, significantly enriching student learning experiences and knowledge acquisition. The ubiquitous use of mobile devices by students in their daily routines substantially augments the effectiveness of Instagram as a digital learning medium. Consequently, in chemistry education, integrating Instagram learning media in teaching topic reaction rate promises to yield improved student learning outcomes. Thus, Instagram learning media emerges as a contributing factor propelling the advancement of student learning outcomes and accomplishments in chemistry, particularly concerning topic reaction rate. Empirical evidence concurs with the impact of

the inquiry learning model on student learning achievements, as evidenced by the enhancement of student learning outcomes. This is consistent with prior research by Nurmayani, which highlights the influence of guided inquiry learning models on learning outcomes within physics education [9].

3. ANOVA Test Analysis

Table 4. ANOVA Test Analysis Data

Aspect	Sig.	Test Decision
Posttest Scores of Critical Thinking Skills	0,001	H_0 is rejected

Based on the outcomes presented in Table 4, it can be inferred that significant disparities emerge in the influence of an Instagram-facilitated inquiry learning model, implemented as a medium for chemistry education, on enhancing students' critical thinking capacities, distinguishing between the experimental and control groups. Social media can amplify essential thinking abilities within the educational sphere [41].

The deployment of Instagram as an instructional tool yields an average efficacy rating of 72%, placing it within a bracket indicative of its pronounced effectiveness in bolstering students' aptitude for critical thinking [11]. These encouraging findings are rooted in students' adeptness at applying skills such as identification, explanation, and decision-making, harmonizing with the amassed data. These proficiencies empower them to tackle challenges and submit their findings for re-evaluation, thereby ensuring the integrity and dependability of their conclusions in the process.

4. Critical Thinking Skills Achievement

The following critical thinking skills achievement percentage (%) test are presented in Figures 1 and 2.

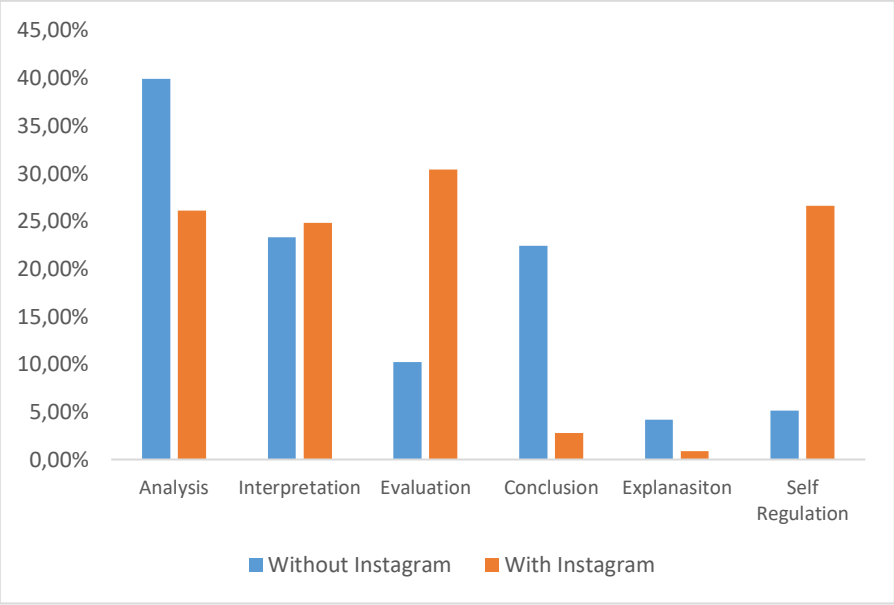

Figure 1. Percentage Achievement (%) Pretest Critical Thinking Skills

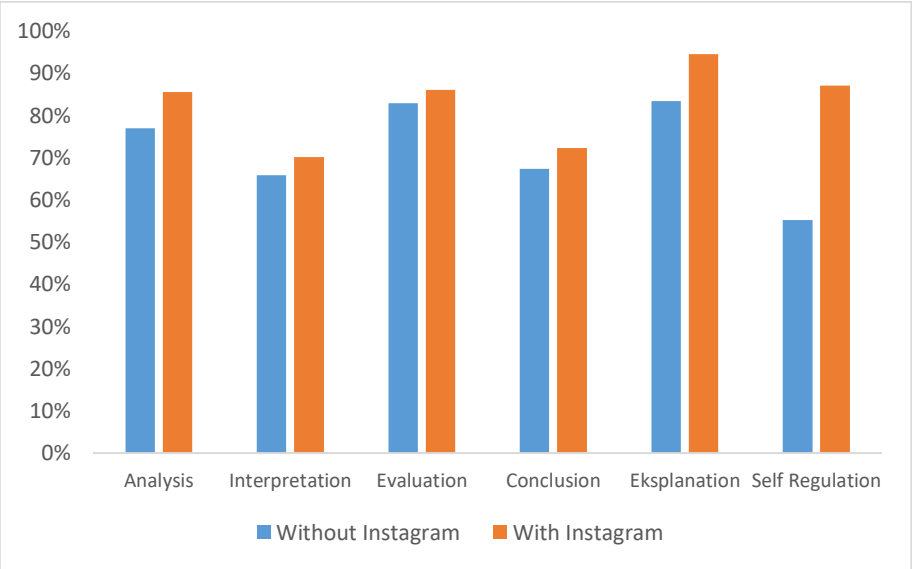

Figure 2. Percentage Achievement (%) Posttest Critical Thinking Skills

Critical thinking skills are assessed through both pretest and posttest questions. As depicted in Figure 1, the evaluation indicator showcases the highest percentage (%) of critical thinking skill achievements within classes utilizing Instagram as a learning medium. Conversely, the analysis indicator holds the highest position in classes without Instagram integration. Figures 1 and 2 collectively illustrate notable enhancements across all critical thinking indicators, encompassing analysis, interpretation, evaluation, inference, explanation, and self-regulation. Figure 2 underscores that the posttest accomplishment percentages (%) for critical thinking skills in classes employing Instagram and those without it are notably elevated in the explanation indicator. In classes leveraging Instagram, the lowest achievement resides in the interpretation indicator, whereas in classes without Instagram integration, it lies within the self-regulation indicator.

Focusing on Figure 2, it becomes evident that one of the critical thinking indicators, specifically explanation, garners the highest achievement in both the experimental and control groups following the administered treatment. Explanation pertains to the capacity to offer logically compelling viewpoints grounded in obtained facts [42]. This observation aligns with prior research by Ramdani, where explanatory indicators similarly secured the highest achievement rate relative to other indicators [43]. Within the context of inquiry models, explanation indicators during discussions or data compilation stages. The prevalence of the explanation indicator's elevated percentage can be attributed to the incorporation of Instagram learning media in this study. The utilized Instagram features encompass an introduction, instructional content, real-world phenomena connected to reaction rates, research videos, and explanations of conducted research. These media attributes

motivate students to seek solutions to posed inquiries [56] proactively. Subsequently, students articulate their findings coherently, comprehensibly communicating with their peers. As a result, the entire class becomes acquainted with the day's subject matter, fostering the development of critical thinking skills.

Conversely, the findings diverge from Anggiasari's study, where the explanatory indicators demonstrated the lowest achievements due to the absence of Instagram as a learning medium [44]. Susilowati's research underscores that explanation entails presenting data alongside well-founded arguments rooted in evidence and acquired facts [45]. Critical thinking skills are harnessed to formulate well-reasoned and informed judgments. [46].

Among the indicators, the second highest attainment in the experimental group is self-regulation. Self-regulation entails the cultivation of skills in self-analysis and self-evaluation. In the self-regulation dimension, learners are trained to introspectively assess their cognitive processes and problem-solving outcomes, aiming to gauge their comprehension of the subject matter. In the context of the inquiry model, the self-regulation facet is embedded within the orientation phase. During this initial stage, students are prompted to individually scrutinize their grasp of previously covered topics [45]. However, the outcomes diverge from the research by Hunaepi, wherein the self-regulation indicators demonstrated a meager 37% achievement, falling within the very low category due to students' struggles in monitoring beliefs rooted in their cognitive processes [47]. Proficient self-regulation empowers students to surmount challenges and harness these difficulties to analyze, evaluate, and implement insights for personal growth [48].

Moving on, the third-highest achievement in the experimental group is evaluation. Evaluation refers to a student's capacity to assess statements or viewpoints from their perspective and that of others [49]. Within the framework of the inquiry model, evaluation criteria are encapsulated in the conclusion phase. This is evident as students formulate conclusions, enabling them to appraise the validity of expressed opinions. This observation resonates with Hidayati's research, where the critical thinking evaluation indicator scored 39.58, indicating sufficiency [50]. The critical thinking evaluation indicators remained relatively low due to students' struggles comprehending and addressing problems [51].

Another critical thinking dimension is analysis, an indicator performing below the attainment threshold. The analysis encompasses the ability to discern relationships among statements, data, facts, and concepts, facilitating simulation [42]. This aligns with the inquiry model's emphasis on honing analytical skills, specifically during the hypothesis formulation phase. At this juncture, students engage with content and, guided by educators, accumulate and explore data to formulate hypotheses [52].

Inference, performing below the analysis indicator, constitutes another facet deserving attention. Inference cultivates students' ability to identify intriguing concepts and formulate problems [49]. Inference metrics are embedded in the problem formulation phase within the

inquiry model. Students can understand the content and respond appropriately to concepts, translating these understandings into problem statements [53]. However, the low attainment could stem from students' challenges in analyzing problems and their unfamiliarity with selecting fitting words for articulating problem formulations. In contrast, [42] findings revealed that the inference critical thinking indicator thrived in the good category, scoring 62%.

The interpretation indicator presents the experimental group's lowest percentage (%) of achievement in critical thinking skills. Interpretation involves grasping and expressing the significance of diverse experiences and situations, encompassing the articulation of meanings from various data encounters, events, choices, and processes [49]. This observation aligns with the inquiry model's focus on refining analytical skills, particularly during hypothesis testing. The subpar performance in this indicator can be attributed to students' hesitancy in confidently presenting answers or arguments, alongside educators' need for enhanced guidance in reclarifying concepts. Furthermore, students need help comprehending presented problems to ensure they effectively test hypotheses and convey comprehension in precise and coherent terms. Similar to these findings, [54] research unveils interpretation indicators in the lower range. Conversely, [50] contradicts this trend, reporting that their critical thinking proficiency in interpreting indicators scored higher than others, achieving 47.91.

Within the control group, the lowest percentage (%) of achievement pertains to the self-regulation indicator. This alignment echoes findings classifying self-regulation indicators within the low range [49]. The inquiry model's orientation phase houses the self-regulation indicators [55]. The subdued achievement in this context can be attributed to students' struggles in addressing teachers' inquiries regarding prior topic reviews and their challenges in autonomously resolving and addressing problems from their perspectives [56].

Figure 3. Analogy of collision theory

Figure 3 constitutes one of several visual components sourced from Instagram accounts integrated into this study. The depicted image serves to illustrate collision theory-related phenomena occurring in everyday life. This visualization enhances students' comprehension and kindles their interest in studying topic reaction rates.

Nonetheless, this study does possess certain limitations. Notably, using mobile phones in the classroom context sometimes needs to improve. It requires a robust and consistent signal, substantial internet data, and access to dependable Wi-Fi. To mitigate these constraints, schools and technical personnel should ensure the proper functionality of Wi-Fi infrastructure and

enhance internet accessibility. Additionally, teachers could enhance student supervision to ensure focused engagement with Instagram-based learning content on mobile devices.

The strengths of this study's research methodology and employed data collection instruments lie in their efficacy in contrasting scores pre and post-treatment across experimental and control groups. However, the methodology and instruments do bear limitations. It proves challenging to definitively ascertain whether the variance in posttest scores arises from the treatment differences in the experimental and control groups or stems from other confounding factors.

This research highlights the pioneering use of Instagram social media with an inquiry learning model as a chemistry learning medium, rendering it a promising avenue for classroom chemistry education. This novelty is underpinned by the scarcity of literature exploring Instagram's integration as a chemistry learning medium within an inquiry-based framework. Furthermore, the observation of critical thinking skills facilitated through Instagram media is a novel addition to the landscape of chemistry education [57]. Consequently, this presents an alternative for chemistry educators to implement, fostering improved learning outcomes and bolstering critical thinking skills. Additionally, this approach contributes to the evolution of social media-integrated learning models, particularly within Instagram-based chemistry education. As a future direction, subsequent research could explore the efficacy of amalgamating Instagram with alternative pedagogical strategies.

CONCLUSION

Based on the research data, there is an influence of Instagram as a medium for learning chemistry in the inquiry learning model on students' critical thinking skills regarding reaction rates. From the N-Gain value obtained, there is an increase in learning outcomes that are higher after using Instagram learning media than conventional methods. In addition, the highest percentage (%) of critical thinking skills was found in the explanation or explanation indicator, while the lowest was in the interpretation indicator in the experimental class and the self-regulation indicator in the control class. Using Instagram learning media on the topic reaction rate combined with the inquiry learning model can be an alternative that can be used by chemistry teachers to be applied in learning. This research is expected to be a reference for developing Instagram as a medium for learning chemistry combined with inquiry learning models and critical thinking skills in chemistry learning to improve student's learning outcomes and critical thinking skills.

REFERENCES

[1] S. W. Al Idrus, A. A. Purwoko, S. Hadisaputra, and E. Junaidi, “Pengembangan Modul Praktikum Kimia Lingkungan Berbasis Green Chemistry Pada Mata Kuliah Kimia Lngkungan,” *Jurnal Pijar Mipa*, vol. 15, no. 5, pp. 541–547, 2020, doi: 10.29303/jpm.v15i5.2171.

[2] H. Kristianto, Y. T. Atmodjo, and L. Gandajaya, “Pengembangan Mata

Kuliah Industri Kimia Berkelanjutan Dengan Metode Pembelajaran Berbasis Masalah," *Jurnal Pendidikan Sains (Jps)*, vol. 7, no. 2, p. 179, 2019, doi: 10.26714/jps.7.2.2019.179-187.

[3] J. Jumrodah, L. Liliasari, Y. H. Adisendjaja, and Y. Sanjaya, "Keterampilan Berpikir Kreatif Mahasiswa Calon Guru Biologi Pada Konsep Biota Laut Menuju Pembangunan Berkelanjutan Melalui Pembelajaran Berbasis Proyek," *Edu Sains: Jurnal Pendidikan Sains dan Matematika*, vol. 9, no. 1, pp. 98–106, Jun. 2021, doi: 10.23971/EDS.V9I1.2993.

[4] W. H. Rawung, D. A. Katuuk, V. N. J. Rotty, and J. S. J. Lengkong, "Kurikulum dan Tantangannya pada Abad 21," *Jurnal Bahana Manajemen Pendidikan*, vol. 10, no. 1, pp. 29–34, Apr. 2021, doi: 10.24036/JBMP.V10I1.112127.

[5] D. M. Anggraeni and F. B. Sole, "E-Learning Moodle, Media Pembelajaran Fisika Abad 21," *Jurnal Penelitian dan Pengkajian Ilmu Pendidikan: e-Saintika* |, vol. 1, no. 2, p. 57, 2018, doi: 10.36312/e-saintika.v1i2.101.

[6] D. Shidiq, A. S. & Nasrudin, "The Elementary Teacher Readiness Toward STEM-Based Contextual Learning In 21st Century Era," *Ilkogretim Online*, vol. 20, no. 1, pp. 145–156, 2021, doi: 10.17051/ilkonline.2021.01.019.

[7] J. Taar and P. Palojoki, "Applying Interthinking For Learning 21st-Century Skills In Home Economics Education," *Learning, Culture, and Social Interaction*, vol. 33, p. 100615, Apr. 2022, doi: 10.1016/J.LCSI.2022.100615.

[8] N. Nuraini, J. A. Jend Yani, S. I. Ulu, and S. Selatan, "Profil Keterampilan Berpikir Kritis Mahasiswa Calon Guru Biologi Sebagai Upaya Mempersiapkan Generasi Abad 21," *Didaktika Biologi: Jurnal Penelitian Pendidikan Biologi*, vol. 1, no. 2, pp. 89–96, Sep. 2017, doi: 10.32502/DIKBIO.V1I2.676.

[9] L. Nurmayani, A. Doyan, and S. P. V. N. Nyoman, "Pengaruh Model Pembelajaran Inkuiri Terbimbing Terhadap Hasil Belajar Fisika Peserta Didik," *JPPIPA*, vol. 4, no. 2, 2018, doi: 10.29303/jppipa.v4i2.113.

[10] M. Munawwarah, N. Laili, and M. Tohir, "Keterampilan Berpikir Kritis Mahasiswa dalam Memecahkan Masalah Matematika Berdasarkan Keterampilan Abad 21," *Alifmatika: Jurnal Pendidikan dan Pembelajaran Matematika*, vol. 2, no. 1, pp. 37–58, Jun. 2020, doi: 10.35316/alifmatika.2020.v2i1.37-58.

[11] M. Isnaini, L. Sekar Utami, and K. Anwar, "Pengaruh Media Instagram #Physics in My Live Model Blended Learning Pada Pembelajaran Fisika Terhadap Keterampilan Berpikir 'Z Generation,'" *Orbita*, vol. 8, no. 1, pp. 181–187, 2022, doi: 10.31764/orbita.v8i1.8657.

[12] I. W. Redhana and I. W. Redhana, "Model Pembelajaran Berbasis Masalah Dan Pertanyaan Socratik Untuk Meningkatkan Keterampilan Berpikir Kritis Siswa," *Jurnal Cakrawala Pendidikan*, vol. 0, no. 3, Jan. 2013, doi: 10.21831/cp.v0i3.1136.

[13] Y. N. Nafiah and W. Suyanto, "Penerapan Model Problem-Based Learning Untuk Meningkatkan Keterampilan Berpikir Kritis Dan Hasil Belajar Siswa," *Jurnal Pendidikan Vokasi*, vol. 4, no. 1, Feb. 2014, doi: 10.21831/JPV.V4I1.2540.

[14] A. S. Nurhayati, "Peran Media Jejaring Sosial Dalam Pembelajaran Abad 21," *Prosiding Temu Ilmiah Nasional Guru*, vol. 1–9, no. November, pp. 632–641, 2016.

[15] J. Jamaluddin, A. W. Jufri, A. Ramdani, and A. Azizah, "Profil Literasi Sains Dan Keterampilan Berpikir Kritis Pendidik Ipa Smp," *Jurnal Penelitian Pendidikan IPA*, vol. 5, no. 1, Jan. 2019, doi: 10.29303/JPPIPA.V5I1.185.

[16] A. Rosa-Castillo, O. García-Pañella, E. Maestre-Gonzalez, A. Pulpón-Segura, A. Roselló-Novella, and M. Solà-Pola, "Gamification On Instagram: Nursing Students' Degree Of Satisfaction With And Perception Of Learning In An Educational Game," *Nurse Education Today*, vol. 118, p. 105533, Nov. 2022, doi: 10.1016/J.NEDT.2022.105533.

[17] W. Prihatiningsih, "Motif Penggunaan Media Sosial Instagram Di Kalangan Remaja," *Communication*, vol. 8, no. 1, p. 51, 2017, doi: 10.36080/comm.v8i1.651.

[18] F. S. Fujiawati and R. M. Raharja, "Pemanfaatan Media Sosial (Instagram) Sebagai Media Penyajian Kreasi Seni Dalam Pembelajaran," *JPKS (Jurnal Pendidikan dan Kajian Seni)*, vol. 6, no. 1, Apr. 2021, doi: 10.30870/JPKS.V6I1.11602.

[19] I. Irwandani and S. Juariyah, "Pengembangan Media Pembelajaran Berupa Komik Fisika Berbantuan Sosial Media Instagram sebagai Alternatif Pembelajaran," *Jurnal Ilmiah Pendidikan Fisika Al-Biruni*, vol. 5, no. 1, pp. 33–42, Apr. 2016, doi: 10.24042/jpifalbiruni.v5i1.103.

[20] E. Dewi Pitaloka, M. Aprilizdihar, and dan Septiana Dewi, "Pemanfaatan Sosial Media Sebagai Sarana Pembelajaran Di Era Digital," *Journal Of Digital Education, Communication, And Arts (Deca)*, vol. 4, no. 02, pp. 101–110, Mar. 2021, doi: 10.30871/DECA.V5I01.3717.

[21] E. W. Novianti and I. N. Arcana, "Pengembangan Media Pembelajaran berbasis Instagram pada Pokok Bahasan Grafik Fungsi untuk Siswa SMA," vol. 8, no. 3, pp. 333–343, 2020.

[22] E. Richter, J. P. Carpenter, A. Meyer, and D. Richter, "Instagram As A Platform For Teacher Collaboration And Digital Social Support," *Computers & Education*, vol. 190, p. 104624, Dec. 2022, doi:10.1016/J.COMPEDU.2022.104624.

[23] I. P. Rahmawati, S. Yamtinah, S. B. Utomo, H. R. Widarti, and A. S. Shidiq, "Effect of Using Instagram Learning Media on Student Learning Outcomes Using the Discovery Learning Model on Reaction Rate Material," *Jurnal Penelitian Pendidikan IPA*, vol. 9, no. 4, pp. 1805–1812, Apr. 2023, doi: 10.29303/jppipa.v9i4.3320.

[24] H. Wijaya and Arismunandar, "Pengembangan Model Pembelajaran Kooperatif Tipe STAD Berbasis Media Sosial," *Jurnal Jaffray*, vol. 16, no. 2, pp. 175–196, Oct. 2018, doi: 10.25278/JJ71.V16I2.302.

[25] R. Kusumaningtyas, I. M. Sholehah, and N. Kholifah, "Peningkatan Kualitas Pembelajaran Guru Melalui Model dan Media Pembelajaran bagi Generasi Z," *Warta LPM*, vol. 23, no. 1, pp. 54–62, Feb. 2020, doi: 10.23917/warta.v23i1.9106.

[26] R. Perdana, A. Ashadi, and S. Yamtinah, "Pengembangan Modul Pembelajaran Kimia Sma/Ma Berbasis Inkuiri Terbimbing Pada Materi Pokok Hidrolisis Garam," *Prosiding SNPS (Seminar Nasional Pendidikan Sains)*, vol. 3, no. 0, pp. 205–214, 2016.

[27] C. L. Lai, G. J. Hwang, and Y. H. Tu, "The Effects Of Computer-Supported Self-Regulation In Science Inquiry On Learning Outcomes, Learning Processes, And Self-Efficacy," *Educational Technology Research and Development*, vol. 66, no. 4, pp. 863–

892, Aug. 2018, doi: 10.1007/S11423-018-9585-Y.

[28] N. Wayan Juniati and I. Wayan Widiana, "Penerapan Model Pembelajaran Inkuiri Untuk Meningkatkan Hasil Belajar IPA," *Jurnal Ilmiah Sekolah Dasar*, vol. 1, no. 1, pp. 20–29, 2017.

[29] H. Mu'alimah and I. Ishafit, "Pembelajaran Inkuiri Kolaboratif Daring Dengan Media Social Whats App Pada Kemampuan Komunikasi Terhadap Materi Kalor Bagi Peserta Didik Di Abad 21," *Prosiding SNPF (Seminar Nasional Pendidikan Fisika)*, vol. 0, no. 0, pp. 200–205, Aug. 2017.

[30] A. Pujianto, D. Darsono, and P. Pujiati, "Pembelajaran Inkuiri untuk Meningkatkan Kemampuan Berpikir Kritis dan Prestasi Belajar IPS," *Jurnal Studi Sosial*, no. 1, 2013.

[31] W. Rahmawati, R., & Wikanengsih, "Respon Siswa Terhadap Pembelajaran Daring Materi Teks Eksplanasi Melalui Metode Inkuiri Berbantuan Media Sosial Instagram," *Parole: Jurnal Pendidikan Bahasa dan Sastra Indonesia*, vol. 4, no. 5, 2021, doi: 10.22460/p.v4i3p%25p.7387.

[32] N. C. Safitri, E. Nursaadah, and I. E. Wijayanti, "Analisis Multipel Representasi Kimia Siswa pada Konsep Laju Reaksi," *EduChemia (Jurnal Kimia dan Pendidikan)*, vol. 4, no. 1, Jan. 2019, doi: 10.30870/educhemia.v4i1.5023.

[33] S. Juliana, "Penerapan Model Pembelajaran Inkuiri Terbimbing Untuk Meningkatkan Hasil Belajar IPA Siswa Kelas VIII Semester II SMPN 5 Siak Kecil Kecamatan Siak Kecil Kabupaten Bengkalis," *Jurnal PAJAR (Pendidikan dan pengajaran)*, vol. 2, no. 4, pp. 530–539, 2018, doi: 10.33578/pjr.v2i4.5694.

[34] N. C. Facione and P. A. Facione, "Externalizing The Critical Thinking In Knowledge Development And Clinical Judgment," *Nursing Outlook*, vol. 44, no. 3, pp. 129–136, May 1996, doi: 10.1016/S0029-6554(06)80005-9.

[35] A. M. Rohim and D. Yulianti, "Pembelajaran Fisika Berbantuan Aplikasi Instagram untuk Meningkatkan Motivasi dan Hasil Belajar Siswa," *Unnes Physics Education Journal*, vol. 9, no. 2, pp. 149–157, 2020, doi: 10.15294/upej.v9i2.41921.

[36] M. J. Gomez-Ortiz, E. Domínguez Romero, and J. Bobkina, "Instagram As A Learning Tool To Improve Technical Vocabulary For Sports Science Students," *Journal of Hospitality, Leisure, Sport & Tourism Education*, vol. 32, p. 100416, Jun. 2023, doi: 10.1016/J.JHLSTE.2022.100416.

[37] N. W. D. Suarsini, I. G. A. Wesnawa, and I. W. Kertih, "Pengembangan Media Pembelajaran Geografi Berbasis Media Sosial Instagram Untuk Peningkatan Motivasi Dan Hasil Belajar Siswa," *Jurnal Pendidikan IPS Indonesia*, vol. 4, no. 2, pp. 72–81, Nov. 2020, doi: 10.23887/PIPS.V4I2.3386.

[38] H. M. Jatmika, "Pemanfaatan Media Visual dalam Menunjang Pembelajaran Pendidikan Jasmani di Sekolah Dasar," *Jurnal Pendidikan Jasmani Indonesia*, vol. 3, no. 1, 2005, doi: 10.21831/JPJI.V3I1.6176.

[39] W. Pertiwi, "Pengembangan Media Pembelajaran Digital Berbasis Instagram untuk Meningkatkan Hasil Belajar Peserta Didik Kelas IV Sekolah Dasar," *Jurnal Imiah Pendidikan dan Pembelajaran*, vol. 6, no. 2, pp. 402–414, 2022.

[40] V. A. Khasana, H. Setiyawan, and N. Desiningrum, "Pengaruh Aplikasi Instagram Terhadap Hasil Belajar Siswa Kelas V Mata Pelajaran Matematika Materi Volume Bangun Ruang Di SDN Bakung Temenggungan Balongbendo

Sidoarjo," *Child Education Journal*, vol. 2, no. 2, pp. 83–91, 2020, doi: 10.33086/cej.v2i2.1590.

[41] R. Al Zoubi, "The Impact Of Media And Information Literacy On Acquiring The Critical Thinking Skill By The Educational Faculty's Students," *Thinking Skills and Creativity*, vol. 39, p. 100782, Mar. 2021, doi: 10.1016/J.TSC.2020.100782.

[42] D. N. Agnafia, "Analisis Kemampuan Berpikir Kritis Siswa Dalam Pembelajaran Biologi," *Florea : Jurnal Biologi dan Pembelajarannya*, vol. 6, no. 1, pp. 45–53, May 2019, doi: 10.25273/florea.v6i1.4369.

[43] A. Ramdani, A. W. Jufri, J. Jamaluddin, and D. Setiadi, "Kemampuan Berpikir Kritis dan Penguasaan Konsep Dasar IPA Peserta Didik," *Jurnal Penelitian Pendidikan IPA*, vol. 6, no. 1, pp. 119–124, Jan. 2020, doi: 10.29303/JPPIPA.V6I1.388.

[44] T. A. Sari, S. Hidayat, B. Azwar, and A. Harfian, "Analisis Keterampilan Berpikir Kritis Siswa SMA Di Kecamatan Kalidoni Dan Ilir Timur Ii Analysis of Critical Thinking Skills of High School Students in Kecamatan Kalidoni and Ilir Timur Ii," *Bioma*, vol. 7, no. 2, pp. 183–195, 2018, doi: 10.26877/bioma.v7i2.2859.

[45] Susilowati, Sajidan, and M. Ramli, "Analisis Keterampilan Berpikir Kritis Siswa Madrasah Aliyah Negeri di Kabupaten Magetan," *Prosiding SNPS (Seminar Nasional Pendidikan Sains)*, vol. 21, no. 2000, pp. 223–231, 2017.

[46] C. O'Reilly, A. Devitt, and N. Hayes, "Critical Thinking In The Preschool Classroom - A Systematic Literature Review," *Thinking Skills and Creativity*, vol. 46, p. 101110, Dec. 2022, doi: 10.1016/J.TSC.2022.101110.

[47] H. Hunaepi, L. Firdaus, T. Samsuri, E. Susantini, and R. Raharjo, "Implementasi Worksheet Inkuiri Terintegrasi Kearifan Lokal Untuk Meningkatkan Keterampilan Berpikir Kritis Mahasiswa," *Bioscientist : Jurnal Ilmiah Biologi*, vol. 8, no. 1, p. 158, 2020, doi: 10.33394/bjib.v8i1.2697.

[48] M. Mayarni and Y. Yulianti, "Hubungan antara Kemampuan Berpikir Kritis dengan Kemampuan Berpikir Kreatif Siswa pada Materi Ekologi," *PENDIPA Journal of Science Education*, vol. 4, no. 3, pp. 39–45, 2020, doi: 10.33369/pendipa.4.3.39-45.

[49] D. Maslakhatunni'mah, L. B. Safitri, and D. N. Agnafia, "Analisis Kemampuan Berpikir Kritis pada Mata Pelajaran IPA Siswa Kelas VII SMP," *Seminar Nasional Pendidikan Sains 2019*, pp. 179–185, 2019.

[50] Ariza Rahmadana Hidayati, Wirawan Fadly, and Rahmi Faradisya Ekapti, "Analisis Keterampilan Berpikir Kritis Siswa pada Pembelajaran IPA Materi Bioteknologi," *Jurnal Tadris IPA Indonesia*, vol. 1, no. 1, pp. 34–48, 2021, doi: 10.21154/jtii.v1i1.68.

[51] R. Priyadi, A. Mustajab, M. Z. Tatsar, and S. Kusairi, "Analisis Kemampuan Berpikir Kritis Siswa SMA Kelas X MIPA dalam Pembelajaran Fisika," *JPFT (Jurnal Pendidikan Fisika Tadulako Online)*, vol. 6, no. 1, pp. 53–55, Mar. 2018.

[52] B. Benyamin, Abd. Qohar, and I. M. Sulandra, "Analisis Kemampuan Berpikir Kritis Siswa SMA Kelas X Dalam Memecahkan Masalah SPLTV," *Jurnal Cendekia : Jurnal Pendidikan Matematika*, vol. 5, no. 2, pp. 909–922, Apr. 2021, doi: 10.31004/CENDEKIA.V5I2.574.

[53] M. Paristiowati, E. V. Nanda, N. A. Putri Hasibuan, and M. Z. Ilmana, "Analysis of Students' Critical Thinking Skills by Applying Flipped Classroom Learning Model using Powtoon Application on

The Topic of Salt Hydrolysis," *JKPK (Jurnal Kimia dan Pendidikan Kimia)*, vol. 7, no. 3, p. 379, Dec. 2022, doi: 10.20961/jkpk.v7i3.67802.

[54] M. Arif, M. Hayudiyani, and medika risnasari, "Identifikasi Kemampuan Berpikir Kritis Siswa Kelas X Tkj Ditinjau Dari Kemampuan Awal Dan Jenis Kelamin Siswa Di SMKN 1 Kamal," *Jurnal Ilmiah Edutic : Pendidikan dan Informatika*, vol. 4, no. 1, pp. 20–27, Nov. 2017, doi: 10.21107/EDUTIC.

[55] M. A. Khairi and J. Ikhsan, "Development of Guided Inquiry-Based Electronic Modules and Its Effects on Students' Chemical Literacy," *JKPK (Jurnal Kimia dan Pendidikan Kimia)*, vol. 7, no. 2, p. 181, Aug. 2022, doi: 10.20961/jkpk.v7i2.62319.

[56] G. Dwiyanti, A. Suryatna, and M. Nurhayati, "Optimization Experimental Procedure and Setup of a Guided Inquiry Laboratory Worksheet of Transesterification Reaction on Biodiesel Production," *JKPK (Jurnal Kimia dan Pendidikan Kimia)*, vol. 3, no. 1, p. 38, May 2018, doi: 10.20961/jkpk.v3i1.11878.

[57] S. Tiaradipa, I. Lestari, M. H. Effendi, and M. Rusdi, "The Development of Scaffolding in Inquiry-Based Learning to Improve Students' Science Process Skills in The Concept of Acid and Base Solution," *JKPK (Jurnal Kimia dan Pendidikan Kimia)*, vol. 5, no. 2, p. 211, Aug. 2020, doi: 10.20961/jkpk.v5i2.42420.