JURNAL TADRIS KIMIYA
p-ISSN : 2527-6816 | e-ISSN : 2527-9637

#18326 Summary

SUMMARY | REVIEW | EDITING

Submission

Authors	Mangara Sihaloho, Ika Riyana Tungkagi, Netty Ino Ischak, Dewi Budi Purwati, Akram La Kilo
Title	Students' Creative Thinking Skills on Reaction Rate Topic through Contextual Teaching and Learning Model
Original file	18326-54560-1-SM.DOCX 2022-06-04
Supp. files	None
Submitter	Dr. Akram La Kilo
Date submitted	June 4, 2022 - 10:39 PM
Section	Articles
Editor	Nurhayati Nurhayati
Abstract Views	54

Status

Status	Published Vol 7, No 1 (2022)
Initiated	2022-06-30
Last modified	2022-07-18

Submission Metadata

Authors

Name	Mangara Sihaloho

Country Indonesia
Bio Statement —
Name Ika Riyana Tungkagi
Affiliation Department of Chemistry Education, Faculty of Mathematics and Natural Sciences, Universitas Negeri Gorontalo, Jl. Prof. Dr. Ing. BJ. Habibie, Bone Bolango Regency, 96119,
Country Indonesia
Bio Statement —
Name Netty Ino Ischak
Affiliation Department of Chemistry, Faculty of Mathematics and Natural Sciences, Universitas Negeri Gorontalo, Jl. Prof. Dr. Ing. BJ. Habibie, Bone Bolango Regency, 96119
Country Indonesia
Bio Statement —
Name Dewi Budi Purwati
Affiliation MAN Insan Cendekia Gorontalo, Jl. Harun Al Rasyid, Moutong, Kec. Tilongkabila, Gorontalo 96138
Country Indonesia
Bio Statement —
Name Akram La Kilo
ORCID iD https://orcid.org/0000-0002-4885-1838
URL https://scholar.google.co.id/citations?user=YWz4wUMAAAAJ&hl=id
Affiliation Department of Chemistry Education, Faculty of Mathematics and Natural Sciences, Universitas Negeri Gorontalo, Jl. Prof. Dr. Ing. BJ. Habibie, Bone Bolango Regency, 96119

Department of Chemistry, Faculty of Mathematics and Natural Sciences, Universitas Negeri Gorontalo, Jl. Prof. Dr. Ing. BJ. Habibie, Bone Bolango Regency, 96119
Country Indonesia
Bio Statement —
Principal contact for editorial correspondence.

Title and Abstract

Title: Students' Creative Thinking Skills on Reaction Rate Topic through Contextual Teaching and Learning Model

Abstract

This research aims to analyze the contextual teaching and learning (CTL) model on students' creative thinking skills on the reaction rate topic. This quantitative research used true experimental design of pretest-posttest control. The samples used in this study were from 11th grade at SMA Negeri 1 Pinolosian. The experimental class sample was given treatment of the CTL learning model while the control class used conventional learning, respectively, were 31 and 30 students of 93 populations. Based on a questionnaire, students' creative thinking skills were obtained through observation during the learning process. The data analysis of the test instrument was carried out through a validity test using the product-moment correlation technique (significant level = 0.05), Lilliefors normality test, homogeneity of variance test and t_{test}. The CTL implementation questionnaire and instrument test data were converted into percentages and categorized. The results showed that the application of the CTL model had a positive effect on students' creative thinking abilities, evidenced by the average score of students in the experimental class before and after treatment increased from 14.55 to 74.84. Otherwise, in the control class, the scores were 30.59 to 33.56. The percentage of students' achievement in creative thinking aspects in the experimental class was good (61%-80%) while the control class was less good (21%-40%). The creative thinking abilities of both classes are very different, which is also reflected in the learning outcomes. The value of t_{count} (2.240) was greater than t_{table} (2.042) at the significant level = 0.05,

and the hypothesis of H_0 was rejected, or H_1 was accepted. The application of the CTL learning model positively influenced students' creative thinking skills on the reaction rate material. Students' low originality abilities compared to fluency, flexibility, and elaboration abilities were also discussed.

Indexing

Keywords contextual teaching and learning; creative thinking skill; the reaction rate

Language en

Supporting Agencies

Agencies —

References

References

Addaini, A., & Alvina, S. (2020). Pengaruh Model Pembelajaran Contextual Teaching Learning (CTL) terhadap Hasil Belajar Siswa pada Materi Suhu dan Kalor. Jurnal Riset Inovasi Pembelajaran Fisika, 2(2), 16–22. https://doi.org/10.29103/relativitas.v3i1.2536

Agustin, Y., Fadiawati, N., & Tania, L. (2016). Peningkatan Keterampilan Berpikir Kritis Siswa pada Materi Laju Reaksi Melalui Pendekatan Saintifik. Jurnal Pendidikan Dan Pembelajaran Kimia, 5(3), 98–112. Retrieved from http://jurnal.fkip.unila.ac.id/index.php/JPK/article/view/12420

Ariesta, N., Ariani, D., Retno, S., & Haryono, H. (2013). Pengaruh Pembelajaran Kimia Dengan Pendekatan CTL (Contextual Teaching and Learning) Melalui Metode Guided Inquiry Dan Proyek Terhadap Prestasi Belajar Ditinjau Dari Kemampuan Matematik Siswa Pada Materi Kelarutan Dan Hasil Kali Kelarutan Kelas XI IPA SMA. Jurnal Pendidikan Kimia Universitas Sebelas Maret, 2(3), 59-67. Retrieved from https://www.neliti.com/id/publications/126088/pengaruh-pembelajaran-kimia-dengan-pendekatan-ctl-contextual-teaching-and-learni

Artini, D., Suardana, N., & Wiratini, M. (2019). Pengaruh Model Pembelajaran Kontekstual pada Pokok Bahasan Hidrokarbon terhadap Hasil Belajar Kimia. Jurnal Pendidikan Kimia Undiksha, 3(1), 20–28. https://doi.org/10.23887/jjpk.v3i1.21156

Coon, D., & Mitterer, J. O. (2014). Psychology: Modules for active learning. Cengage Learning.

Daud, A. M., Omar, J., Turiman, P., & Osman, K. (2012). Creativity in science education. Procedia-Social and Behavioral Sciences, 59, 467-474. https://doi.org/10.1016/j.sbspro.2012.09.302

Febrianti, Y., Djahir, Y., & Fatimah, S. (2016). Analisis Kemampuan Berpikir Kreatif Peserta Didik dengan Memanfaatkan Lingkungan pada Mata Pelajaran Ekonomi di SMA Negeri 6 Palembang. Jurnal Profit, 3(1), 121–127. Retrieved from https://ejournal.unsri.ac.id/index.php/jp/article/view/5561

Haryanti, Y. D., & Saputra, D. S. (2019). Instrumen penilaian berpikir kreatif pada pendidikan abad 21. Jurnal Cakrawala Pendas, 5(2), 58-64. http://dx.doi.org/10.31949/jcp.v5i2.1350

Hasanah, N., Sutarto, S., Nuriman, N., & Budiarso, A. S. (2020). STEM-CP (Science, Technology, Engineering, Mathematics, and Contextual Problem) Based Colloid Textbook to Increase Creative Thinking Skill for Chemistry Learning in Senior High School. Pancaran Pendidikan, 9(1). https://doi.org/10.25037/pancaran.v9i1.274

Ilaah, Y. F. (2015). Critical thinking skill of student SMA Kemala Bhayangkari 1 Surabaya on reaction rates topic by implementation of inquiry learning models. UNESA Journal of Chemical Education, 4(1). Retrieved fro https://ejournal.unesa.ac.id/index.php/journal-of-chemical-education/article/view/10854

Ischak, N. I., Odja, E. A., La Kilo, J., & La Kilo, A. (2020). Pengaruh Keterampilan Proses Sains Melalui Model Inkuiri Terbimbing terhadap Hasil Belajar Siswa pada Materi Larutan Asam Basa. Hydrogen: Jurnal Kependidikan Kimia, 8(2), 58–66. Retrieved from http://e-journal.undikma.ac.id/index.php/hydrogen/article/view/2748-6847-1

Jumi, W., Suleman, N., & Tangio, J. S. (2018). Identifikasi Kemampuan Berpikir Kreatif Siswa Menggunakan Soal Tes Open Ended Problem Pada Materi Elektrokimia di SMA Negeri 1 Telaga. Jambura Journal of Educational Chemistry, 13(1), 35-43. Retrieved from https://www.neliti.com/publications/277442/identifikasi-kemampuan-berpikir-kreatif-siswa-menggunakan-soal-tes-open-ended-pr

Juniwati, J., & Sari, R. P. (2019). Pengaruh Model Contextual Teaching and Learning (CTL) pada Pembelajaran IPA Terhadap Keterampilan Berfikir Kritis Peserta Didik. KATALIS: Jurnal Penelitian Kimia dan Pendidikan Kimia, 2(2), 38-45. Retrieved from https://ejurnalunsam.id/index.php/katalis/article/view/1844

La Kilo, A. (2017). Solusi rumus derajat keasaman reaksi asam basa pada larutan penyangga dengan metode mol awal (rumus akram). PATEN, 8(1065). Retrieved from https://www.academia.edu/download/58857177/Rumus_Akram_dan_hakinya.pdf

Laliyo, L. A. R., Kau, M., La Kilo, J., & La Kilo, A. (2020). Kemampuan siswa memecahkan masalah hukum-hukum dasar kimia melalui pembelajaran inkuiri terbimbing. AR-RAZI Jurnal Ilmiah, 8(1), 1–8. https://doi.org/10.29406/ar-r.v8i1.1875

Mulyono, Y. (2018). Improving creativity of the future physics teachers through general biology learning based on CTL with experimental method. Indonesian Journal of Science and Education, 2(1), 1–7. https://doi.org/ 10.31002/ijose.v2i1.621

Nugraheni, R. A. S. (2015). Pengaruh Contextual Teaching and Learning (CTL) terhadap Sikap peduli Lingkungan Siswa Kelas IV di SD Negeri Selang Kecamatan Wonosari Kabupaten Gunungkidul. Thesis, Lumbung Pustaka Universitas Negeri Yogyakarta. Retrieved from https://eprints.uny.ac.id/23454/1/SKRIPSI.pdf

Osman, S. Z. M., Jamaludin, R., & Iranmanesh, M. (2015). Student Centered Learning at USM: What Lecturer and Students Think of This New Approach?. Journal of Education and Practice, 6(19), 264-277. Retrieved from https://eric.ed.gov/?id=EJ1079536

Pikoli, M., Sukertini, K., & Isa, I. (2022). Analisis Model Mental Siswa dalam Mentransformasikan Konsep Laju Reaksi Melalui Multipel Representasi. Jambura Journal of Educational Chemistry, 4(1), 8–12. https://doi.org/10.34312/jjec.v4i1.13515

Purwaningrum, J. P. (2016). Mengembangkan Kemampuan Berpikir Kreatif Matematis Melalui Discovery Learning Berbasis Scientific Approach. Refleksi Edukatika, 6(2), 145–157. https://doi.org/10.24176/re.v6i2.613

Putra, R. D., Rinanto, Y., Dwiastuti, S., & Irfa, I. (2016). Peningkatan Kemampuan Berpikir Kreatif Siswa melalui Model Pembelajaran Inkuiri Terbimbing pada Siswa Kelas XI MIA 1 SMA Negeri Colomadu Karanganyar Tahun Pelajaran 2015 / 2016 The Increasing of Students Creative Thinking Ability Through of Inquiry Learni. Proceeding Biology Education Conference, 13(1), 330–334. Retrieved from https://jurnal.uns.ac.id/prosbi/article/view/5738

Salleh, S. M., Tasir, Z., & Shukor, N. A. (2012). Web-based simulation learning framework to enhance students' critical thinking skills. Procedia-Social and Behavioral Sciences, 64, 372–381. https://doi.org/10.1016/j.sbspro.2012.11.044

Samosir, B. S., Lisna, A., & Tua, H. (2019). Pengaruh Model Pembelajaran Kontekstual terhadap Kemampun Berpikir Kreatif dan Hasil Belajar Siswa. Jurnal Karya Pendidikan Matematika, 6(2), 1–7. Retrieved from https://jurnal.unimus.ac.id/index.php/JPMat/article/view/5037

Retrieved from https://journal.uinmataram.ac.id/index.php/jpfi/article/view/3057

Saputra, H., Kurniati, T., & Fadhilah, R. (2020). Efektivitas Metode Praktikum Indikator asam basa Berbasis Contextual Teaching Learning (CTL) terhadap hasil belajar siswa kelas XI SMA Negeri 7 Pontianak. Ar-Razi Jurnal Ilmiah, 8(1), 44–51. http://dx.doi.org/10.29406/ar-r.v8i1.1824

Setiawati, S. S. (2020). Profil model mental siswa pada submateri hukum laju reaksi dengan menggunakan tes diagnostik model mental pilihan ganda dua tingkat. Doctoral dissertation, Universitas Pendidikan Indonesia. Retrieved from http://repository.upi.edu/id/eprint/54582

Siswanto, J., & Mustofa, A. W. (2012). Pengaruh Penggunaan Model Pembelajaran Kontekstual Dengan Media Audio-Visual Terhadap Kemampuan Berpikir Kritis Dan Kreatif Siswa. Media Penelitian Pendidikan, 6(1), 1-9. Retrieved from http://journal.upgris.ac.id/index.php/mediapenelitianpendidikan/article/view/358

Subawa, K., La Kilo, A., & Laliyo, L. A. R. (2018). Penerapan Model Learning Cycle pada Materi Laju Reaksi untuk Meningkatkan Hasil Belajar. Jambura Journal of Educational Chemistry, 13(1), 51–58. Retrieved from https://media.neliti.com/media/publications/277384-penerapan-model-learning-cycle-pada-mate-9095d31a.pdf

Suryono, S. (2019). Penerapan Pembelajaran Kontekstual (Contextual Teaching And Learning) Dalam Pembelajaran Sistem Periodik Unsur Siswa Kelas X Mipa 3 Sma Negeri 5 Jember. BIO-CONS: Jurnal Biologi dan Konservasi, 1(1), 17-27. Retrieved from http://jurnal.unipar.ac.id/index.php/biocons/article/view/227/233

Syuhada, F. A., Dalimunthe, M., Sari, W. S. N., & Sihombing, J. L. (2020). Penerapan Model Pembelajaran Contextual Teaching and Learning dengan Media LKS untuk Meningkatkan Kerjasama dan hasil Belajar Kimia Siswa. JS (Jurnal Sekolah), 4(2), 150-157. Retrieved from file:///C:/Users/asus/Downloads/17971-40147-1-SM.pdf

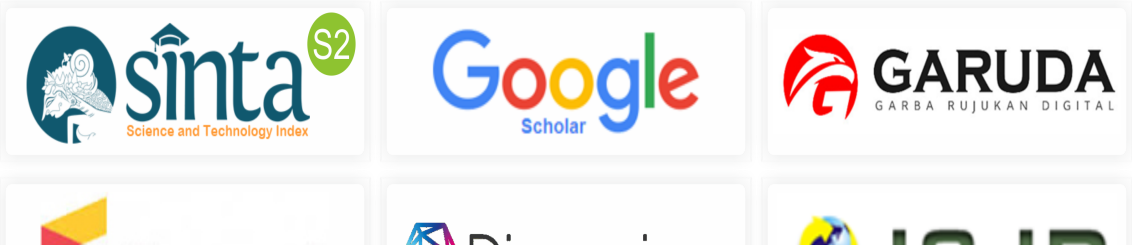
Taofek, I., & Agustini, R. (2020). Pengembangan Lembar Kerja Siswa berbasis Contextual Teaching and Learning untuk Meningkatkan Keterampilan Berpikir Kritis Siswa pada Materi Laju Reaksi Kimia Kelas XI SMA. UNESA Journal of Chemical Education, 9(1), 121-126. Retrieved from https://ejournal.unesa.ac.id/index.php/journal-of-chemical-education/article/view/32066

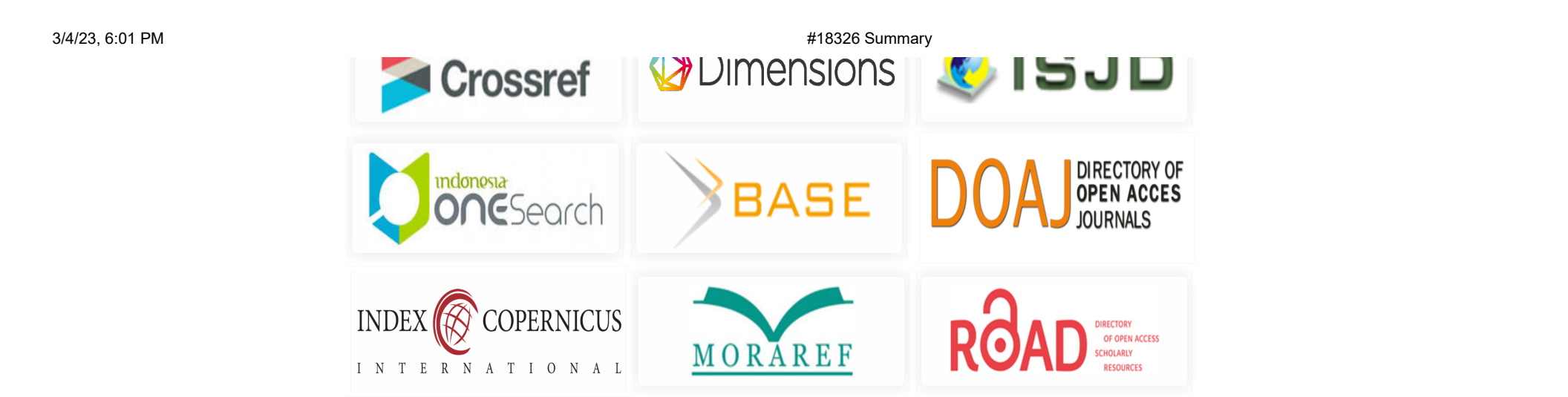
Winarti, W. (2016). Contextual teaching and learning (CTL) untuk meningkatkan kemampuan berpikir kreatif siswa. Jurnal Pendidikan Fisika Dan Keilmuan (JPFK), 1(1), 1-8. http://doi.org/10.25273/jpfk.v1i1.4

Yamin, M. (2013). Strategi dan metode dalam model pembelajaran. Jakarta: GP Press Group.

Zhafirah, T., & Utami, L. (2019). Pengaruh Penerapan Model Pembelajaran CTL Dengan Media Lingkungan Terhadap Motivasi Belajar Siswa Pada Materi Koloid. JEDCHEM (JOURNAL EDUCATION AND CHEMISTRY), 1(2), 64-71. Retrieved from http://ejournal.uniks.ac.id/index.php/JEDCHEM/article/view/137/133

Journal Tadris Kimiya Is Indexed By :





JURNAL TADRIS KIMIYA
p-ISSN : 2527-6816 | e-ISSN : 2527-9637

#18326 Review

SUMMARY | REVIEW | EDITING

Submission

Authors	Mangara Sihaloho, Ika Riyana Tungkagi, Netty Ino Ischak, Dewi Budi Purwati, Akram La Kilo
Title	Students' Creative Thinking Skills on Reaction Rate Topic through Contextual Teaching and Learning Model
Section	Articles
Editor	Nurhayati Nurhayati

Peer Review

Round 1

Review Version	18326-54561-1-RV.DOCX 2022-06-04
Initiated	2022-06-13
Last modified	2022-06-28
Uploaded file	None

Editor Decision

Decision	Accept Submission 2022-06-29
Notify Editor	Editor/Author Email Record 2022-06-29
Editor Version	18326-56158-1-ED.DOCX 2022-06-28 18326-56158-2-ED.DOCX 2022-06-28
Author Version	18326-55387-1-ED.DOCX 2022-06-15 DELETE 18326-55387-2-ED.DOCX 2022-06-29 DELETE

Journal Tadris Kimiya Is Indexed By :

Author
2022-06-15 10:56 PM

Subject: Study of Students' Creative Thinking Skills on Reaction Rate Topic through Contextual Teaching and Learning Model DELETE

Dear Auditors

We thank the editors and reviewers who have thoroughly read our manuscript. Their comments and suggestions really helped us to improve the script. We have tried our best to respond to all points raised. Hopefully this fix has fulfilled the intended thing.

Best regards,

Akram La Kilo
Thank you for your participation. We will inform you further.
Journal of Tadris Kimiya
http://journal.uinsgd.ac.id/index.php/tadris-kimiya/index

Section Editor
2022-06-28 11:59 PM

Subject: [JTK] Editor Decision DELETE

Dr. Akram La Kilo:

We have reached a decision regarding your submission to JTK (Jurnal Tadris Kimiya), "Study of Students' Creative Thinking Skills on Reaction Rate Topic through Contextual Teaching and Learning Model".

Our decision is: Revisions Required

Nurhayati Nurhayati
Department of Chemistry Education, UIN Sunan Gunung Djati Bandung
Phone 089650289453
nurhayati@uinsgd.ac.id
Thank you for your participation. We will inform you further.
Journal of Tadris Kimiya
http://journal.uinsgd.ac.id/index.php/tadris-kimiya/index

Author
2022-06-29 04:44 PM

Subject: Study of Students' Creative Thinking Skills on Reaction Rate Topic through Contextual Teaching and Learning Model DELETE

Dear Editors

Thank you for reviewing and commenting on our manuscript well. We have fixed that. Hopefully this has met the demands of this journal.

Best regrads,

Akram La Kilo
Thank you for your participation. We will inform you further.
Journal of Tadris Kimiya
http://journal.uinsgd.ac.id/index.php/tadris-kimiya/index

Close

JURNAL TADRIS KIMIYA
p-ISSN : 2527-6816 | e-ISSN : 2527-9637

ACCREDITATION

COLLABORATIVE

Article Template

#18326 Editing

SUMMARY | REVIEW | EDITING

Submission

Authors	Mangara Sihaloho, Ika Riyana Tungkagi, Netty Ino Ischak, Dewi Budi Purwati, Akram La Kilo
Title	Students' Creative Thinking Skills on Reaction Rate Topic through Contextual Teaching and Learning Model
Section	Articles
Editor	Nurhayati Nurhayati

Copyediting

COPYEDIT INSTRUCTIONS

REVIEW METADATA	REQUEST	UNDERWAY	COMPLETE
1. Initial Copyedit	2022-06-29	—	2022-06-29
File: 18326-56244-1-CE.DOCX 2022-06-29			
2. Author Copyedit	2022-06-29	2022-06-29	
File: 18326-56244-2-CE.DOCX 2022-06-30			
Choose File No file chosen Upload			
3. Final Copyedit	—	—	2022-06-30
File: None			
Copyedit Comments 2022-06-30			

ADDITIONAL MENU

FOCUS AND SCOPE
PUBLICATION ETHICS
SECTION POLICY
EDITORIAL TEAM
REVIEWERS
ONLINE SUBMISSIONS
AUTHOR GUIDELINES
INDEXING
CITEDNESS IN SCOPUS

USER

Nama pengguna
Kata sandi
Ingat saya
Masuk

Journal Help

AUTHOR

Submissions
- Active (0)
- Archive (1)
- New Submission

PHP Quick Profiler Details Metrics

MENDELEY

turnitin

CONTACT AND FOLLOW US

Galley Format		FILE		
1.	PDF VIEW PROOF	18326-57228-1-PB.PDF	2022-07-18	8
Supplementary Files		FILE		
		None		

Layout Comments No Comments

Proofreading

REVIEW METADATA

		REQUEST	UNDERWAY	COMPLETE
1.	Author	—	—	
2.	Proofreader	—	—	—
3.	Layout Editor	—	—	—

Proofreading Corrections No Comments PROOFING INSTRUCTIONS

Journal Tadris Kimiya Is Indexed By :

HOTS acid-base buffer solution conceptual understanding critical thinking ability critical thinking skills e-module hasil belajar ikatan kimia inkuiri inkuiri terbimbing keterampilan berpikir kritis keterampilan proses sains learning media learning outcomes misconception misconceptions pembelajaran kimia pendekatan saintifik problem based learning scientific literacy

NOTIFICATIONS

- View (2 new)
- Manage

OPEN JOURNAL SYSTEMS

Study of Students' Creative Thinking Skills on Reaction Rate Topic through Contextual Teaching and Learning Model

Ika Riyana Tungkagi[1], Mangara Sihaloho[2], dan Akram La Kilo[3*]

[1] Department of Chemistry, Faculty of Mathematics and Natural Sciences, State University of Gorontalo, Jl. Gen. Sudirman No.6, Dulalowo Tim., Kec. Central City, Gorontalo City, Gorontalo 96128
[2]Chemistry Study Program, Department of Chemistry, Faculty of Mathematics and Natural Sciences, State University of Gorontalo, Jalan Prof. Dr. Ing. BJ. Habibie, Bone Bolango Regency, 96119, Indonesia.
[*]E-mail: akram@ung.ac.id

Received: xxxxxx; Accepted: xxxxxx; Published: xxxxxxx
(single space blank, 12 pt)

Abstract

This research aims to study the contextual teaching and learning (CTL) model on students' creative thinking skills on the reaction rate topic. This research was a quantitative research using true experimental design of pretest posttest-only control. The samples used in this study ware XI MIA class at SMA Negeri 1 Pinolosian. The experimental class sample was given treatment of the CTL learning model while the control class used conventional learning. The results showed that the application of the CTL model had a positive effect on students' creative thinking abilities. This is evidenced by the average score of students in the experimental class before and after treatment increased from 14.55 to 74.84. Otherwise, in the control class the scores ware 30.59 to 33.56. The percentage of students' achievement in creative thinking aspects in the experimental class was good (61% -80%) while the control class was less good (21% -40%). The creative thinking abilities of the both classes are very different which is also reflected in the learning outcomes. Students' low originality abilities compared to fluency, flexibility, and elaboration abilities were also discussed.

Keywords: Contextual teaching and learning; Reaction rate; Creative thinking skill

DOI: http://dx.doi.org/10.15575/jtk.xxx.xxx

1. Introduction

The standard of 21st century education is to have creative thinking skills. Every teacher plays an important role in achieving an educational goal. One of the main goals of this century's education is to emphasize students' ability to think creatively. Creative thinking is an activity to solve a problem that is carried out through an unconscious experiential process which includes fluency in generating a number of ideas, flexibility in using time in producing various types of solutions obtained, novelty of ideas or solutions produced (Coon & Mitterer, 2014). In the 2013 curriculum, the learning process is expected to encourage students to be able to ask questions, reason, and explain the subject matter that has been obtained so that the learning process is more meaningful (Andi et al., 2020, Jamaluddin et al., 2015) .

Creative thinking is the ability to develop an unusual discovery of new ideas, as well as quality ideas (Febrianti et al., 2016) . The ability to think creatively is also a person's process of thinking and expressing new relationships, seeing events from a new perspective, and being able to combine two new concepts that were previously known (Putra et al., 2016). Students must have the ability to acquire, choosing, critical,

systematic, logical, creative and the ability to work together effectively (Samosir et al., 2019). The creative thinking process is convergent to capture the situation, make evaluations and consider the consequences of the chosen solution (Winarti, 2015; Adzliana et al., 2012).

One of the suitable learning models for the 2013 curriculum and in accordance with authentic assessment is contextual teaching and learning (CTL) (Juniwati & Sari, 2015). This learning model can help teachers relate the material being taught to students' real world situations and encourage students to make connections between their knowledge and its application in everyday life (Ariesta et al., 2013, Sugiyanto, 2010) . In delivering the material, the selected context or example must be in accordance with the daily life and cognitive level of students. Therefore, the selection of appropriate examples can help students to think and take responsibility for their ideas or opinions. Students become more actively involved in discussions so that they are more confident in expressing their opinions and asking questions about things related to the material being studied (Artini et al., 2019) .

The Contextual Teaching and Learning model can improve student learning outcomes because students work and experience, not just receiving material from the teacher (Addaini, 2020) . This model can also build conducive interactions between students and teachers (Siswo, 2019) and motivate students to understand the meaning of each material through connectivity with everyday life (Zhafirah et al., 2019; Martinis Yamin, 2013) . These activities indirectly affect students' ability to think critically and creatively in solving various problems they experience (Putra et al., 2016) . This model can make students more active in learning, asking more questions, and following learning well (Saputra et al., 2020).

The results of the initial observation at the SMA in Bolaang Mongondow Selatan showed that not all of the basic chemistry competencies for class XI were taught to students. The teacher only chooses basic competencies related to material at an advanced level and phenomena can be found by students in everyday life. The learning is carried out from home because of the covid-19 pandemic. Students tend to learn by memorizing, not understanding and there are many students who feel bored. La Kilo (2017) reported that many students do not understand chemistry because their tendency is to memorize without understanding. This way of memorizing has a bad effect on students' creative thinking skills in processing information from abstract chemical material. The rate of reaction is abstract material and is difficult for students to understand (Taofek & Rusdiana, 2020) . The learning process that takes place in schools is still oriented to the teacher who delivers the material, while students only act as recipients of information (Siswanto & Mustofa, 2012) .

This study aims to study *Contextual Teaching and Learning* (CTL) learning model on students' creative thinking skills in the chemical subject of reaction rate material. The creative thinking abilities of students studied consist of four aspects, namely fluency, flexibility, originality, and elaboration.

2. Research Method

This research was conducted at SMA Negeri 1 Pinolosian on students in XI grade of MIA 2 and MIA 3 , respectively, as the experimental class (31 students) and the control class (30 students). The research design used Pretest Posttest-only control. The data for the two classes were collected using observation, documentation, questionnaire, and test. The questionnaire used was intended to determine student responses to the use of the contextual teaching learning (CTL) model on the reaction rate topic (**Table 1**). Students' creative thinking skills are obtained through a written test instrument with 9 items of reaction rate material. This instrument refers to the four indicators of students' creative thinking aspects proposed by (Purwaningrum, 2016); fluency, flexibility, originality, and elaboration.

Table 1. Questionnaire on the implementation of the contextual teaching and learning model.

Code	Statemants
S1	The teacher conveys the learning objectives well
S2	Each case given by the teacher in learning the material on the rate of reaction can be done either individually or in groups.
S3	I can cooperate better with a group of friends when working on tasks related to everyday life.
S4	The understanding of the reaction rate material becomes better after the teacher explains the material related to everyday life.
S5	The results of my study of the material my reaction rate increased.
S6	The atmosphere in the classroom is more conducive and fun when the teacher explains the reaction rate material associated with everyday life.
S7	The presentation of the display of questions explained by the teacher and associated with everyday life, adds to understanding.
S8	After explaining the reaction rate material by relating it to everyday life, I dared to communicate with my friends and teachers during the learning process.
S9	The presentation of the material explained by the teacher by relating it to everyday life may increase my desire to explore the material, especially the reaction rate material.
S10	I think that the CTL method applied by the teacher in the classroom, especially in learning the reaction rate material, is very appropriate.

In this study, the measurement of students' creative thinking skills used a written test instrument. The instrument in the study refers to the four indicators of the creative thinking aspect of students proposed by (Purwaningrum, 2016). The criteria for assessing students' creative thinking abilities can be seen in Table 2.

Table 2. Creative Thinking Skills Grid

Skills	Indicators	Items
Fluency	Students can compose answers that are relevant to the information given about the reaction rate topic.	1, 5, 6
Flexibility	Students can solve problems with varied answers and according to their experience	2, 4, 7, 8
Originality	Students can solve problems according to their own ideas	9
Elaboration	Students can make an answer model according to the problem or information obtained on the reaction rate material.	6, 3

Analysis of observational data was carried out by observing students' creative thinking skills during the learning process. Then the data were analyzed and described to determine the effect of the contextual teaching and learning (CTL) model. Meanwhile, the data analysis of the test instrument was carried out through a validity test using the product moment correlation technique (significant level = 0.05), Liefors normality test, homogeneity of variance test and t-test. Data of the LTC implementation questionnaire and instrument test were converted into percent and categorized by value as shown in **Table 3**.

Table 3. Questionnaire Categories and Student's Creative Thinking

Value Range (%)	Category
0 – 20	Very less
21 – 40	Not enough
41-60	Enough
61- 80	Good
81- 100	Very good

3. Result and Discussion

3.1. Implementation of the CTL contextual learning model

The use of the contextual teaching and learning (CTL) model on the reaction rate material obtained a very good response from most students as the results of the questionnaire shown in S1, S3, S4, S7, and S10 in Figure 1. Students were able to work well with the tasks given by the teacher. The teacher conveys the learning objectives well and presents the material in an interesting

way, which was related to everyday life. In addition, the curiosity and communication arising from the students resulted in a conducive classroom atmosphere as well as the support for presentations from S2, S5, S6, S8, and S9. There are a small number of students who respond negatively to this CTL model, especially cooperation (S3) and curiosity (S9). The LCT learning model applied to this reaction rate material has met the requirements and the data obtained can be used in this study and compared the results with conventional learning.

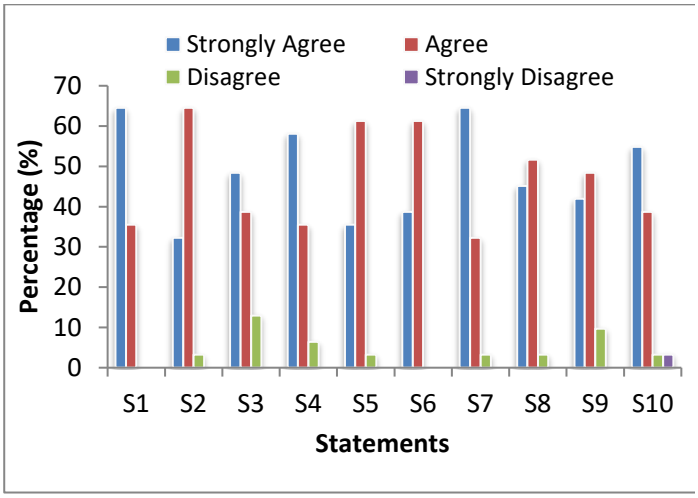


Figure 1The results of the questionnaire test on the implementation of the contextual teaching and learning (CTL) learning model

Nugraheni (2015) reports that the CTL model can make students care about the environment compared to conventional learning. This research not only makes students care about the environment but students also care about learning as expressed in the passion and cooperation between students.

3.2. Data Test

Normality

The normality test in this study used the Liliefors formula with a significant level of 0.05. The results obtained from the two classes can be seen in Table 4.

Table 4. Normality Test Results

Class	Group	N	L count	L table	Status
Expt.	Pre-test	31	0.16	0.24	Normal
	Posttest	31	0.14		
Control	Pre-test	30	0.10		
	Posttest	30	0.11		

The results of the normality test of the pre-test and posttest for the experiment class (XI MIA 2) and the control class (XI MIA 3) showed that the L_{table} at the significant level of 0.05 was 0.242. This value was smaller than the value of L_{count} ($L_{count} < L_{table}$) so that H_o was accepted, the data was normally distributed.

Homogeneity

The homogeneity test used Fisher (F) test with a significant level of = 0.05. The results of the homogeneity test obtained from the two classes can be seen in **Error! Reference source not found.**.

Table 5. Homogeneity Test Results

Class	Variance	F_{count}	F_{table}	Concl.
Expt.	115.35	1.091	1.854	Homoge-neous
Control	105.69	1.091	1.854	

The data shows that the $F_{count} < F_{table}$ (1.091 < 1.854) so H_0 was accepted, which indicated that the variance of the two samples was homogeneous.

Hypothesis

The results of the calculation of the normality test and the homogeneity of variance at the pretest and posttest showed that the two samples (classes) were normally distributed and homogeneous, so that the hypothesis testing requirements in this study were met with the t-test. H the results of the calculation obtained the value of t_{count} = 2.240 and t_{table} = 2.042 with a significant level of = 0.05. Because $t_{count} > t_{table}$, then H_0 was rejected or H_1 was accepted. This means that the application of the contextual teaching and learning (CTL) model has a positive influence on students' creative thinking skills on the reaction rate topic.

3.3. Students' Creative Thinking Skills

The achievement of creative thinking skills of experimental class and control class students

were shown in Figure 2. The results of the control class students' creative thinking were very low for all indicators, with an average score of 30.7%. Otherwise, the creative thinking ability of experimental class students who were taught using the CTL model was high, with an average score of 73.70%. Specifically for the experimental class, 3 students scored in the high category (85), 20 students in the medium category (between 70 and 85), and 8 students scored low, 70.

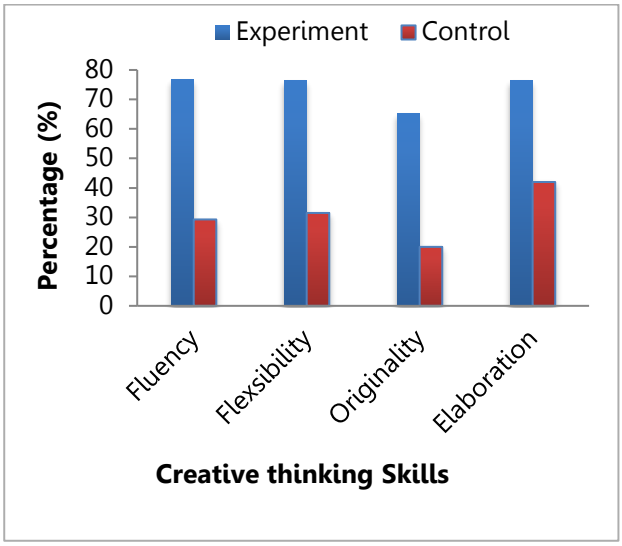


Figure 2. Percentage of achievement of each indicator of students' creative thinking based on the posttest results of the Experiment class (XI MIA2) and Control class (XI MIA3).

Fluency skill of experimental class students showed that students could think fluently, generate opinions or solve problems, and always think of more than one answer, with an ability level of 76.77%. In the second aspect, flexibility skill has score of 76.40%, meaning that students were able to generate ideas, answers or can look for many different problem solving alternatives. Creative thinking were also a habit of a person to turn on an imagination, express and create amazing new points of view and unexpected ideas (Purwaningrum, 2016) . The elaboration skill of students was 76.45 % where students can enrich and develop an idea that details the details of a situation so that it is more interesting. Meanwhile, students' originality skill decreased to 65.16% compared to the other three thinking skills. The achievement in the originality aspect was low compared to the fluency, flexibility, and elaboration thinking aspects. In the control class, the ability to think creatively from fluency, flexibility, originality, and elaboration was successively 29.3%, 31.5%, 20%, and 42%. This shows that conventional learning on the reaction rate material was not able to explore students' creative thinking skills. Conventional learning encourages students to only memorize instead of understanding which can cause students to lack understanding of chemistry because the creativity potential of students does not rise (Hasanah et al., 2020; Laliyo et al., 2020; Subawa et al., 2018) .

Students' thinking ability is also reflected in the pre-test and posttest learning outcomes as shown in Figure 3.

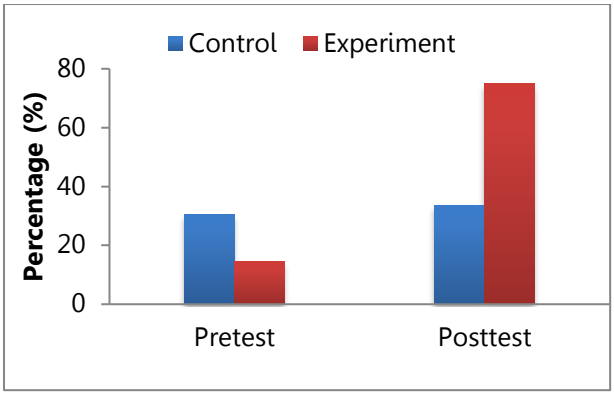


Figure 3. Average of pretest and posttest for experimental and control class

Based on **Figure 3**, the pretest results of the experimental class (XI MIA 2) students obtained an average of 14.55% which was lower than the average score of the control class (XI MIA3), 30.59%. In contrast, the posttest results of experimental class students after the implementation of the contextual teaching and learning (CTL) model experienced an increase with an average score of 78.84%. This means that the creative thinking level of the experimental class students to complete and answer the questions has reached the minimum completeness criteria (Kriteria Ketuntasan Minimum, KKM). For the control class (XI MIA3), the posttest obtained an average

score of 33.56%, there was no significant increase in the value of the pretest score. Control class students were less able to solve problems and their scores have not reached the KKM, which results in low creative thinking skills. This shows that the use of the CTL model can make students develop an idea that is detailed and interesting from a situation.

Students' creative thinking skill can be improved by using learning methods that are implemented in the learning process. In this case students were directly involved in solving problems so that students were likely to be able to generate new ideas (originality), broadly and diversely (Yulianti & Saputra Suhandi, 2019) . Originality in problem solving refers to the ability of students to answer problems with several different answers that are correct or one answer that cannot be done by other students. (Jumi et al., 2018). One aspect that is predicted to increase the ability of originality is to guide students intensely in solving problems. Through the guidance process with a science process skills approach, students are directly involved, not only listening, but they can solve problems in the laboratory to gain knowledge (Ischak et al., 2020) . This was where students actually act as scientists in finding new ideas. Hasanah et al. (2020) also reported that students' innovations or new ideas in solving chemical problems related to everyday life can be improved through the STEM-Cp (Science, Technology, Engineering, Mathematics, and Contextual Problem) approach. Students' independence in learning to practice creative thinking skills can be done through STEM-Cp-based books that are associated with problems in everyday life (Hasanah et al., 2020) .

4. Conclusion

The application of the *contextual teaching and learning (CTL) learning model* positively affects students' creative thinking skills on the reaction rate material. On the other hand, conventional learning does not generate these abilities. The proof is through statistical analysis of test results from pre-test and post-test. Through CTL learning, students' creative thinking ability is high (73.70%) , although the value of originality ability is lower, 65.16%. To train students' thinking skills, especially originality, it is estimated that this can be done by self-study through the STME-Cp-based Reaction Rate book and guided learning with a process skills approach.

References

Addaini, A. S. (2020). Pengaruh Model Pembelajaran Contextual Teaching Learning (CTL) terhadap Hasil Belajar Siswa pada Materi Suhu dan Kalor. *Jurnal Riset Inovasi Pembelajaran Fisika*, *2*(2), 16–22.

Andi, F., Makharany, S., Wildany, D., Sari, N., & Sihombing, J. L. (2020). *Penerapan Model Pembelajaran Contextual Teaching and Learning dengan Media LKS untuk Meningkatkan Kerjasama dan Hasil Belajar Kimia*. *4*(April), 150–157.

Ariesta, N., Retno, S., & Ariani, D. (2013). Pengaruh Pembelajaran Kimia dengan Pendekatan CTL (Contextual Teaching And Learning) melalui Metode Guided Inquiry dan Proyek terhadap Siswa pada Materi Kelarutan dan Hasil Kali Kelarutan Kelas XI IPA SMA N 1 Karanganyar. *Jurnal Pendidikan Kimia*, *2*(3), 59–67.

Artini, D., Suardana, N., & Wiratini, M. (2019). Pengaruh Model Pembelajaran Kontekstual pada Pokok Bahasan Hidrokarbon terhadap Hasil Belajar Kimia. *Jurnal Pendidikan Kimia Undiksha*, *3*(1), 20–28.

Febrianti, Y., Djahir, Y., & Fatimah, S. (2016). Analisis Kemampuan Berpikir Kreatif Peserta Didik dengan Memanfaatkan Lingkungan pada Mata Pelajaran Ekonomi di SMA Negeri 6 Palembang. *Jurnal Profit*, *3*(1), 121–127.

Hasanah, N., Sutarto, S., Nuriman, N., & Budiarso, A. S. (2020). STEM-CP (Science, Technology, Engineering, Mathematics, and Contextual Problem) Based Colloid Textbook to Increase Creative Thinking Skill for Chemistry Learning in Senior High School. *Pancaran Pendidikan*, *9*(1).

Ischak, N. I., Odja, E. A., La Kilo, J., & La Kilo, A.

(2020). Pengaruh Keterampilan Proses Sains Melalui Model Inkuiri Terbimbing terhadap Hasil Belajar Siswa pada Materi Larutan Asam Basa. *Hydrogen: Jurnal Kependidikan Kimia*, *8*(2), 58–66.

Jumi, W., Suleman, N., & Tangio, J. S. (2018). *Identifikasi Kemampuan Berpikir Kreatif Siswa Menggunakan Soal Tes Open Ended Problem Pada Materi Elektrokimia di SMA Negeri 1 Telaga*. *13*, 35–43.

Juniwati, & Sari, R. P. (2015). *Pengaruh Model Contextual Teaching and Learning (CTL) pada Pembelajaran IPA terhadap Keterampilan Berfikir Kritis Peserta Didik*. 38–45.

La Kilo, A. (2017). Solusi rumus derajat keasaman reaksi asam basa pada larutan penyangga dengan metode mol awal (rumus akram). *PATEN*, *8*(1065).

Laliyo, L. A. R., Kau, M., La Kilo, J., & La Kilo, A. (2020). Kemampuan siswa memecahkan masalah hukum-hukum dasar kimia melalui pembelajaran inkuiri terbimbing. *AR-RAZI Jurnal Ilmiah*, *8*(1), 1–8. https://doi.org/10.29406/ar-r.v8i1.1875

Nugraheni, R. A. S. (2015). *Pengaruh contextual teaching and learning (CTL) terhadap sikap peduli lingkungan siswa kelas IV SD negeri selang kecamatan wonosari kabupaten gunungkidul* (p. 89).

Purwaningrum, J. P. (2016). Mengembangkan Kemampuan Berpikir Kreatif Matematis Melalui Discovery Learning Berbasis Scientific Approach. *Refleksi Edukatika*, *6*(2), 145–157. https://doi.org/10.24176/re.v6i2.613

Putra, R. D., Rinanto, Y., Dwiastuti, S., & Irfa, I. (2016). Peningkatan Kemampuan Berpikir Kreatif Siswa melalui Model Pembelajaran Inkuiri Terbimbing pada Siswa Kelas XI MIA 1 SMA Negeri Colomadu Karanganyar Tahun Pelajaran 2015 / 2016 The Increasing of Students Creative Thinking Ability Through of Inquiry Learni. *Proceeding Biology Education Conference*, *13*(1), 330–334.

Samosir, B. S., Lisna, A., & Tua, H. (2019). Pengaruh Model Pembelajaran Kontekstual terhadap Kemampun Berpikir Kreatif dan Hasil Belajar Siswa. *Jurnal Karya Pendidikan Matematika*, *6*(2), 1–7.

Saputra, H., Kurniati, T., & Fadhilah, R. (2020). *Efektivitas Metode Praktikum Indikator asam basa Berbasis Contextual Teaching Learning (CTL) terhadap hasil belajar siswa kelas XI SMA Negeri 7 Pontianak*. *8*(1), 44–51.

Siswanto, J., & Mustofa, A. W. (2012). *Pengaruh penggunaan model pembelajaran kontekstual dengan media audio-visual terhadap kemampuan berpikir kritis dan kreatif siswa 1*.

Siswo, S. (2019). Penerapan Pembelajaran Kontekstual (Contextual Teaching and Learning) dalam Pembelajaran Sistem Periodik Unsur siswa Kelas X MIPA 3 SMA Negeri 5 Jember. *Jurnal Biologi Dan Konservasi*, *1*(1).

Subawa, K., La Kilo, A., & Laliyo, L. A. R. (2018). Penerapan Model Learning Cycle pada Materi Laju Reaksi untuk Meningkatkan Hasil Belajar. *Jambura Journal of Educational Chemistry*, *13*(1), 51–58.

Taofek, I., & Rusdiana, A. (2020). Pengembangan Lembar Kerja Siswa Berbasis Contextual Teaching and Learning untuk Meningkatkan Keterampilan Berpikir Kritis Siswa pada Materi Laju Reaksi Kimia kelas XI SMA. *Journal of Chemical Education*, *9*(1), 121–125.

Winarti. (2015). *Contextual Teaching and Learning (CTL) untuk Meningkatkan Kemampuan Berpikir Kreatif Siswa*. *1*(1), 1–8.

Yulianti, Y., & Saputra Suhandi, D. (2019). Instrumen Penilaian Berpikir Kreatif Pada Pendidikan Abad 21. *Jurnal Cakrawala Pendas*, *5*(2), 40–44.

Zhafirah, T., Utami, L., Islam, U., Sultan, N., & Kasim, S. (2019). *PENGARUH PENERAPAN MODEL PEMBELAJARAN CTL DENGAN MEDIA*. *1*(2), 64–71.

Study of Students' Creative Thinking Skills on Reaction Rate Topic through Contextual Teaching and Learning Model

Received: xxxxxx; Accepted: xxxxxx; Published: xxxxxxx
(single space blank, 12 pt)

Abstract

This research aims to study the contextual teaching and learning (CTL) model on students' creative thinking skills on the reaction rate topic. This research was a quantitative research using true experimental design of pretest posttest ~~only~~ control. The samples used in this study ware XI MIA class at SMA Negeri 1 Pinolosian. The experimental class sample was given treatment of the CTL learning model while the control class used conventional learning. The results showed that the application of the CTL model had a positive effect on students' creative thinking abilities. This is evidenced by the average score of students in the experimental class before and after treatment increased from 14.55 to 74.84. Otherwise, in the control class the scores ware 30.59 to 33.56. The percentage of students' achievement in creative thinking aspects in the experimental class was good (61% -80%) while the control class was less good (21% -40%). The creative thinking abilities of the both classes are very different which is also reflected in the learning outcomes. Because the value of t_{count} (2.240) was greater than t_{table} (2.042) at the significant level = 0.05, the hypothesis of H_0 was rejected or H_1 was accepted. This means that the application of the CTL learning model had a positive influence on students' creative thinking skills on the reaction rate material. Students' low originality abilities compared to fluency, flexibility, and elaboration abilities were also discussed.

Keywords: Contextual teaching and learning; Reaction rate; Creative thinking skill

DOI: http://dx.doi.org/10.15575/jtk.xxx.xxx

Commented [Author1]: Perbaiki nama desainnya, sesuaikan literatur jenis penelitian true experimental

Commented [Author2]: Tambahkan hasil uji hipotesisnya

1. Introduction

The standard of 21st century education is to have creative thinking skills. Every teacher plays an important role in achieving an educational goal. One of the main goals of this century's education is to emphasize students' ability to think creatively. Creative thinking is an activity to solve a problem that is carried out through an unconscious experiential process which includes fluency in generating a number of ideas, flexibility in using time in producing various types of solutions obtained, novelty of ideas or solutions produced (Coon & Mitterer, 2014). In the 2013 curriculum, the learning process is expected to encourage students to be able to ask questions, reason, and explain the subject matter that has been obtained so that the learning process is more meaningful (Andi et al., 2020, Jamaluddin et al., 2015) .

Creative thinking is the ability to develop an unusual discovery of new ideas, as well as quality ideas (Febrianti et al., 2016) . The ability to think creatively is also a person's process of thinking and expressing new relationships, seeing events from a new perspective, and being able to combine two new concepts that were previously known (Putra et al., 2016). Students must have the ability to acquire, choosing, critical, systematic, logical, creative and the ability to work together effectively (Samosir et al., 2019). The creative thinking process is convergent to capture the situation, make evaluations and consider the consequences of the chosen solution (Winarti, 2015; Adzliana et al., 2012).

One of the suitable learning models for the 2013 curriculum and in accordance with authentic assessment is contextual teaching and learning (CTL) (Juniwati & Sari, 2015). This learning model can help teachers relate the material being taught to students' real world situations and encourage students to make connections between their knowledge

and its application in everyday life (Ariesta et al., 2013, Sugiyanto, 2010) . In delivering the material, the selected context or example must be in accordance with the daily life and cognitive level of students. Therefore, the selection of appropriate examples can help students to think and take responsibility for their ideas or opinions. Students become more actively involved in discussions so that they are more confident in expressing their opinions and asking questions about things related to the material being studied (Artini et al., 2019) .

The Contextual Teaching and Learning model can improve student learning outcomes because students work and experience, not just receiving material from the teacher (Addaini, 2020) . This model can also build conducive interactions between students and teachers (Siswo, 2019) and motivate students to understand the meaning of each material through connectivity with everyday life (Zhafirah et al., 2019; Martinis Yamin, 2013)~~.~~ These activities indirectly affect students' ability to think critically and creatively in solving various problems they experience (Putra et al., 2016) . This model can make students more active in learning, asking more questions, and following learning well (Saputra et al., 2020).

The results of the initial observation at the SMA in Bolaang Mongondow Selatan showed that not all of the basic chemistry competencies for class XI were taught to students. The teacher only chooses basic competencies related to material at an advanced level and phenomena can be found by students in everyday life. The learning is carried out from home because of the covid-19 pandemic. Students tend to learn by memorizing, not understanding and there are many students who feel bored. La Kilo (2017) reported that many students do not understand chemistry because their tendency is to memorize without understanding. This way of memorizing has a bad effect on students' creative thinking skills in processing information from abstract chemical material. The rate of reaction is abstract material and is difficult for students to understand (Taofek & Rusdiana, 2020) . The learning process that takes place in schools is still oriented to the teacher who delivers the material, while students only act as recipients of information (Siswanto & Mustofa, 2012) .

This study aims to study *Contextual Teaching and Learning* (CTL) learning model on students' creative thinking skills in the chemical subject of reaction rate material. The creative thinking abilities of students studied consist of four aspects, namely fluency, flexibility, originality, and elaboration.

2. Research Method

This research was conducted at SMA Negeri 1 Pinolosian on students in XI grade of MIA 2 and MIA 3 , respectively, as the experimental class (31 students) and the control class (30 students). The samples were taken from 93 populations (3 classes) by simple random sampling. The research design used Pretest Posttest ~~-only~~ control. The data for the two classes were collected using ~~observation, documentation,~~ questionnaire~~,~~ and test. The questionnaire used was intended to determine student responses to the use of the contextual teaching learning (CTL) model on the reaction rate topic (**Table 1**~~Table 1~~). Students' creative thinking skills are obtained through a written test instrument with 9 items of reaction rate material. This instrument refers to the four indicators of students' creative thinking aspects proposed by (Purwaningrum, 2016); fluency, flexibility, originality, and elaboration.

Commented [Author3]: Tambahkan populasi dan teknik pengambilan sampel:

Commented [Author4]: Perbaiki Nama desain penelitian untuk true experimental design

Commented [Author5]: Tidak ada datanya

Table 1. Questionnaire on the implementation of the contextual teaching and learning model.

Code	Statemants
S1	The teacher conveys the learning objectives well
S2	Each case given by the teacher in learning the material on the rate of reaction can be done either individually or in groups.
S3	I can cooperate better with a group of friends when working on tasks related to everyday life.
S4	The understanding of the reaction rate material becomes better after the teacher explains the material related to

	everyday life.
S5	The results of my study of the material my reaction rate increased.
S6	The atmosphere in the classroom is more conducive and fun when the teacher explains the reaction rate material associated with everyday life.
S7	The presentation of the display of questions explained by the teacher and associated with everyday life, adds to understanding.
S8	After explaining the reaction rate material by relating it to everyday life, I dared to communicate with my friends and teachers during the learning process.
S9	The presentation of the material explained by the teacher by relating it to everyday life may increase my desire to explore the material, especially the reaction rate material.
S10	I think that the CTL method applied by the teacher in the classroom, especially in learning the reaction rate material, is very appropriate.

In this study, the measurement of students' creative thinking skills used a written test instrument. The instrument in the study refers to the four indicators of the creative thinking aspect of students proposed by (Purwaningrum, 2016). The criteria for assessing students' creative thinking abilities can be seen in Table 2~~Table 2~~.

Table 2. Creative Thinking Skills Grid

Skills	Indicators	Items
Fluency	Students can compose answers that are relevant to the information given about the reaction rate topic.	1, 5, 6
Flexibility	Students can solve problems with varied answers and according to their experience	2, 4, 7, 8
Originality	Students can solve problems according to their own ideas	9
Elaboration	Students can make an answer model according to the problem or information obtained on the reaction rate material.	6, 3

Analysis of observational data was carried out by observing students' creative thinking skills during the learning process. Then the data were analyzed and described to determine the effect of the contextual teaching and learning (CTL) model. Meanwhile, the data analysis of the test instrument was carried out through a validity test using the product moment correlation technique (significant level = 0.05), Liefors normality test, homogeneity of variance test and t-test. Data of the LTC implementation questionnaire and instrument test were converted into percent and categorized by value as shown in **Table 3**~~Table 2~~.

Table 3. Questionnaire Categories and Student's Creative Thinking

Value Range (%)	Category
0 – 20	Very less
21 – 40	Not enough
41-60	Enough
61- 80	Good
81- 100	Very good

Testing the hypothesis in this study using a t-test, with the design:

$$H_o: t_{count} \leq t_{table}$$

$$H_1: t_{count} > t_{tabel}$$

where

H_0: there is no positive effect of using the CTL model on students' creative thinking skills

H_1: there is a positive effect of using the CTL model on students' creative thinking skills.

Commented [Author6]: Tambahkan teknik analisis data untuk menguji hipotesis

Formatted: Font: Not Bold

3. Result and Discussion

3.1. Implementation of the CTL contextual learning model

The use of the contextual teaching and learning (CTL) model on the reaction rate material obtained a very good response from most students as the results of the questionnaire shown in S1, S3, S4, S7, and S10 in Figure 1~~Figure 1~~. Students were able to work well with the tasks given by the teacher. The teacher conveys the learning objectives well and presents the material in an interesting way, which was related to everyday life. In addition, the curiosity and communication arising from the students

Formatted: Font: 11 pt, Not Bold, Font color: Black

resulted in a conducive classroom atmosphere as well as the support for presentations from S2, S5, S6, S8, and S9. There are a small number of students who respond negatively to this CTL model, especially cooperation (S3) and curiosity (S9). The LCT learning model applied to this reaction rate material has met the requirements and the data obtained can be used in this study and compared the results with conventional learning.

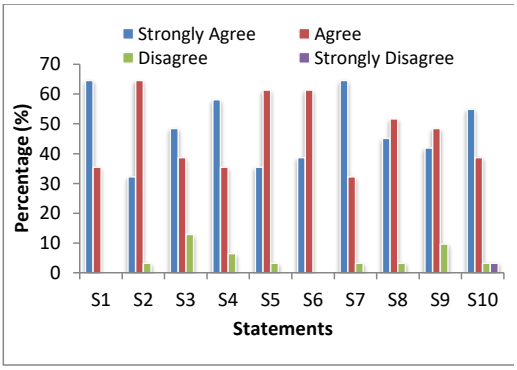


Figure 11 The results of the questionnaire test on the implementation of the contextual teaching and learning (CTL) learning model

Nugraheni (2015) reports that the CTL model can make students care about the environment compared to conventional learning. This research not only makes students care about the environment but students also care about learning as expressed in the passion and cooperation between students.

3.2. Data Test

Normality

The normality test in this study used the Liliefors formula with a significant level of 0.05. The results obtained from the two classes can be seen in Table 4Table 3.

Table 4. Normality Test Results

Class	Group	N	L_{count}	L_{table}	Status
Expt.	Pre-test	31	0.16	0.24	Normal
	Posttest	31	0.14		
Control	Pre-test	30	0.10		
	Posttest	30	0.11		

The results of the normality test of the pre-test and posttest for the experiment class (XI MIA 2) and the control class (XI MIA 3) showed that the L_{table} at the significant level of 0.05 was 0.242. This value was smaller than the value of L_{count} ($L_{count} < L_{table}$) so that H_o was accepted, the data was normally distributed.

Homogeneity

The homogeneity test used Fisher (F) test with a significant level of = 0.05. The results of the homogeneity test obtained from the two classes can be seen in **Error! Reference source not found.**Table 4.

Table 5. Homogeneity Test Results

Class	Variance	F_{count}	F_{table}	Concl.
Expt.	115.35	1.091	1.854	Homoge-neous
Control	105.69	1.091	1.854	

The data shows that the $F_{count} < F_{table}$ (1.091 < 1.854) so H_0 was accepted, which indicated that the variance of the two samples was homogeneous.

Hypothesis

The results of the calculation of the normality test and the homogeneity of variance at the pretest and posttest showed that the two samples (classes) were normally distributed and homogeneous, so that the hypothesis testing requirements in this study were met with the t-test. H the results of the calculation obtained the value of t_{count} = 2.240 and t_{table} = 2.042 with a significant level of = 0.05. Because $t_{count} > t_{table}$, then H_0 was rejected or H_1 was accepted. This means that the application of the contextual teaching and learning (CTL) model has a positive influence on students' creative thinking skills on the reaction rate topic.

3.3. Students' Creative Thinking Skills

The achievement of creative thinking skills of experimental class and control class students were shown in Figure 2Figure 2. The results of

Formatted: Font: 11 pt, Not Bold

Formatted: Font: 11 pt, Not Bold, Font color: Black

the control class students' creative thinking were very low for all indicators, with an average score of 30.7%. Otherwise, the creative thinking ability of experimental class students who were taught using the CTL model was high, with an average score of 73.70%. Specifically for the experimental class, 3 students scored in the high category (85), 20 students in the medium category (between 70 and 85), and 8 students scored low, 70.

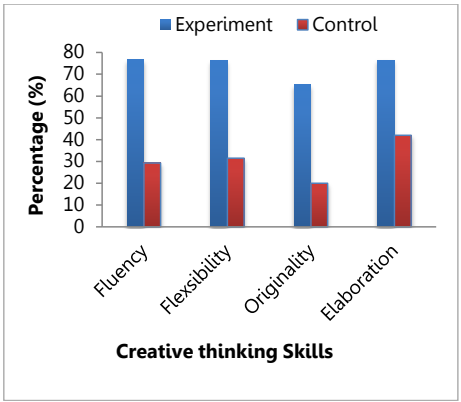


Figure 22. Percentage of achievement of each indicator of students' creative thinking based on the posttest results of the Experiment class (XI MIA2) and Control class (XI MIA3).

Fluency skill of experimental class students showed that students could think fluently, generate opinions or solve problems, and always think of more than one answer, with an ability level of 76.77%. In the second aspect, flexibility skill has score of 76.40%, meaning that students were able to generate ideas, answers or can look for many different problem solving alternatives. Creative thinking were also a habit of a person to turn on an imagination, express and create amazing new points of view and unexpected ideas (Purwaningrum, 2016) . The elaboration skill of students was 76.45 % where students can enrich and develop an idea that details the details of a situation so that it is more interesting. Meanwhile, students' originality skill decreased to 65.16% compared to the other three thinking skills. The achievement in the originality aspect was low compared to the fluency, flexibility, and elaboration thinking aspects. In the control class, the ability to think creatively from fluency, flexibility, originality, and elaboration was successively 29.3%, 31.5%, 20%, and 42%. (Pikoli et al., (2022) reported that students' multiple representations in understanding the concept of reaction rate were still very low at the submicroscopic level where the three mental models from the initial, synthetic, and scientific models were 36.2, 29.4 and 34.4%, respectively. Even the type 00 mental model (both answer and reason were wrong) was found in many students in determining the graph of the relationship between the rate and the concentration of the reactants (Setiawati, 2020). This shows that conventional learning on the reaction rate material was not able to explore students' creative thinking skills. Conventional learning encourages students to only memorize instead of understanding which can cause students to lack understanding of chemistry because the creativity potential of students does not rise (Hasanah et al., 2020; Laliyo et al., 2020; Subawa et al., 2018). The inquiry learning model and scientific approach were effective in improving students' critical thinking skills on the reaction rate material (Agustin et al., 2016; Ilaah, 2015).

Students' thinking ability is also reflected in the pre-test and posttest learning outcomes as shown in Figure 3Figure 3.

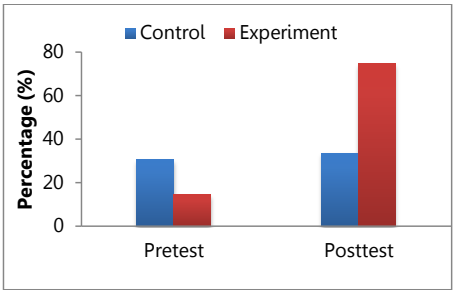


Figure 33. Average of pretest and posttest for experimental and control class

Commented [Author7]: Tambahkan hasil penelitian uang relevanteknik analisis data untuk menguji hipotesisrimental design

Formatted: Font: Not Bold

Based on **Figure 3**~~Figure 3~~, the pretest results of the experimental class (XI MIA 2) students obtained an average of 14.55% which was lower than the average score of the control class (XI MIA3), 30.59%. In contrast, the posttest results of experimental class students after the implementation of the contextual teaching and learning (CTL) model experienced an increase with an average score of 78.84%. This means that the creative thinking level of the experimental class students to complete and answer the questions has reached the minimum completeness criteria (Kriteria Ketuntasan Minimum, KKM). For the control class (XI MIA3), the posttest obtained an average score of 33.56%, there was no significant increase in the value of the pretest score. Control class students were less able to solve problems and their scores have not reached the KKM, which results in low creative thinking skills. This shows that the use of the CTL model can make students develop an idea that is detailed and interesting from a situation.

Students' creative thinking skill can be improved by using learning methods that are implemented in the learning process. In this case students were directly involved in solving problems so that students were likely to be able to generate new ideas (originality), broadly and diversely (Yulianti & Saputra Suhandi, 2019) . Originality in problem solving refers to the ability of students to answer problems with several different answers that are correct or one answer that cannot be done by other students. (Jumi et al., 2018). One aspect that is predicted to increase the ability of originality is to guide students intensely in solving problems. Through the guidance process with a science process skills approach, students are directly involved, not only listening, but they can solve problems in the laboratory to gain knowledge (Ischak et al., 2020) . This was where students actually act as scientists in finding new ideas. Hasanah et al. (2020) also reported that students' innovations or new ideas in solving chemical problems related to everyday life can be improved through the STEM-Cp (Science, Technology, Engineering, Mathematics, and Contextual Problem) approach. Students' independence in learning to practice creative thinking skills can be done through STEM-Cp-based books that are associated with problems in everyday life (Hasanah et al., 2020) .

4. Conclusion

The application of the *contextual teaching and learning (CTL) learning model* positively affects students' creative thinking skills on the reaction rate material. On the other hand, conventional learning does not generate these abilities. The proof is through statistical analysis of test results from pre-test and post-test. Through CTL learning, students' creative thinking ability is high (73.70%) , although the value of originality ability is lower, 65.16%. To train students' thinking skills, especially originality, it is estimated that this can be done by self-study through the STME-Cp-based Reaction Rate book and guided learning with a process skills approach.

References

Addaini, A. S. (2020). Pengaruh Model Pembelajaran Contextual Teaching Learning (CTL) terhadap Hasil Belajar Siswa pada Materi Suhu dan Kalor. *Jurnal Riset Inovasi Pembelajaran Fisika*, *2*(2), 16–22.

Agustin, Y., Fadiawati, N., & Tania, L. (2016). Peningkatan Keterampilan Berpikir Kritis Siswa pada Materi Laju Reaksi Melalui Pendekatan Saintifik. *Jurnal Pendidikan Dan Pembelajaran Kimia*, *5*(3), 98–112.

Andi, F., Makharany, S., Wildany, D., Sari, N., & Sihombing, J. L. (2020). *Penerapan Model Pembelajaran Contextual Teaching and Learning dengan Media LKS untuk Meningkatkan Kerjasama dan Hasil Belajar Kimia*. *4*(April), 150–157.

Ariesta, N., Retno, S., & Ariani, D. (2013). Pengaruh Pembelajaran Kimia dengan Pendekatan CTL (Contextual Teaching And Learning) melalui Metode Guided Inquiry dan Proyek terhadap Siswa pada Materi Kelarutan dan Hasil Kali Kelarutan Kelas XI IPA SMA N 1 Karanganyar.

Jurnal Pendidikan Kimia, *2*(3), 59–67.

Artini, D., Suardana, N., & Wiratini, M. (2019). Pengaruh Model Pembelajaran Kontekstual pada Pokok Bahasan Hidrokarbon terhadap Hasil Belajar Kimia. *Jurnal Pendidikan Kimia Undiksha*, *3*(1), 20–28.

Febrianti, Y., Djahir, Y., & Fatimah, S. (2016). Analisis Kemampuan Berpikir Kreatif Peserta Didik dengan Memanfaatkan Lingkungan pada Mata Pelajaran Ekonomi di SMA Negeri 6 Palembang. *Jurnal Profit*, *3*(1), 121–127.

Hasanah, N., Sutarto, S., Nuriman, N., & Budiarso, A. S. (2020). STEM-CP (Science, Technology, Engineering, Mathematics, and Contextual Problem) Based Colloid Textbook to Increase Creative Thinking Skill for Chemistry Learning in Senior High School. *Pancaran Pendidikan*, *9*(1).

Ilaah, Y. F. (2015). Critical thinking skill of student SMA Kemala Bhayangkari 1 Surabaya on reaction rates topic by implementation of inquiry learning models. *UNESA Journal of Chemical Education*, *4*(1).

Ischak, N. I., Odja, E. A., La Kilo, J., & La Kilo, A. (2020). Pengaruh Keterampilan Proses Sains Melalui Model Inkuiri Terbimbing terhadap Hasil Belajar Siswa pada Materi Larutan Asam Basa. *Hydrogen: Jurnal Kependidikan Kimia*, *8*(2), 58–66.

Jumi, W., Suleman, N., & Tangio, J. S. (2018). *Identifikasi Kemampuan Berpikir Kreatif Siswa Menggunakan Soal Tes Open Ended Problem Pada Materi Elektrokimia di SMA Negeri 1 Telaga*. *13*, 35–43.

Juniwati, & Sari, R. P. (2015). *Pengaruh Model Contextual Teaching and Learning (CTL) pada Pembelajaran IPA terhadap Keterampilan Berfikir Kritis Peserta Didik*. 38–45.

La Kilo, A. (2017). Solusi rumus derajat keasaman reaksi asam basa pada larutan penyangga dengan metode mol awal (rumus akram). *PATEN*, *8*(1065).

Laliyo, L. A. R., Kau, M., La Kilo, J., & La Kilo, A. (2020). Kemampuan siswa memecahkan masalah hukum-hukum dasar kimia melalui pembelajaran inkuiri terbimbing. *AR-RAZI Jurnal Ilmiah*, *8*(1), 1–8. https://doi.org/10.29406/ar-r.v8i1.1875

Nugraheni, R. A. S. (2015). *Pengaruh contextual teaching and learning (CTL) terhadap sikap peduli lingkungan siswa kelas IV SD negeri selang kecamatan wonosari kabupaten gunungkidul* (p. 89).

Pikoli, M., Sukertini, K., & Isa, I. (2022). Analisis Model Mental Siswa dalam Mentransformasikan Konsep Laju Reaksi Melalui Multipel Representasi. *Jambura Journal of Educational Chemistry*, *4*(1), 8–12.

Purwaningrum, J. P. (2016). Mengembangkan Kemampuan Berpikir Kreatif Matematis Melalui Discovery Learning Berbasis Scientific Approach. *Refleksi Edukatika*, *6*(2), 145–157. https://doi.org/10.24176/re.v6i2.613

Putra, R. D., Rinanto, Y., Dwiastuti, S., & Irfa, I. (2016). Peningkatan Kemampuan Berpikir Kreatif Siswa melalui Model Pembelajaran Inkuiri Terbimbing pada Siswa Kelas XI MIA 1 SMA Negeri Colomadu Karanganyar Tahun Pelajaran 2015 / 2016 The Increasing of Students Creative Thinking Ability Through of Inquiry Learni. *Proceeding Biology Education Conference*, *13*(1), 330–334.

Samosir, B. S., Lisna, A., & Tua, H. (2019). Pengaruh Model Pembelajaran Kontekstual terhadap Kemampun Berpikir Kreatif dan Hasil Belajar Siswa. *Jurnal Karya Pendidikan Matematika*, *6*(2), 1–7.

Saputra, H., Kurniati, T., & Fadhilah, R. (2020). *Efektivitas Metode Praktikum Indikator asam basa Berbasis Contextual Teaching Learning (CTL) terhadap hasil belajar siswa kelas XI SMA Negeri 7 Pontianak*. *8*(1), 44–51.

Setiawati, S. S. (2020). *Profil model mental siswa pada submateri hukum laju reaksi dengan menggunakan tes diagnostik model mental pilihan ganda dua tingkat*. Universitas Pendidikan Indonesia.

Siswanto, J., & Mustofa, A. W. (2012). *Pengaruh penggunaan model pembelajaran kontekstual dengan media audio-visual terhadap kemampuan berpikir kritis dan kreatif siswa 1*.

Siswo, S. (2019). Penerapan Pembelajaran Kontekstual (Contextual Teaching and Learning) dalam Pembelajaran Sistem

Periodik Unsur siswa Kelas X MIPA 3 SMA Negeri 5 Jember. *Jurnal Biologi Dan Konservasi*, *1*(1).

Subawa, K., La Kilo, A., & Laliyo, L. A. R. (2018). Penerapan Model Learning Cycle pada Materi Laju Reaksi untuk Meningkatkan Hasil Belajar. *Jambura Journal of Educational Chemistry*, *13*(1), 51–58.

Taofek, I., & Rusdiana, A. (2020). Pengembangan Lembar Kerja Siswa Berbasis Contextual Teaching and Learning untuk Meningkatkan Keterampilan Berpikir Kritis Siswa pada Materi Laju Reaksi Kimia kelas XI SMA. *Journal of Chemical Education*, *9*(1), 121–125.

Winarti. (2015). *Contextual Teaching and Learning (CTL) untuk Meningkatkan Kemampuan Berpikir Kreatif Siswa*. *1*(1), 1–8.

Yulianti, Y., & Saputra Suhandi, D. (2019). Instrumen Penilaian Berpikir Kreatif Pada Pendidikan Abad 21. *Jurnal Cakrawala Pendas*, *5*(2), 40–44.

Zhafirah, T., Utami, L., Islam, U., Sultan, N., & Kasim, S. (2019). *PENGARUH PENERAPAN MODEL PEMBELAJARAN CTL DENGAN MEDIA*. *1*(2), 64–71.

Study of Students' Creative Thinking Skills on Reaction Rate Topic through Contextual Teaching and Learning Model

Received: xxxxxx; Accepted: xxxxxx; Published: xxxxxxx
(single space blank, 12 pt)

Abstract

This research aims to study the contextual teaching and learning (CTL) model on students' creative thinking skills on the reaction rate topic. This research was a quantitative research using true experimental design of pretest posttest ~~only~~ control. The samples used in this study were XI MIA class at SMA Negeri 1 Pinolosian. The experimental class sample was given treatment of the CTL learning model while the control class used conventional learning, respectively, were 31 and 30 students of 93 populations. Students' creative thinking skills were obtained through observation during the learning process based on a questionnaire. Meanwhile, the data analysis of the test instrument was carried out through a validity test using the product moment correlation technique (significant level = 0.05), Liefors normality test, homogeneity of variance test and t-test. Data of the CTL implementation questionnaire and instrument test were converted into percent and categorized. The results showed that the application of the CTL model had a positive effect on students' creative thinking abilities. This is evidenced by the average score of students in the experimental class before and after treatment increased from 14.55 to 74.84. Otherwise, in the control class the scores ware 30.59 to 33.56. The percentage of students' achievement in creative thinking aspects in the experimental class was good (61% -80%) while the control class was less good (21% -40%). The creative thinking abilities of the both classes are very different which is also reflected in the learning outcomes. Because the value of t_{count} (2.240) was greater than t_{table} (2.042) at the significant level = 0.05, the hypothesis of $H_0$was rejected or $H_1$was accepted. This means that the application of the CTL learning model had a positive influence on students' creative thinking skills on the reaction rate material.Students' low originality abilities compared to fluency, flexibility, and elaboration abilities were also discussed.

Keywords: Contextual teaching and learning; Reaction rate; Creative thinking skill

DOI: http://dx.doi.org/10.15575/jtk.xxx.xxx

Commented [Author1]: Perbaiki nama desainnya, sesuaikan literatur jenis penelitian true experimental

Commented [Author2]: Tambahkan hasil uji hipotesisnya

1. Introduction

The standard of 21st century education is to have creative thinking skills. Every teacher plays an important role in achieving an educational goal. One of the main goals of this century's education is to emphasize students' ability to think creatively. Creative thinking is an activity to solve a problem that is carried out through an unconscious experiential process which includes fluency in generating a number of ideas, flexibility in using time in producing various types of solutions obtained, novelty of ideas or solutions produced (Coon & Mitterer, 2014). In the 2013 curriculum, the learning process is expected to encourage students to be able to ask questions, reason, and explain the subject matter that has been obtained so that the learning process is more meaningful (Andi et al., 2020, Jamaluddin et al., 2015) .

Creative thinking is the ability to develop an unusual discovery of new ideas, as well as quality ideas (Febrianti et al., 2016) . The ability to think creatively is also a person's process of thinking and expressing new relationships, seeing events from a new perspective, and being able to combine two new concepts that were previously known (Putra et al., 2016). Students must have the ability to acquire, choosing, critical, systematic, logical, creative and the ability to work together effectively (Samosir et al., 2019). The creative thinking process is convergent to capture the situation, make evaluations and consider the consequences

of the chosen solution (Winarti, 2015; Adzliana et al., 2012).

One of the suitable learning models for the 2013 curriculum and in accordance with authentic assessment is contextual teaching and learning (CTL) (Juniwati & Sari, 2015). This learning model can help teachers relate the material being taught to students' real world situations and encourage students to make connections between their knowledge and its application in everyday life (Ariesta et al., 2013, Sugiyanto, 2010) . In delivering the material, the selected context or example must be in accordance with the daily life and cognitive level of students. Therefore, the selection of appropriate examples can help students to think and take responsibility for their ideas or opinions. Students become more actively involved in discussions so that they are more confident in expressing their opinions and asking questions about things related to the material being studied (Artini et al., 2019) .

The Contextual Teaching and Learning model can improve student learning outcomes because students work and experience, not just receiving material from the teacher (Addaini, 2020) . This model can also build conducive interactions between students and teachers (Siswo, 2019) and motivate students to understand the meaning of each material through connectivity with everyday life (Zhafirah et al., 2019; Martinis Yamin, 2013). These activities indirectly affect students' ability to think critically and creatively in solving various problems they experience (Putra et al., 2016) . This model can make students more active in learning, asking more questions, and following learning well (Saputra et al., 2020).

The results of the initial observation at the SMA in Bolaang Mongondow Selatan showed that not all of the basic chemistry competencies for class XI were taught to students. The teacher only chooses basic competencies related to material at an advanced level and phenomena can be found by students in everyday life. The learning is carried out from home because of the covid-19 pandemic. Students tend to learn by memorizing, not understanding and there are many students who feel bored. La Kilo (2017) reported that many students do not understand chemistry because their tendency is to memorize without understanding. This way of memorizing has a bad effect on students' creative thinking skills in processing information from abstract chemical material. The rate of reaction is abstract material and is difficult for students to understand (Taofek & Rusdiana, 2020) . The learning process that takes place in schools is still oriented to the teacher who delivers the material, while students only act as recipients of information (Siswanto & Mustofa, 2012) .

This study aims to study *Contextual Teaching and Learning* (CTL) learning model on students' creative thinking skills in the chemical subject of reaction rate material. The creative thinking abilities of students studied consist of four aspects, namely fluency, flexibility, originality, and elaboration.

2. Research Method

This research was conducted at SMA Negeri 1 Pinolosian on students in XI grade of MIA 2 and MIA 3, respectively, as the experimental class (31 students) and the control class (30 students). The samples were taken from 93 populations (3 classes) by simple random sampling. The CTL learning model was applied in the experimental class for 3 meetings (2x45 minutes). While the control class was taught with conventional learning. The main stages of learning the CTL model are observing, asking questions, collecting and communicating the topic given. Students observed the phenomenon of swimming pools that were given chlorine. The teacher involved students in asking questions and seeking information on the topic. Data collection based on the student worksheet on the factors that affect the reaction rate. In groups, students read and discuss/analyze the questions and then provide conclusions from the given phenomena. The next stage (association), students conclude the factors that affect the reaction rate. Each group conveys and concludes the results of joint

Commented [Author3]: Tambahkanpopulasidanteknikpengambilansampel:

discussions regarding the phenomena that have been presented in the worksheet. Finally, students pay attention to the teacher's explanation of the factors that affect the rate of reaction.

The research design used Pretest Posttest-~~only~~ control. The data for the two classes were collected using ~~observation, documentation,~~questionnaire~~,~~ and test. The questionnaire used was intended to determine student responses to the use of the contextual teaching learning (CTL) model on the reaction rate topic (**Table 1**~~Table 1~~). Students' creative thinking skills are obtained through a written test instrument with 9 items of reaction rate material. This instrument refers to the four indicators of students' creative thinking aspects proposed by (Purwaningrum, 2016); fluency, flexibility, originality, and elaboration.

Table 1. Questionnaire on the implementation of the contextual teaching and learning model.

Code	Statemants
S1	The teacher conveys the learning objectives well
S2	Each case given by the teacher in learning the material on the rate of reaction can be done either individually or in groups.
S3	I can cooperate better with a group of friends when working on tasks related to everyday life.
S4	The understanding of the reaction rate material becomes better after the teacher explains the material related to everyday life.
S5	The results of my study of the material my reaction rate increased.
S6	The atmosphere in the classroom is more conducive and fun when the teacher explains the reaction rate material associated with everyday life.
S7	The presentation of the display of questions explained by the teacher and associated with everyday life, adds to understanding.
S8	After explaining the reaction rate material by relating it to everyday life, I dared to communicate with my friends and teachers during the learning process.
S9	The presentation of the material explained by the teacher by relating it to everyday life may increase my desire to explore the material, especially the reaction rate material.
S10	I think that the CTL method applied by the teacher in the classroom, especially in learning the reaction rate material, is very appropriate.

In this study, the measurement of students' creative thinking skills used a written test instrument. The instrument in the study refers to the four indicators of the creative thinking aspect of students proposed by (Purwaningrum, 2016). The criteria for assessing students' creative thinking abilities can be seen in Table 2~~Table 2~~.

Table 2. Creative Thinking Skills Grid

Skills	Indicators	Items
Fluency	Students can compose answers that are relevant to the information given about the reaction rate topic.	1, 5, 6
Flexibility	Students can solve problems with varied answers and according to their experience	2, 4, 7, 8
Originality	Students can solve problems according to their own ideas	9
Elaboration	Students can make an answer model according to the problem or information obtained on the reaction rate material.	6, 3

Analysis of observational data was carried out by observing students' creative thinking skills during the learning process. Then the data were analyzed and described to determine the effect of the contextual teaching and learning (CTL) model. Meanwhile, the data analysis of the test instrument was carried out through a validity test using the product moment correlation technique (significant level = 0.05), Liefors normality test, homogeneity of variance test and t-test. Data of the LTC implementation questionnaire and instrument test were converted into percent and categorized by value as shown in **Table 3**~~Table 2~~.

Commented [Author4]: Perbaiki Nama desainpenelitianuntuk true experimental design

Commented [Author5]: Tidak ada datanya

Formatted: Font: Not Bold

Table 3. Questionnaire Categories and Student's Creative Thinking

Value Range (%)	Category
0 – 20	Very less
21 – 40	Not enough
41-60	Enough
61- 80	Good
81- 100	Very good

Testing the hypothesis in this study using a t-test, with the design:

$$H_o: t_{count} \leq t_{table}$$

$$H_1: t_{count} > t_{tabel}$$

where

H_0: there is no positive effect of using the CTL model on students' creative thinking skills

H_1: there is a positive effect of using the CTL model on students' creative thinking skills.

3. Result and Discussion

3.1. Implementation of the CTL contextual learning model

The use of the contextual teaching and learning (CTL) model on the reaction rate material obtained a very good response from most students as the results of the questionnaire shown in S1, S3, S4, S7, and S10 in Figure 1~~Figure 1~~. Students were able to work well with the tasks given by the teacher. The teacher conveys the learning objectives well and presents the material in an interesting way, which was related to everyday life. In addition, the curiosity and communication arising from the students resulted in a conducive classroom atmosphere as well as the support for presentations from S2, S5, S6, S8, and S9. There are a small number of students who respond negatively to this CTL model, especially cooperation (S3) and curiosity (S9). The CTL learning model applied to this reaction rate material has met the requirements and the data obtained can be used in this study and compared the results with conventional learning.

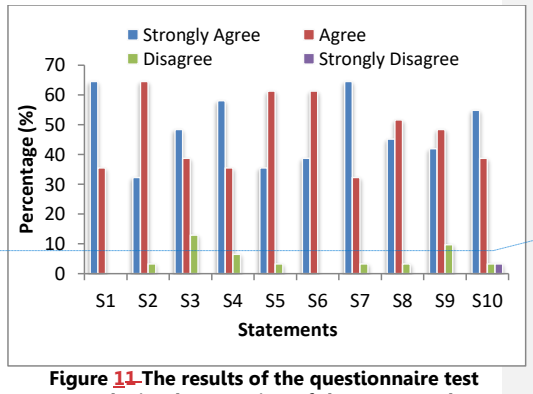


Figure 11 The results of the questionnaire test on the implementation of the contextual teaching and learning (CTL) learning model

Nugraheni (2015) reports that the CTL modelcan make students care about the environment compared to conventional learning. This research not only makes students care about the environment but students also care about learning as expressed in the passion and cooperation between students.

3.2. Data Test

Normality

The normality test in this study used the Liliefors formulawith a significant level of 0.05. The results obtained from the two classes can be seen in Table 4~~Table 3~~.

Table 4. Normality Test Results

Class	Group	N	L_{count}	L_{table}	Status
Expt.	Pre-test	31	0.16	0.24	Normal
	Posttest	31	0.14		
Control	Pre-test	30	0.10		
	Posttest	30	0.11		

The results of the normality test of the pre-test and posttest for the experiment class (XI MIA 2) and the control class (XI MIA 3) showed that the L_{table} at the significant level of 0.05 was 0.242. This value was smaller than the value of L_{count} ($L_{count} < L_{table}$) so that H_o was accepted, the data was normally distributed.

Commented [Author6]: Tambahkan teknik analisis data untuk menguji hipotesis

Formatted: Font: Not Italic

Formatted: Font: 11 pt, Not Bold, Font color: Black

Formatted: Font: 11 pt, Not Bold

Homogeneity

The homogeneity test used Fisher (F) test with a significant level of = 0.05. The results of the homogeneity test obtained from the two classes can be seen in **Error! Reference source not found.**~~Table 4~~.

Table 5. Homogeneity Test Results

Class	Variance	F_{count}	F_{table}	Concl.
Expt.	115.35	1.091	1.854	Homoge-
Control	105.69	1.091	1.854	neous

The data shows that the $F_{count} < F_{table}$ (1.091 < 1.854) so H_0 was accepted, which indicated that the variance of the two samples was homogeneous.

Hypothesis

The results of the calculation of the normality test and the homogeneity of variance at the pretest and posttest showed that the two samples (classes) were normally distributed and homogeneous, so that the hypothesis testing requirements in this study were met with the t-test. H the results of the calculation obtained the value of t_{count} = 2.240 and t_{table} = 2.042 with a significant level of = 0.05. Because $t_{count} > t_{table}$, then H_0 wasrejected or H_1 was accepted. This means that the application of the contextual teaching and learning (CTL) modelhas a positive influence on students' creative thinking skills on the reaction rate topic.

3.3. Students' Creative Thinking Skills

The achievement of creative thinking skills of experimental class and control class students were shown in Figure 2~~Figure 2~~. The results of the control class students' creative thinking were very low for all indicators, with an average score of 30.7%. Otherwise, the creative thinking ability of experimental class students who were taught using the CTL model was high, with an average score of 73.70%. Specifically for the experimental class, 3 students scored in the high category (85), 20 students in the medium category (between 70 and 85), and 8 students scored low, 70.

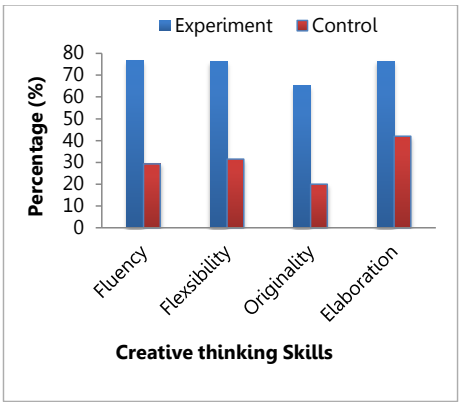


Figure ~~22~~. Percentage of achievement of each indicator of students' creative thinking based on the posttest results of the Experiment class (XI MIA2) and Control class (XI MIA3).

Fluency skill of experimental class studentsshowed that students could think fluently, generate opinions or solve problems, and always think of more than one answer, with an ability level of 76.77%. In the second aspect, flexibilityskill has score of 76.40%, meaning that students were able to generate ideas, answers or can look for many different problem solving alternatives. Creative thinking were also a habit of a person to turn on an imagination, express and create amazing new points of view and unexpected ideas (Purwaningrum, 2016) . The elaboration skill of students was 76.45 % where students can enrich and develop an idea that details the details of a situation so that it is more interesting. Meanwhile, students' originality skill decreased to 65.16% compared to the other three thinking skills. The achievement in the originality aspect was low compared to the fluency, flexibility, and elaboration thinking aspects. In the control class, the ability to think creatively from fluency, flexibility, originality, and elaboration was successively29.3%, 31.5%, 20%, and 42%. ~~(~~Pikoli et al., (2022)reported that students' multiple representations in understanding the concept of reaction rate were still very low at the submicroscopic level where the three mental models from the initial, synthetic, and scientific models were 36.2, 29.4 and 34.4%,

Commented [d7]: Sudah jelas datanya dari pretes tdan postest

Formatted: Font: 11 pt, Not Bold, Font color: Black

respectively. Even the type 00 mental model (both answer and reason were wrong) was found in many students in determining the graph of the relationship between the rate and the concentration of the reactants(Setiawati, 2020).This shows that conventional learning on the reaction rate material was not able to explore students' creative thinking skills. Conventional learning encourages students to only memorize instead of understanding which can cause students to lack understanding of chemistry because the creativity potential of students does not rise (Hasanah et al., 2020; Laliyo et al., 2020; Subawa et al., 2018). The inquiry learning model and scientific approach were effective in improving students' critical thinking skills on the reaction rate material (Agustin et al., 2016; Ilaah, 2015).

Students' thinking ability is also reflected in the pre-test and posttest learning outcomes on topic of factors affecting the rate of reaction as shown in Figure 3~~Figure 3~~.

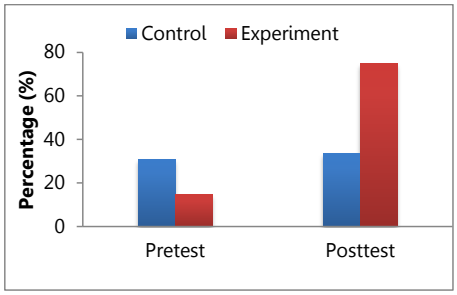


Figure 3~~3~~. Average of pretest and posttest for experimental and control class

Based on **Figure 3**~~Figure 3~~, the pretest results of the experimental class (XI MIA 2) students obtained an average of 14.55% which was lower than the average score of the control class (XI MIA3), 30.59%. In contrast, the posttest results of experimental class students after the implementation of the contextual teaching and learning (CTL) modelexperiencedan increase with an average score of 78.84%. This means that the creative thinking level of the experimental class students to complete and answer the questions has reached the minimum completeness criteria (Kriteria Ketuntasan Minimum, KKM). For the control class (XI MIA3), the posttest obtained an average score of 33.56%, there was no significant increase in the value of the pretest score. Control class students were less able to solve problems and their scores have not reached the KKM, which results in low creative thinking skills. This shows that the use of the CTL model can make students develop an idea that is detailed and interesting from a situation. This was in line with reports that CTL was proven to be effective in improving students' cognitive abilities and thinking skills both through simulations and experiments related to phenomena in everyday life (Mulyono, 2018; Salleh et al., 2012).

Students' creative thinking skill can be improved by using learning methods that are implemented in the learning process. In this case students were directly involved in solving problems so that students were likely to be able to generate new ideas (originality), broadly and diversely (Yulianti & Saputra Suhandi, 2019) . Originality in problemsolving refers to the ability of students to answer problems with several different answers that are correct or one answer that cannot be done by other students. (Jumi et al., 2018). One aspect that is predicted to increase the ability of originality is to guide students intensely in solving problems. Through the guidance process with a science process skills approach, students are directly involved, not only listening, but they can solve problems in the laboratory to gain knowledge (Ischak et al., 2020) . This was where students actually act as scientists in finding new ideas. Hasanah et al. (2020) also reported that students' innovations or new ideas in solving chemical problems related to everyday life can be improved through the STEM-Cp (Science, Technology, Engineering, Mathematics, and Contextual Problem) approach. Students' independence in learning to practice creative thinking skills can be done through STEM-Cp-based books that are associated with problems in everyday life (Hasanah et al., 2020) .

Commented [Author8]: Tambahkan hasil penelitian uang relevanteknik analisis data untuk menguji hipotesisrimental design

Formatted: Highlight

Formatted: Highlight

Formatted: Font: Not Bold

4. Conclusion

The application of the *contextual teaching and learning (CTL) learning model* positively affects students' creative thinking skills on the reaction rate material. On the other hand, conventional learning does not generate these abilities. The proof is through statistical analysis of test results from pre-test and post-test. Through CTL learning, students' creative thinking ability is high (73.70%) , although the value of originality ability is lower, 65.16%. To train students' thinking skills, especially originality, it is estimated that this can be done by self-study through the STME-Cp-based Reaction Rate book and guided learning with a process skills approach.

References

Addaini, A. S. (2020). Pengaruh Model Pembelajaran Contextual Teaching Learning (CTL) terhadap Hasil Belajar Siswa pada Materi Suhu dan Kalor. *Jurnal Riset Inovasi Pembelajaran Fisika*, *2*(2), 16–22.

Agustin, Y., Fadiawati, N., & Tania, L. (2016). Peningkatan Keterampilan Berpikir Kritis Siswa pada Materi Laju Reaksi Melalui Pendekatan Saintifik. *Jurnal Pendidikan Dan Pembelajaran Kimia*, *5*(3), 98–112.

Andi, F., Makharany, S., Wildany, D., Sari, N., & Sihombing, J. L. (2020). *Penerapan Model Pembelajaran Contextual Teaching and Learning dengan Media LKS untuk Meningkatkan Kerjasama dan Hasil Belajar Kimia*. *4*(April), 150–157.

Ariesta, N., Retno, S., & Ariani, D. (2013). Pengaruh Pembelajaran Kimia dengan Pendekatan CTL (Contextual Teaching And Learning) melalui Metode Guided Inquiry dan Proyek terhadap Siswa pada Materi Kelarutan dan Hasil Kali Kelarutan Kelas XI IPA SMA N 1 Karanganyar. *Jurnal Pendidikan Kimia*, *2*(3), 59–67.

Artini, D., Suardana, N., & Wiratini, M. (2019). Pengaruh Model Pembelajaran Kontekstual pada Pokok Bahasan Hidrokarbon terhadap Hasil Belajar Kimia. *Jurnal Pendidikan Kimia Undiksha*, *3*(1), 20–28.

Febrianti, Y., Djahir, Y., & Fatimah, S. (2016). Analisis Kemampuan Berpikir Kreatif Peserta Didik dengan Memanfaatkan Lingkungan pada Mata Pelajaran Ekonomi di SMA Negeri 6 Palembang. *Jurnal Profit*, *3*(1), 121–127.

Hasanah, N., Sutarto, S., Nuriman, N., & Budiarso, A. S. (2020). STEM-CP (Science, Technology, Engineering, Mathematics, and Contextual Problem) Based Colloid Textbook to Increase Creative Thinking Skill for Chemistry Learning in Senior High School. *Pancaran Pendidikan*, *9*(1).

Ilaah, Y. F. (2015). Critical thinking skill of student SMA Kemala Bhayangkari 1 Surabaya on reaction rates topic by implementation of inquiry learning models. *UNESA Journal of Chemical Education*, *4*(1).

Ischak, N. I., Odja, E. A., La Kilo, J., & La Kilo, A. (2020). Pengaruh Keterampilan Proses Sains Melalui Model Inkuiri Terbimbing terhadap Hasil Belajar Siswa pada Materi Larutan Asam Basa. *Hydrogen: Jurnal Kependidikan Kimia*, *8*(2), 58–66.

Jumi, W., Suleman, N., & Tangio, J. S. (2018). *Identifikasi Kemampuan Berpikir Kreatif Siswa Menggunakan Soal Tes Open Ended Problem Pada Materi Elektrokimia di SMA Negeri 1 Telaga*. *13*, 35–43.

Juniwati, & Sari, R. P. (2015). *Pengaruh Model Contextual Teaching and Learning (CTL) pada Pembelajaran IPA terhadap Keterampilan Berfikir Kritis Peserta Didik*. 38–45.

La Kilo, A. (2017). Solusi rumus derajat keasaman reaksi asam basa pada larutan penyangga dengan metode mol awal (rumus akram). *PATEN*, *8*(1065).

Laliyo, L. A. R., Kau, M., La Kilo, J., & La Kilo, A. (2020). Kemampuan siswa memecahkan masalah hukum-hukum dasar kimia melalui pembelajaran inkuiri terbimbing. *AR-RAZI Jurnal Ilmiah*, *8*(1), 1–8. https://doi.org/10.29406/ar-r.v8i1.1875

Mulyono, Y. (2018). Improving creativity of the future physics teachers through general biology learning based on CTL with experimental method. *Indonesian Journal of Science and Education*, *2*(1), 1–7.

Nugraheni, R. A. S. (2015). *Pengaruh*

Formatted: Highlight

contextual teaching and learning (CTL) terhadap sikap peduli lingkungan siswa kelas IV SD negeri selang kecamatan wonosari kabupaten gunungkidul (p. 89).

Pikoli, M., Sukertini, K., & Isa, I. (2022). Analisis Model Mental Siswa dalam Mentransformasikan Konsep Laju Reaksi Melalui Multipel Representasi. *Jambura Journal of Educational Chemistry*, *4*(1), 8–12.

Purwaningrum, J. P. (2016). Mengembangkan Kemampuan Berpikir Kreatif Matematis Melalui Discovery Learning Berbasis Scientific Approach. *Refleksi Edukatika*, *6*(2), 145–157. https://doi.org/10.24176/re.v6i2.613

Putra, R. D., Rinanto, Y., Dwiastuti, S., & Irfa, I. (2016). Peningkatan Kemampuan Berpikir Kreatif Siswa melalui Model Pembelajaran Inkuiri Terbimbing pada Siswa Kelas XI MIA 1 SMA Negeri Colomadu Karanganyar Tahun Pelajaran 2015 / 2016 The Increasing of Students Creative Thinking Ability Through of Inquiry Learni. *Proceeding Biology Education Conference*, *13*(1), 330–334.

Salleh, S. M., Tasir, Z., & Shukor, N. A. (2012). Web-based simulation learning framework to enhance students' critical thinking skills. *Procedia-Social and Behavioral Sciences*, *64*, 372–381.

Samosir, B. S., Lisna, A., & Tua, H. (2019). Pengaruh Model Pembelajaran Kontekstual terhadap Kemampun Berpikir Kreatif dan Hasil Belajar Siswa. *Jurnal Karya Pendidikan Matematika*, *6*(2), 1–7.

Saputra, H., Kurniati, T., & Fadhilah, R. (2020). *Efektivitas Metode Praktikum Indikator asam basa Berbasis Contextual Teaching Learning (CTL) terhadap hasil belajar siswa kelas XI SMA Negeri 7 Pontianak*. *8*(1), 44–51.

Setiawati, S. S. (2020). *Profil model mental siswa pada submateri hukum laju reaksi dengan menggunakan tes diagnostik model mental pilihan ganda dua tingkat*. Universitas Pendidikan Indonesia.

Siswanto, J., & Mustofa, A. W. (2012). *Pengaruh penggunaan model pembelajaran kontekstual dengan media audio-visual terhadap kemampuan berpikir kritis dan kreatif siswa 1*.

Siswo, S. (2019). Penerapan Pembelajaran Kontekstual (Contextual Teaching and Learning) dalam Pembelajaran Sistem Periodik Unsur siswa Kelas X MIPA 3 SMA Negeri 5 Jember. *Jurnal Biologi Dan Konservasi*, *1*(1).

Subawa, K., La Kilo, A., & Laliyo, L. A. R. (2018). Penerapan Model Learning Cycle pada Materi Laju Reaksi untuk Meningkatkan Hasil Belajar. *Jambura Journal of Educational Chemistry*, *13*(1), 51–58.

Taofek, I., & Rusdiana, A. (2020). Pengembangan Lembar Kerja Siswa Berbasis Contextual Teaching and Learning untuk Meningkatkan Keterampilan Berpikir Kritis Siswa pada Materi Laju Reaksi Kimia kelas XI SMA. *Journal of Chemical Education*, *9*(1), 121–125.

Winarti. (2015). *Contextual Teaching and Learning (CTL) untuk Meningkatkan Kemampuan Berpikir Kreatif Siswa*. *1*(1), 1–8.

Yulianti, Y., & Saputra Suhandi, D. (2019). Instrumen Penilaian Berpikir Kreatif Pada Pendidikan Abad 21. *Jurnal Cakrawala Pendas*, *5*(2), 40–44.

Zhafirah, T., Utami, L., Islam, U., Sultan, N., & Kasim, S. (2019). *PENGARUH PENERAPAN MODEL PEMBELAJARAN CTL DENGAN MEDIA*. *1*(2), 64–71.

Formatted: Highlight

Study of Students' Creative Thinking Skills on Reaction Rate Topic through Contextual Teaching and Learning Model

Received: xxxxxx; Accepted: xxxxxx; Published: xxxxxxx
(single space blank, 12 pt)

Abstract

This research aims to study the contextual teaching and learning (CTL) model on students' creative thinking skills on the reaction rate topic. This research was a quantitative research using true experimental design of pretest posttest-only control. The samples used in this study ware XI MIA class at SMA Negeri 1 Pinolosian. The experimental class sample was given treatment of the CTL learning model while the control class used conventional learning. The results showed that the application of the CTL model had a positive effect on students' creative thinking abilities. This is evidenced by the average score of students in the experimental class before and after treatment increased from 14.55 to 74.84. Otherwise, in the control class the scores ware 30.59 to 33.56. The percentage of students' achievement in creative thinking aspects in the experimental class was good (61% -80%) while the control class was less good (21% -40%). The creative thinking abilities of the both classes are very different which is also reflected in the learning outcomes. Students' low originality abilities compared to fluency, flexibility, and elaboration abilities were also discussed.

Keywords: Contextual teaching and learning; Reaction rate; Creative thinking skill

DOI: http://dx.doi.org/10.15575/jtk.xxx.xxx

Commented [MP1]: informasi kurang lengkap. Jumlah sampel, uji analisis (hasil belajar dan berpikir kreatif), taraf signifikan, interpretasi hasil analisis, instrument berpikir kreatif

1. Introduction

The standard of 21st century education is to have creative thinking skills. Every teacher plays an important role in achieving an educational goal. One of the main goals of this century's education is to emphasize students' ability to think creatively. Creative thinking is an activity to solve a problem that is carried out through an unconscious experiential process which includes fluency in generating a number of ideas, flexibility in using time in producing various types of solutions obtained, novelty of ideas or solutions produced (Coon & Mitterer, 2014). In the 2013 curriculum, the learning process is expected to encourage students to be able to ask questions, reason, and explain the subject matter that has been obtained so that the learning process is more meaningful (Andi et al., 2020, Jamaluddin et al., 2015) .

Creative thinking is the ability to develop an unusual discovery of new ideas, as well as quality ideas (Febrianti et al., 2016) . The ability to think creatively is also a person's process of thinking and expressing new relationships, seeing events from a new perspective, and being able to combine two new concepts that were previously known (Putra et al., 2016). Students must have the ability to acquire, choosing, critical, systematic, logical, creative and the ability to work together effectively (Samosir et al., 2019). The creative thinking process is convergent to capture the situation, make evaluations and consider the consequences of the chosen solution (Winarti, 2015; Adzliana et al., 2012).

Commented [MP2]: kurang tajam dalam mengungkapkan permasalahan penelitian. Belum mengaitkan mengapa solusinya menggunakan CTL. Perlu ditambahkan fakta-fakta yang mendukung permasalahan yang diangkat dan hasil-hasil penelitian yang mendukung dipilihnya solusi yang dapat mengatasi masalah

One of the suitable learning models for the 2013 curriculum and in accordance with authentic assessment is contextual teaching and learning (CTL) (Juniwati & Sari, 2015). This learning model can help teachers relate the material being taught to students' real world situations and encourage students to make connections between their knowledge and its application in everyday life (Ariesta et al., 2013, Sugiyanto, 2010) . In delivering the material, the selected context or example must be in accordance with the daily life and cognitive level of students. Therefore, the selection of

appropriate examples can help students to think and take responsibility for their ideas or opinions. Students become more actively involved in discussions so that they are more confident in expressing their opinions and asking questions about things related to the material being studied (Artini et al., 2019) .

The Contextual Teaching and Learning model can improve student learning outcomes because students work and experience, not just receiving material from the teacher (Addaini, 2020) . This model can also build conducive interactions between students and teachers (Siswo, 2019) and motivate students to understand the meaning of each material through connectivity with everyday life (Zhafirah et al., 2019; Martinis Yamin, 2013) . These activities indirectly affect students' ability to think critically and creatively in solving various problems they experience (Putra et al., 2016) . This model can make students more active in learning, asking more questions, and following learning well (Saputra et al., 2020).

The results of the initial observation at the SMA in Bolaang Mongondow Selatan showed that not all of the basic chemistry competencies for class XI were taught to students. The teacher only chooses basic competencies related to material at an advanced level and phenomena can be found by students in everyday life. The learning is carried out from home because of the covid-19 pandemic. Students tend to learn by memorizing, not understanding and there are many students who feel bored. La Kilo (2017) reported that many students do not understand chemistry because their tendency is to memorize without understanding. This way of memorizing has a bad effect on students' creative thinking skills in processing information from abstract chemical material. The rate of reaction is abstract material and is difficult for students to understand (Taofek & Rusdiana, 2020) . The learning process that takes place in schools is still oriented to the teacher who delivers the material, while students only act as recipients of information (Siswanto & Mustofa, 2012) .

This study aims to study *Contextual Teaching and Learning* (CTL) learning model on students' creative thinking skills in the chemical subject of reaction rate material. The creative thinking abilities of students studied consist of four aspects, namely fluency, flexibility, originality, and elaboration.

2. Research Method

This research was conducted at SMA Negeri 1 Pinolosian on students in XI grade of MIA 2 and MIA 3 , respectively, as the experimental class (31 students) and the control class (30 students). The research design used Pretest Posttest-only control. The data for the two classes were collected using observation, documentation, questionnaire, and test. The questionnaire used was intended to determine student responses to the use of the contextual teaching learning (CTL) model on the reaction rate topic (**Table 1**). Students' creative thinking skills are obtained through a written test instrument with 9 items of reaction rate material. This instrument refers to the four indicators of students' creative thinking aspects proposed by (Purwaningrum, 2016); fluency, flexibility, originality, and elaboration.

Commented [MP3]: Pembelajaran dg treatment CTL dilakukan dalam berapa kali pertemuan?

Commented [MP4]: Ditambahkan langkah-langkah CTL yang dilakukan dalam penelitian ini. Pembelajaran konvensional yang dilakukan pada kelompok control juga sebaiknya dijelaskan.

Table 1. Questionnaire on the implementation of the contextual teaching and learning model.

Code	Statemants
S1	The teacher conveys the learning objectives well
S2	Each case given by the teacher in learning the material on the rate of reaction can be done either individually or in groups.
S3	I can cooperate better with a group of friends when working on tasks related to everyday life.
S4	The understanding of the reaction rate material becomes better after the teacher explains the material related to everyday life.
S5	The results of my study of the material my reaction rate increased.
S6	The atmosphere in the classroom is more conducive and fun when the teacher explains the reaction rate material associated with everyday life.

S7	The presentation of the display of questions explained by the teacher and associated with everyday life, adds to understanding.
S8	After explaining the reaction rate material by relating it to everyday life, I dared to communicate with my friends and teachers during the learning process.
S9	The presentation of the material explained by the teacher by relating it to everyday life may increase my desire to explore the material, especially the reaction rate material.
S10	I think that the CTL method applied by the teacher in the classroom, especially in learning the reaction rate material, is very appropriate.

In this study, the measurement of students' creative thinking skills used a written test instrument. The instrument in the study refers to the four indicators of the creative thinking aspect of students proposed by (Purwaningrum, 2016). The criteria for assessing students' creative thinking abilities can be seen in Table 2.

Table 2. Creative Thinking Skills Grid

Skills	Indicators	Items
Fluency	Students can compose answers that are relevant to the information given about the reaction rate topic.	1, 5, 6
Flexibility	Students can solve problems with varied answers and according to their experience	2, 4, 7, 8
Originality	Students can solve problems according to their own ideas	9
Elaboration	Students can make an answer model according to the problem or information obtained on the reaction rate material.	6, 3

Analysis of observational data was carried out by observing students' creative thinking skills during the learning process. Then the data were analyzed and described to determine the effect of the contextual teaching and learning (CTL) model. Meanwhile, the data analysis of the test instrument was carried out through a validity test using the product moment correlation technique (significant level = 0.05), Liefors normality test, homogeneity of variance test and t-test. Data of the LTC implementation questionnaire and instrument test were converted into percent and categorized by value as shown in **Table 3**.

Table 3. Questionnaire Categories and Student's Creative Thinking

Value Range (%)	Category
0 – 20	Very less
21 – 40	Not enough
41-60	Enough
61- 80	Good
81- 100	Very good

3. Result and Discussion

3.1. Implementation of the CTL contextual learning model

The use of the contextual teaching and learning (CTL) model on the reaction rate material obtained a very good response from most students as the results of the questionnaire shown in S1, S3, S4, S7, and S10 in Figure 1. Students were able to work well with the tasks given by the teacher. The teacher conveys the learning objectives well and presents the material in an interesting way, which was related to everyday life. In addition, the curiosity and communication arising from the students resulted in a conducive classroom atmosphere as well as the support for presentations from S2, S5, S6, S8, and S9. There are a small number of students who respond negatively to this CTL model, especially cooperation (S3) and curiosity (S9). The LCT learning model applied to this reaction rate material has met the requirements and the data obtained can be used in this study and compared the results with conventional learning.

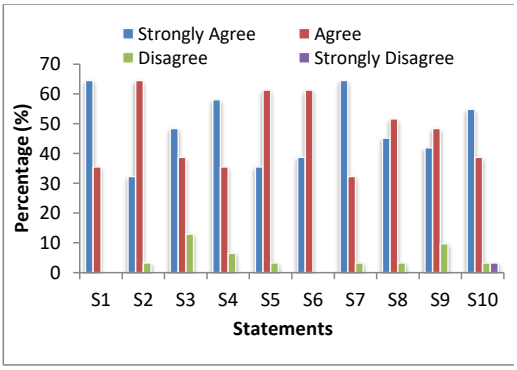


Figure 1The results of the questionnaire test on the implementation of the contextual teaching and learning (CTL) learning model

Nugraheni (2015) reports that the CTL model can make students care about the environment compared to conventional learning. This research not only makes students care about the environment but students also care about learning as expressed in the passion and cooperation between students.

3.2. Data Test

Normality

The normality test in this study used the Liliefors formula with a significant level of 0.05. The results obtained from the two classes can be seen in Table 4.

Table 4. Normality Test Results

Class	Group	N	L_{count}	L_{table}	Status
Expt.	Pre-test	31	0.16		
	Posttest	31	0.14	0.24	Normal
Control	Pre-test	30	0.10		
	Posttest	30	0.11		

The results of the normality test of the pre-test and posttest for the experiment class (XI MIA 2) and the control class (XI MIA 3) showed that the L_{table} at the significant level of 0.05 was 0.242. This value was smaller than the value of L_{count} ($L_{count} < L_{table}$) so that H_o was accepted, the data was normally distributed.

Homogeneity

The homogeneity test used Fisher (F) test with a significant level of = 0.05. The results of the homogeneity test obtained from the two classes can be seen in **Error! Reference source not found.**.

Table 5. Homogeneity Test Results

Class	Variance	F_{count}	F_{table}	Concl.
Expt.	115.35	1.091	1.854	Homoge-
Control	105.69	1.091	1.854	neous

The data shows that the $F_{count} < F_{table}$ (1.091 < 1.854) so H_0 was accepted, which indicated that the variance of the two samples was homogeneous.

Hypothesis

The results of the calculation of the normality test and the homogeneity of variance at the pretest and posttest showed that the two samples (classes) were normally distributed and homogeneous, so that the hypothesis testing requirements in this study were met with the t-test. H the results of the calculation obtained the value of t_{count} = 2.240 and t_{table} = 2.042 with a significant level of = 0.05. Because $t_{count} > t_{table}$, then H_0 was rejected or H_1 was accepted. This means that the application of the contextual teaching and learning (CTL) model has a positive influence on students' creative thinking skills on the reaction rate topic.

Commented [MP5]: Menggunakan data yang mana?

3.3. Students' Creative Thinking Skills

Commented [MP6]: Perlu lebih digali lebih dalam mengapa CTL unggul dalam meningkatkan kemampuan berpikir kreatif.

The achievement of creative thinking skills of experimental class and control class students were shown in Figure 2. The results of the control class students' creative thinking were very low for all indicators, with an average score of 30.7%. Otherwise, the creative thinking ability of experimental class students who were taught using the CTL model was high, with an average score of 73.70%. Specifically for the experimental class, 3 students scored in the high category (85), 20 students in the medium category (between 70 and 85), and 8 students scored low, 70.

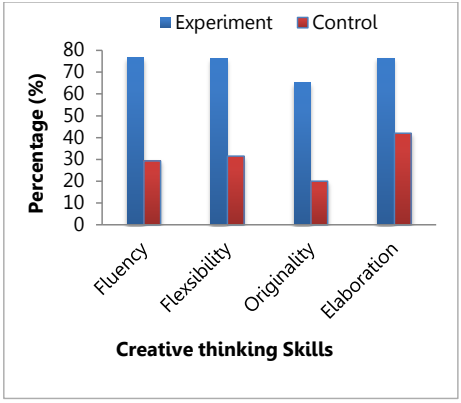


Figure 2. Percentage of achievement of each indicator of students' creative thinking based on the posttest results of the Experiment class (XI MIA2) and Control class (XI MIA3).

Fluency skill of experimental class students showed that students could think fluently, generate opinions or solve problems, and always think of more than one answer, with an ability level of 76.77%. In the second aspect, flexibility skill has score of 76.40%, meaning that students were able to generate ideas, answers or can look for many different problem solving alternatives. Creative thinking were also a habit of a person to turn on an imagination, express and create amazing new points of view and unexpected ideas (Purwaningrum, 2016) . The elaboration skill of students was 76.45 % where students can enrich and develop an idea that details the details of a situation so that it is more interesting. Meanwhile, students' originality skill decreased to 65.16% compared to the other three thinking skills. The achievement in the originality aspect was low compared to the fluency, flexibility, and elaboration thinking aspects. In the control class, the ability to think creatively from fluency, flexibility, originality, and elaboration was successively 29.3%, 31.5%, 20%, and 42%. This shows that conventional learning on the reaction rate material was not able to explore students' creative thinking skills. Conventional learning encourages students to only memorize instead of understanding which can cause students to lack understanding of chemistry because the creativity potential of students does not rise (Hasanah et al., 2020; Laliyo et al., 2020; Subawa et al., 2018) .

Students' thinking ability is also reflected in the pre-test and posttest learning outcomes as shown in Figure 3.

Commented [MP7]: Apakah ini menggunakan instrumen yg sama dg instrumen berpikir kreatif? Mohon ditambahkan penjelasan

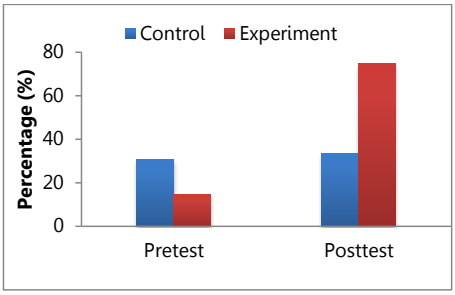


Figure 3. Average of pretest and posttest for experimental and control class

Based on **Figure 3**, the pretest results of the experimental class (XI MIA 2) students obtained an average of 14.55% which was lower than the average score of the control class (XI MIA3), 30.59%. In contrast, the posttest results of experimental class students after the implementation of the contextual teaching and learning (CTL) model experienced an increase with an average score of 78.84%. This means that the creative thinking level of the experimental class students to complete and answer the questions has reached the minimum completeness criteria (Kriteria Ketuntasan Minimum, KKM). For the control class (XI MIA3), the posttest obtained an average score of 33.56%, there was no significant increase in the value of the pretest score. Control class students were less able to solve problems and their scores have not reached the KKM, which results in low creative thinking skills. This shows that the use of the CTL model can make students develop an idea that is detailed and interesting from a situation.

Students' creative thinking skill can be improved by using learning methods that are implemented in the learning process. In this case students were directly involved in solving

problems so that students were likely to be able to generate new ideas (originality), broadly and diversely (Yulianti & Saputra Suhandi, 2019) . Originality in problem solving refers to the ability of students to answer problems with several different answers that are correct or one answer that cannot be done by other students. (Jumi et al., 2018). One aspect that is predicted to increase the ability of originality is to guide students intensely in solving problems. Through the guidance process with a science process skills approach, students are directly involved, not only listening, but they can solve problems in the laboratory to gain knowledge (Ischak et al., 2020) . This was where students actually act as scientists in finding new ideas. Hasanah et al. (2020) also reported that students' innovations or new ideas in solving chemical problems related to everyday life can be improved through the STEM-Cp (Science, Technology, Engineering, Mathematics, and Contextual Problem) approach. Students' independence in learning to practice creative thinking skills can be done through STEM-Cp-based books that are associated with problems in everyday life (Hasanah et al., 2020) .

4. Conclusion

The application of the *contextual teaching and learning (CTL) learning model* positively affects students' creative thinking skills on the reaction rate material. On the other hand, conventional learning does not generate these abilities. The proof is through statistical analysis of test results from pre-test and post-test. Through CTL learning, students' creative thinking ability is high (73.70%) , although the value of originality ability is lower, 65.16%. To train students' thinking skills, especially originality, it is estimated that this can be done by self-study through the STME-Cp-based Reaction Rate book and guided learning with a process skills approach.

References

Addaini, A. S. (2020). Pengaruh Model Pembelajaran Contextual Teaching Learning (CTL) terhadap Hasil Belajar Siswa pada Materi Suhu dan Kalor. *Jurnal Riset Inovasi Pembelajaran Fisika*, *2*(2), 16–22.

Andi, F., Makharany, S., Wildany, D., Sari, N., & Sihombing, J. L. (2020). *Penerapan Model Pembelajaran Contextual Teaching and Learning dengan Media LKS untuk Meningkatkan Kerjasama dan Hasil Belajar Kimia*. *4*(April), 150–157.

Ariesta, N., Retno, S., & Ariani, D. (2013). Pengaruh Pembelajaran Kimia dengan Pendekatan CTL (Contextual Teaching And Learning) melalui Metode Guided Inquiry dan Proyek terhadap Siswa pada Materi Kelarutan dan Hasil Kali Kelarutan Kelas XI IPA SMA N 1 Karanganyar. *Jurnal Pendidikan Kimia*, *2*(3), 59–67.

Artini, D., Suardana, N., & Wiratini, M. (2019). Pengaruh Model Pembelajaran Kontekstual pada Pokok Bahasan Hidrokarbon terhadap Hasil Belajar Kimia. *Jurnal Pendidikan Kimia Undiksha*, *3*(1), 20–28.

Febrianti, Y., Djahir, Y., & Fatimah, S. (2016). Analisis Kemampuan Berpikir Kreatif Peserta Didik dengan Memanfaatkan Lingkungan pada Mata Pelajaran Ekonomi di SMA Negeri 6 Palembang. *Jurnal Profit*, *3*(1), 121–127.

Hasanah, N., Sutarto, S., Nuriman, N., & Budiarso, A. S. (2020). STEM-CP (Science, Technology, Engineering, Mathematics, and Contextual Problem) Based Colloid Textbook to Increase Creative Thinking Skill for Chemistry Learning in Senior High School. *Pancaran Pendidikan*, *9*(1).

Ischak, N. I., Odja, E. A., La Kilo, J., & La Kilo, A. (2020). Pengaruh Keterampilan Proses Sains Melalui Model Inkuiri Terbimbing terhadap Hasil Belajar Siswa pada Materi Larutan Asam Basa. *Hydrogen: Jurnal Kependidikan Kimia*, *8*(2), 58–66.

Jumi, W., Suleman, N., & Tangio, J. S. (2018). *Identifikasi Kemampuan Berpikir Kreatif Siswa Menggunakan Soal Tes Open Ended Problem Pada Materi Elektrokimia di SMA Negeri 1 Telaga*. *13*, 35–43.

Juniwati, & Sari, R. P. (2015). *Pengaruh Model Contextual Teaching and Learning (CTL) pada Pembelajaran IPA terhadap Keterampilan Berfikir Kritis Peserta Didik*. 38–45.

Commented [MP8]: Fokuskan sesuai dengan tujuan, dan pembahasan

La Kilo, A. (2017). Solusi rumus derajat keasaman reaksi asam basa pada larutan penyangga dengan metode mol awal (rumus akram). *PATEN*, *8*(1065).

Laliyo, L. A. R., Kau, M., La Kilo, J., & La Kilo, A. (2020). Kemampuan siswa memecahkan masalah hukum-hukum dasar kimia melalui pembelajaran inkuiri terbimbing. *AR-RAZI Jurnal Ilmiah*, *8*(1), 1–8. https://doi.org/10.29406/ar-r.v8i1.1875

Nugraheni, R. A. S. (2015). *Pengaruh contextual teaching and learning (CTL) terhadap sikap peduli lingkungan siswa kelas IV SD negeri selang kecamatan wonosari kabupaten gunungkidul* (p. 89).

Purwaningrum, J. P. (2016). Mengembangkan Kemampuan Berpikir Kreatif Matematis Melalui Discovery Learning Berbasis Scientific Approach. *Refleksi Edukatika*, *6*(2), 145–157. https://doi.org/10.24176/re.v6i2.613

Putra, R. D., Rinanto, Y., Dwiastuti, S., & Irfa, I. (2016). Peningkatan Kemampuan Berpikir Kreatif Siswa melalui Model Pembelajaran Inkuiri Terbimbing pada Siswa Kelas XI MIA 1 SMA Negeri Colomadu Karanganyar Tahun Pelajaran 2015 / 2016 The Increasing of Students Creative Thinking Ability Through of Inquiry Learni. *Proceeding Biology Education Conference*, *13*(1), 330–334.

Samosir, B. S., Lisna, A., & Tua, H. (2019). Pengaruh Model Pembelajaran Kontekstual terhadap Kemampun Berpikir Kreatif dan Hasil Belajar Siswa. *Jurnal Karya Pendidikan Matematika*, *6*(2), 1–7.

Saputra, H., Kurniati, T., & Fadhilah, R. (2020). *Efektivitas Metode Praktikum Indikator asam basa Berbasis Contextual Teaching Learning (CTL) terhadap hasil belajar siswa kelas XI SMA Negeri 7 Pontianak*. *8*(1), 44–51.

Siswanto, J., & Mustofa, A. W. (2012). *Pengaruh penggunaan model pembelajaran kontekstual dengan media audio-visual terhadap kemampuan berpikir kritis dan kreatif siswa 1*.

Siswo, S. (2019). Penerapan Pembelajaran Kontekstual (Contextual Teaching and Learning) dalam Pembelajaran Sistem Periodik Unsur siswa Kelas X MIPA 3 SMA Negeri 5 Jember. *Jurnal Biologi Dan Konservasi*, *1*(1).

Subawa, K., La Kilo, A., & Laliyo, L. A. R. (2018). Penerapan Model Learning Cycle pada Materi Laju Reaksi untuk Meningkatkan Hasil Belajar. *Jambura Journal of Educational Chemistry*, *13*(1), 51–58.

Taofek, I., & Rusdiana, A. (2020). Pengembangan Lembar Kerja Siswa Berbasis Contextual Teaching and Learning untuk Meningkatkan Keterampilan Berpikir Kritis Siswa pada Materi Laju Reaksi Kimia kelas XI SMA. *Journal of Chemical Education*, *9*(1), 121–125.

Winarti. (2015). *Contextual Teaching and Learning (CTL) untuk Meningkatkan Kemampuan Berpikir Kreatif Siswa*. *1*(1), 1–8.

Yulianti, Y., & Saputra Suhandi, D. (2019). Instrumen Penilaian Berpikir Kreatif Pada Pendidikan Abad 21. *Jurnal Cakrawala Pendas*, *5*(2), 40–44.

Zhafirah, T., Utami, L., Islam, U., Sultan, N., & Kasim, S. (2019). *PENGARUH PENERAPAN MODEL PEMBELAJARAN CTL DENGAN MEDIA*. *1*(2), 64–71.

Study of Students' Creative Thinking Skills on Reaction Rate Topic through Contextual Teaching and Learning Model

Received: xxxxxx; Accepted: xxxxxx; Published: xxxxxxx
(single space blank, 12 pt)

Abstract

This research aims to study the contextual teaching and learning (CTL) model on students' creative thinking skills on the reaction rate topic. This research was a quantitative research using true experimental design of pretest posttest-only control. The samples used in this study ware XI MIA class at SMA Negeri 1 Pinolosian. The experimental class sample was given treatment of the CTL learning model while the control class used conventional learning. The results showed that the application of the CTL model had a positive effect on students' creative thinking abilities. This is evidenced by the average score of students in the experimental class before and after treatment increased from 14.55 to 74.84. Otherwise, in the control class the scores ware 30.59 to 33.56. The percentage of students' achievement in creative thinking aspects in the experimental class was good (61% -80%) while the control class was less good (21% -40%). The creative thinking abilities of the both classes are very different which is also reflected in the learning outcomes. Students' low originality abilities compared to fluency, flexibility, and elaboration abilities were also discussed.

Keywords: Contextual teaching and learning; Reaction rate; Creative thinking skill

DOI: http://dx.doi.org/10.15575/jtk.xxx.xxx

Commented [Author1]: Perbaiki nama desainnya, sesuaikan literatur jenis penelitian true experimental

Commented [Author2]: Tambahkan hasil uji hipotesisnya

1. Introduction

The standard of 21st century education is to have creative thinking skills. Every teacher plays an important role in achieving an educational goal. One of the main goals of this century's education is to emphasize students' ability to think creatively. Creative thinking is an activity to solve a problem that is carried out through an unconscious experiential process which includes fluency in generating a number of ideas, flexibility in using time in producing various types of solutions obtained, novelty of ideas or solutions produced (Coon & Mitterer, 2014). In the 2013 curriculum, the learning process is expected to encourage students to be able to ask questions, reason, and explain the subject matter that has been obtained so that the learning process is more meaningful (Andi et al., 2020, Jamaluddin et al., 2015) .

Creative thinking is the ability to develop an unusual discovery of new ideas, as well as quality ideas (Febrianti et al., 2016) . The ability to think creatively is also a person's process of thinking and expressing new relationships, seeing events from a new perspective, and being able to combine two new concepts that were previously known (Putra et al., 2016). Students must have the ability to acquire, choosing, critical, systematic, logical, creative and the ability to work together effectively (Samosir et al., 2019). The creative thinking process is convergent to capture the situation, make evaluations and consider the consequences of the chosen solution (Winarti, 2015; Adzliana et al., 2012).

One of the suitable learning models for the 2013 curriculum and in accordance with authentic assessment is contextual teaching and learning (CTL) (Juniwati & Sari, 2015). This learning model can help teachers relate the material being taught to students' real world situations and encourage students to make connections between their knowledge and its application in everyday life (Ariesta et al., 2013, Sugiyanto, 2010) . In delivering the material, the selected context or example

must be in accordance with the daily life and cognitive level of students. Therefore, the selection of appropriate examples can help students to think and take responsibility for their ideas or opinions. Students become more actively involved in discussions so that they are more confident in expressing their opinions and asking questions about things related to the material being studied (Artini et al., 2019) .

The Contextual Teaching and Learning model can improve student learning outcomes because students work and experience, not just receiving material from the teacher (Addaini, 2020) . This model can also build conducive interactions between students and teachers (Siswo, 2019) and motivate students to understand the meaning of each material through connectivity with everyday life (Zhafirah et al., 2019; Martinis Yamin, 2013) . These activities indirectly affect students' ability to think critically and creatively in solving various problems they experience (Putra et al., 2016) . This model can make students more active in learning, asking more questions, and following learning well (Saputra et al., 2020).

The results of the initial observation at the SMA in Bolaang Mongondow Selatan showed that not all of the basic chemistry competencies for class XI were taught to students. The teacher only chooses basic competencies related to material at an advanced level and phenomena can be found by students in everyday life. The learning is carried out from home because of the covid-19 pandemic. Students tend to learn by memorizing, not understanding and there are many students who feel bored. La Kilo (2017) reported that many students do not understand chemistry because their tendency is to memorize without understanding. This way of memorizing has a bad effect on students' creative thinking skills in processing information from abstract chemical material. The rate of reaction is abstract material and is difficult for students to understand (Taofek & Rusdiana, 2020) . The learning process that takes place in schools is still oriented to the teacher who delivers the material, while students only act as recipients of information (Siswanto & Mustofa, 2012) .

This study aims to study *Contextual Teaching and Learning* (CTL) learning model on students' creative thinking skills in the chemical subject of reaction rate material. The creative thinking abilities of students studied consist of four aspects, namely fluency, flexibility, originality, and elaboration.

2. Research Method

This research was conducted at SMA Negeri 1 Pinolosian on students in XI grade of MIA 2 and MIA 3 , respectively, as the experimental class (31 students) and the control class (30 students). The research design used Pretest Posttest-only control. The data for the two classes were collected using observation, documentation, questionnaire, and test. The questionnaire used was intended to determine student responses to the use of the contextual teaching learning (CTL) model on the reaction rate topic (**Table 1**). Students' creative thinking skills are obtained through a written test instrument with 9 items of reaction rate material. This instrument refers to the four indicators of students' creative thinking aspects proposed by (Purwaningrum, 2016); fluency, flexibility, originality, and elaboration.

Commented [Author3]: Tambahkan populasi dan teknik pengambilan sampel

Commented [Author4]: Perbaiki Nama desain penelitian untuk true experimental design

Commented [Author5]: Tidak ada datanya

Table 1. Questionnaire on the implementation of the contextual teaching and learning model.

Code	Statemants
S1	The teacher conveys the learning objectives well
S2	Each case given by the teacher in learning the material on the rate of reaction can be done either individually or in groups.
S3	I can cooperate better with a group of friends when working on tasks related to everyday life.
S4	The understanding of the reaction rate material becomes better after the teacher explains the material related to everyday life.
S5	The results of my study of the material my reaction rate increased.
S6	The atmosphere in the classroom is more conducive and fun when the

	teacher explains the reaction rate material associated with everyday life.
S7	The presentation of the display of questions explained by the teacher and associated with everyday life, adds to understanding.
S8	After explaining the reaction rate material by relating it to everyday life, I dared to communicate with my friends and teachers during the learning process.
S9	The presentation of the material explained by the teacher by relating it to everyday life may increase my desire to explore the material, especially the reaction rate material.
S10	I think that the CTL method applied by the teacher in the classroom, especially in learning the reaction rate material, is very appropriate.

In this study, the measurement of students' creative thinking skills used a written test instrument. The instrument in the study refers to the four indicators of the creative thinking aspect of students proposed by (Purwaningrum, 2016). The criteria for assessing students' creative thinking abilities can be seen in Table 2.

Table 2. Creative Thinking Skills Grid

Skills	Indicators	Items
Fluency	Students can compose answers that are relevant to the information given about the reaction rate topic.	1, 5, 6
Flexibility	Students can solve problems with varied answers and according to their experience	2, 4, 7, 8
Originality	Students can solve problems according to their own ideas	9
Elaboration	Students can make an answer model according to the problem or information obtained on the reaction rate material.	6, 3

Analysis of observational data was carried out by observing students' creative thinking skills during the learning process. Then the data were analyzed and described to determine the effect of the contextual teaching and learning (CTL) model. Meanwhile, the data analysis of the test instrument was carried out through a validity test using the product moment correlation technique (significant level = 0.05), Liefors normality test, homogeneity of variance test and t-test. Data of the LTC implementation questionnaire and instrument test were converted into percent and categorized by value as shown in **Table 3**.

Table 3. Questionnaire Categories and Student's Creative Thinking

Value Range (%)	Category
0 – 20	Very less
21 – 40	Not enough
41-60	Enough
61- 80	Good
81- 100	Very good

Commented [Author6]: Tambahkan teknik analisis data untuk menguji hipotesis

3. Result and Discussion

3.1. Implementation of the CTL contextual learning model

The use of the contextual teaching and learning (CTL) model on the reaction rate material obtained a very good response from most students as the results of the questionnaire shown in S1, S3, S4, S7, and S10 in Figure 1. Students were able to work well with the tasks given by the teacher. The teacher conveys the learning objectives well and presents the material in an interesting way, which was related to everyday life. In addition, the curiosity and communication arising from the students resulted in a conducive classroom atmosphere as well as the support for presentations from S2, S5, S6, S8, and S9. There are a small number of students who respond negatively to this CTL model, especially cooperation (S3) and curiosity (S9). The LCT learning model applied to this reaction rate material has met the requirements and the data obtained can be used in this study and compared the results with conventional learning.

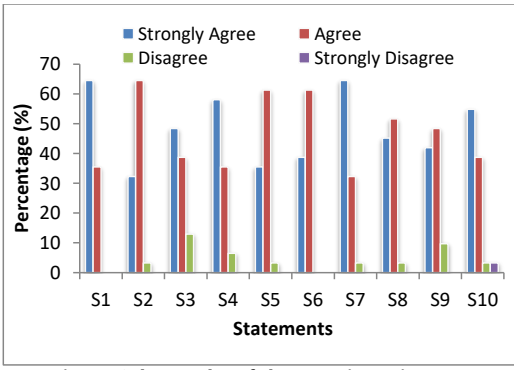


Figure 1The results of the questionnaire test on the implementation of the contextual teaching and learning (CTL) learning model

Nugraheni (2015) reports that the CTL model can make students care about the environment compared to conventional learning. This research not only makes students care about the environment but students also care about learning as expressed in the passion and cooperation between students.

3.2. Data Test

Normality

The normality test in this study used the Liliefors formula with a significant level of 0.05. The results obtained from the two classes can be seen in Table 4.

Table 4. Normality Test Results

Class	Group	N	L_{count}	L_{table}	Status
Expt.	Pre-test	31	0.16	0.24	Normal
	Posttest	31	0.14		
Control	Pre-test	30	0.10		
	Posttest	30	0.11		

The results of the normality test of the pre-test and posttest for the experiment class (XI MIA 2) and the control class (XI MIA 3) showed that the L_{table} at the significant level of 0.05 was 0.242. This value was smaller than the value of L_{count} ($L_{count} < L_{table}$) so that H_o was accepted, the data was normally distributed.

Homogeneity

The homogeneity test used Fisher (F) test with a significant level of = 0.05. The results of the homogeneity test obtained from the two classes can be seen in **Error! Reference source not found.**.

Table 5. Homogeneity Test Results

Class	Variance	F_{count}	F_{table}	Concl.
Expt.	115.35	1.091	1.854	Homoge-neous
Control	105.69	1.091	1.854	

The data shows that the $F_{count} < F_{table}$ (1.091 < 1.854) so H_0 was accepted, which indicated that the variance of the two samples was homogeneous.

Hypothesis

The results of the calculation of the normality test and the homogeneity of variance at the pretest and posttest showed that the two samples (classes) were normally distributed and homogeneous, so that the hypothesis testing requirements in this study were met with the t-test. H the results of the calculation obtained the value of t_{count} = 2.240 and t_{table} = 2.042 with a significant level of = 0.05. Because $t_{count} > t_{table}$, then H_0 was rejected or H_1 was accepted. This means that the application of the contextual teaching and learning (CTL) model has a positive influence on students' creative thinking skills on the reaction rate topic.

3.3. Students' Creative Thinking Skills

The achievement of creative thinking skills of experimental class and control class students were shown in Figure 2. The results of the control class students' creative thinking were very low for all indicators, with an average score of 30.7%. Otherwise, the creative thinking ability of experimental class students who were taught using the CTL model was high, with an average score of 73.70%. Specifically for the experimental class, 3 students scored in the high category (85), 20 students in the medium category (between 70 and 85), and 8 students scored low, 70.

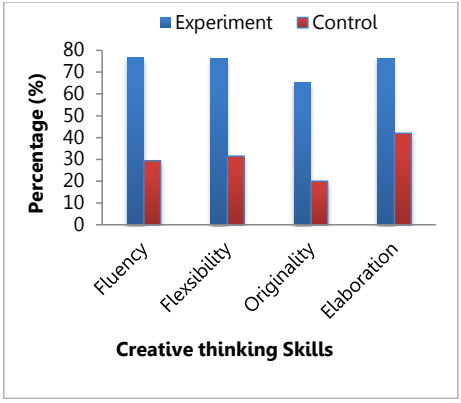


Figure 2. Percentage of achievement of each indicator of students' creative thinking based on the posttest results of the Experiment class (XI MIA2) and Control class (XI MIA3).

Fluency skill of experimental class students showed that students could think fluently, generate opinions or solve problems, and always think of more than one answer, with an ability level of 76.77%. In the second aspect, flexibility skill has score of 76.40%, meaning that students were able to generate ideas, answers or can look for many different problem solving alternatives. Creative thinking were also a habit of a person to turn on an imagination, express and create amazing new points of view and unexpected ideas (Purwaningrum, 2016) . The elaboration skill of students was 76.45 % where students can enrich and develop an idea that details the details of a situation so that it is more interesting. Meanwhile, students' originality skill decreased to 65.16% compared to the other three thinking skills. The achievement in the originality aspect was low compared to the fluency, flexibility, and elaboration thinking aspects. In the control class, the ability to think creatively from fluency, flexibility, originality, and elaboration was successively 29.3%, 31.5%, 20%, and 42%. This shows that conventional learning on the reaction rate material was not able to explore students' creative thinking skills. Conventional learning encourages students to only memorize instead of understanding which can cause students to lack understanding of chemistry because the creativity potential of students does not rise (Hasanah et al., 2020; Laliyo et al., 2020; Subawa et al., 2018) .

Students' thinking ability is also reflected in the pre-test and posttest learning outcomes as shown in Figure 3.

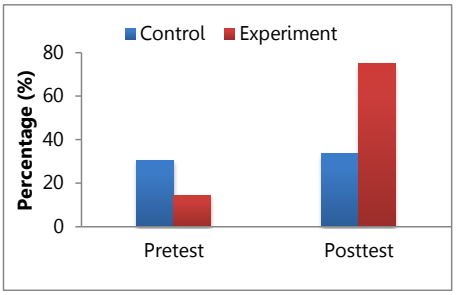


Figure 3. Average of pretest and posttest for experimental and control class

Based on **Figure 3**, the pretest results of the experimental class (XI MIA 2) students obtained an average of 14.55% which was lower than the average score of the control class (XI MIA3), 30.59%. In contrast, the posttest results of experimental class students after the implementation of the contextual teaching and learning (CTL) model experienced an increase with an average score of 78.84%. This means that the creative thinking level of the experimental class students to complete and answer the questions has reached the minimum completeness criteria (Kriteria Ketuntasan Minimum, KKM). For the control class (XI MIA3), the posttest obtained an average score of 33.56%, there was no significant increase in the value of the pretest score. Control class students were less able to solve problems and their scores have not reached the KKM, which results in low creative thinking skills. This shows that the use of the CTL model can make students develop an idea that is detailed and interesting from a situation.

Students' creative thinking skill can be improved by using learning methods that are

Commented [Author7]: Tambahkan hasil penelitian uang relevanteknik analisis data untuk menguji hipotesisrimental design

implemented in the learning process. In this case students were directly involved in solving problems so that students were likely to be able to generate new ideas (originality), broadly and diversely (Yulianti & Saputra Suhandi, 2019) . Originality in problem solving refers to the ability of students to answer problems with several different answers that are correct or one answer that cannot be done by other students. (Jumi et al., 2018). One aspect that is predicted to increase the ability of originality is to guide students intensely in solving problems. Through the guidance process with a science process skills approach, students are directly involved, not only listening, but they can solve problems in the laboratory to gain knowledge (Ischak et al., 2020) . This was where students actually act as scientists in finding new ideas. Hasanah et al. (2020) also reported that students' innovations or new ideas in solving chemical problems related to everyday life can be improved through the STEM-Cp (Science, Technology, Engineering, Mathematics, and Contextual Problem) approach. Students' independence in learning to practice creative thinking skills can be done through STEM-Cp-based books that are associated with problems in everyday life (Hasanah et al., 2020) .

4. Conclusion

The application of the *contextual teaching and learning (CTL) learning model* positively affects students' creative thinking skills on the reaction rate material. On the other hand, conventional learning does not generate these abilities. The proof is through statistical analysis of test results from pre-test and post-test. Through CTL learning, students' creative thinking ability is high (73.70%) , although the value of originality ability is lower, 65.16%. To train students' thinking skills, especially originality, it is estimated that this can be done by self-study through the STME-Cp-based Reaction Rate book and guided learning with a process skills approach.

References

Addaini, A. S. (2020). Pengaruh Model Pembelajaran Contextual Teaching Learning (CTL) terhadap Hasil Belajar Siswa pada Materi Suhu dan Kalor. *Jurnal Riset Inovasi Pembelajaran Fisika*, *2*(2), 16–22.

Andi, F., Makharany, S., Wildany, D., Sari, N., & Sihombing, J. L. (2020). *Penerapan Model Pembelajaran Contextual Teaching and Learning dengan Media LKS untuk Meningkatkan Kerjasama dan Hasil Belajar Kimia*. *4*(April), 150–157.

Ariesta, N., Retno, S., & Ariani, D. (2013). Pengaruh Pembelajaran Kimia dengan Pendekatan CTL (Contextual Teaching And Learning) melalui Metode Guided Inquiry dan Proyek terhadap Siswa pada Materi Kelarutan dan Hasil Kali Kelarutan Kelas XI IPA SMA N 1 Karanganyar. *Jurnal Pendidikan Kimia*, *2*(3), 59–67.

Artini, D., Suardana, N., & Wiratini, M. (2019). Pengaruh Model Pembelajaran Kontekstual pada Pokok Bahasan Hidrokarbon terhadap Hasil Belajar Kimia. *Jurnal Pendidikan Kimia Undiksha*, *3*(1), 20–28.

Febrianti, Y., Djahir, Y., & Fatimah, S. (2016). Analisis Kemampuan Berpikir Kreatif Peserta Didik dengan Memanfaatkan Lingkungan pada Mata Pelajaran Ekonomi di SMA Negeri 6 Palembang. *Jurnal Profit*, *3*(1), 121–127.

Hasanah, N., Sutarto, S., Nuriman, N., & Budiarso, A. S. (2020). STEM-CP (Science, Technology, Engineering, Mathematics, and Contextual Problem) Based Colloid Textbook to Increase Creative Thinking Skill for Chemistry Learning in Senior High School. *Pancaran Pendidikan*, *9*(1).

Ischak, N. I., Odja, E. A., La Kilo, J., & La Kilo, A. (2020). Pengaruh Keterampilan Proses Sains Melalui Model Inkuiri Terbimbing terhadap Hasil Belajar Siswa pada Materi Larutan Asam Basa. *Hydrogen: Jurnal Kependidikan Kimia*, *8*(2), 58–66.

Jumi, W., Suleman, N., & Tangio, J. S. (2018). *Identifikasi Kemampuan Berpikir Kreatif Siswa Menggunakan Soal Tes Open Ended Problem Pada Materi Elektrokimia di SMA Negeri 1 Telaga*. *13*, 35–43.

Juniwati, & Sari, R. P. (2015). *Pengaruh Model Contextual Teaching and Learning (CTL)*

pada Pembelajaran IPA terhadap Keterampilan Berfikir Kritis Peserta Didik. 38–45.

La Kilo, A. (2017). Solusi rumus derajat keasaman reaksi asam basa pada larutan penyangga dengan metode mol awal (rumus akram). *PATEN*, *8*(1065).

Laliyo, L. A. R., Kau, M., La Kilo, J., & La Kilo, A. (2020). Kemampuan siswa memecahkan masalah hukum-hukum dasar kimia melalui pembelajaran inkuiri terbimbing. *AR-RAZI Jurnal Ilmiah*, *8*(1), 1–8. https://doi.org/10.29406/ar-r.v8i1.1875

Nugraheni, R. A. S. (2015). *Pengaruh contextual teaching and learning (CTL) terhadap sikap peduli lingkungan siswa kelas IV SD negeri selang kecamatan wonosari kabupaten gunungkidul* (p. 89).

Purwaningrum, J. P. (2016). Mengembangkan Kemampuan Berpikir Kreatif Matematis Melalui Discovery Learning Berbasis Scientific Approach. *Refleksi Edukatika*, *6*(2), 145–157. https://doi.org/10.24176/re.v6i2.613

Putra, R. D., Rinanto, Y., Dwiastuti, S., & Irfa, I. (2016). Peningkatan Kemampuan Berpikir Kreatif Siswa melalui Model Pembelajaran Inkuiri Terbimbing pada Siswa Kelas XI MIA 1 SMA Negeri Colomadu Karanganyar Tahun Pelajaran 2015 / 2016 The Increasing of Students Creative Thinking Ability Through of Inquiry Learni. *Proceeding Biology Education Conference*, *13*(1), 330–334.

Samosir, B. S., Lisna, A., & Tua, H. (2019). Pengaruh Model Pembelajaran Kontekstual terhadap Kemampun Berpikir Kreatif dan Hasil Belajar Siswa. *Jurnal Karya Pendidikan Matematika*, *6*(2), 1–7.

Saputra, H., Kurniati, T., & Fadhilah, R. (2020). *Efektivitas Metode Praktikum Indikator asam basa Berbasis Contextual Teaching Learning (CTL) terhadap hasil belajar siswa kelas XI SMA Negeri 7 Pontianak*. *8*(1), 44–51.

Siswanto, J., & Mustofa, A. W. (2012). *Pengaruh penggunaan model pembelajaran kontekstual dengan media audio-visual terhadap kemampuan berpikir kritis dan kreatif siswa 1*.

Siswo, S. (2019). Penerapan Pembelajaran Kontekstual (Contextual Teaching and Learning) dalam Pembelajaran Sistem Periodik Unsur siswa Kelas X MIPA 3 SMA Negeri 5 Jember. *Jurnal Biologi Dan Konservasi*, *1*(1).

Subawa, K., La Kilo, A., & Laliyo, L. A. R. (2018). Penerapan Model Learning Cycle pada Materi Laju Reaksi untuk Meningkatkan Hasil Belajar. *Jambura Journal of Educational Chemistry*, *13*(1), 51–58.

Taofek, I., & Rusdiana, A. (2020). Pengembangan Lembar Kerja Siswa Berbasis Contextual Teaching and Learning untuk Meningkatkan Keterampilan Berpikir Kritis Siswa pada Materi Laju Reaksi Kimia kelas XI SMA. *Journal of Chemical Education*, *9*(1), 121–125.

Winarti. (2015). *Contextual Teaching and Learning (CTL) untuk Meningkatkan Kemampuan Berpikir Kreatif Siswa*. *1*(1), 1–8.

Yulianti, Y., & Saputra Suhandi, D. (2019). Instrumen Penilaian Berpikir Kreatif Pada Pendidikan Abad 21. *Jurnal Cakrawala Pendas*, *5*(2), 40–44.

Zhafirah, T., Utami, L., Islam, U., Sultan, N., & Kasim, S. (2019). *PENGARUH PENERAPAN MODEL PEMBELAJARAN CTL DENGAN MEDIA*. *1*(2), 64–71.

Study of Students' Creative Thinking Skills on Reaction Rate Topic through Contextual Teaching and Learning Model

Received: xxxxxx; Accepted: xxxxxx; Published: xxxxxxx
(single space blank, 12 pt)

Abstract

This research aims to study the contextual teaching and learning (CTL) model on students' creative thinking skills on the reaction rate topic. This research was a quantitative research using true experimental design of pretest posttest ~~only~~ control. The samples used in this study were XI MIA class at SMA Negeri 1 Pinolosian. The experimental class sample was given treatment of the CTL learning model while the control class used conventional learning, respectively, were 31 and 30 students of 93 populations. Students' creative thinking skills were obtained through observation during the learning process based on a questionnaire. Meanwhile, the data analysis of the test instrument was carried out through a validity test using the product moment correlation technique (significant level = 0.05), Liefors normality test, homogeneity of variance test and t-test. Data of the CTL implementation questionnaire and instrument test were converted into percent and categorized. The results showed that the application of the CTL model had a positive effect on students' creative thinking abilities. This is evidenced by the average score of students in the experimental class before and after treatment increased from 14.55 to 74.84. Otherwise, in the control class the scores ware 30.59 to 33.56. The percentage of students' achievement in creative thinking aspects in the experimental class was good (61% -80%) while the control class was less good (21% -40%). The creative thinking abilities of the both classes are very different which is also reflected in the learning outcomes. Because the value of t_{count} (2.240) was greater than t_{table} (2.042) at the significant level = 0.05, the hypothesis of $H_0$was rejected or $H_1$was accepted. This means that the application of the CTL learning model had a positive influence on students' creative thinking skills on the reaction rate material.Students' low originality abilities compared to fluency, flexibility, and elaboration abilities were also discussed.

Keywords: Contextual teaching and learning; Reaction rate; Creative thinking skill

DOI: http://dx.doi.org/10.15575/jtk.xxx.xxx

Commented [Author1]: Perbaiki nama desainnya, sesuaikan literatur jenis penelitian true experimental

Commented [Author2]: Tambahkan hasil uji hipotesisnya

1. Introduction

The standard of 21st century education is to have creative thinking skills. Every teacher plays an important role in achieving an educational goal. One of the main goals of this century's education is to emphasize students' ability to think creatively. Creative thinking is an activity to solve a problem that is carried out through an unconscious experiential process which includes fluency in generating a number of ideas, flexibility in using time in producing various types of solutions obtained, novelty of ideas or solutions produced (Coon & Mitterer, 2014). In the 2013 curriculum, the learning process is expected to encourage students to be able to ask questions, reason, and explain the subject matter that has been obtained so that the learning process is more meaningful (Andi et al., 2020, Jamaluddin et al., 2015) .

Creative thinking is the ability to develop an unusual discovery of new ideas, as well as quality ideas (Febrianti et al., 2016) . The ability to think creatively is also a person's process of thinking and expressing new relationships, seeing events from a new perspective, and being able to combine two new concepts that were previously known (Putra et al., 2016). Students must have the ability to acquire, choosing, critical, systematic, logical, creative and the ability to work together effectively (Samosir et al., 2019). The creative thinking process is convergent to capture the situation, make evaluations and consider the consequences

of the chosen solution (Winarti, 2015; Adzliana et al., 2012).

One of the suitable learning models for the 2013 curriculum and in accordance with authentic assessment is contextual teaching and learning (CTL) (Juniwati & Sari, 2015). This learning model can help teachers relate the material being taught to students' real world situations and encourage students to make connections between their knowledge and its application in everyday life (Ariesta et al., 2013, Sugiyanto, 2010) . In delivering the material, the selected context or example must be in accordance with the daily life and cognitive level of students. Therefore, the selection of appropriate examples can help students to think and take responsibility for their ideas or opinions. Students become more actively involved in discussions so that they are more confident in expressing their opinions and asking questions about things related to the material being studied (Artini et al., 2019) .

The Contextual Teaching and Learning model can improve student learning outcomes because students work and experience, not just receiving material from the teacher (Addaini, 2020) . This model can also build conducive interactions between students and teachers (Siswo, 2019) and motivate students to understand the meaning of each material through connectivity with everyday life (Zhafirah et al., 2019; Martinis Yamin, 2013). These activities indirectly affect students' ability to think critically and creatively in solving various problems they experience (Putra et al., 2016) . This model can make students more active in learning, asking more questions, and following learning well (Saputra et al., 2020).

The results of the initial observation at the SMA in Bolaang Mongondow Selatan showed that not all of the basic chemistry competencies for class XI were taught to students. The teacher only chooses basic competencies related to material at an advanced level and phenomena can be found by students in everyday life. The learning is carried out from home because of the covid-19 pandemic. Students tend to learn by memorizing, not understanding and there are many students who feel bored. La Kilo (2017) reported that many students do not understand chemistry because their tendency is to memorize without understanding. This way of memorizing has a bad effect on students' creative thinking skills in processing information from abstract chemical material. The rate of reaction is abstract material and is difficult for students to understand (Taofek & Rusdiana, 2020) . The learning process that takes place in schools is still oriented to the teacher who delivers the material, while students only act as recipients of information (Siswanto & Mustofa, 2012) .

This study aims to study *Contextual Teaching and Learning* (CTL) learning model on students' creative thinking skills in the chemical subject of reaction rate material. The creative thinking abilities of students studied consist of four aspects, namely fluency, flexibility, originality, and elaboration.

2. Research Method

This research was conducted at SMA Negeri 1 Pinolosian on students in XI grade of MIA 2 and MIA 3, respectively, as the experimental class (31 students) and the control class (30 students). The samples were taken from 93 populations (3 classes) by simple random sampling. The CTL learning model was applied in the experimental class for 3 meetings (2x45 minutes). While the control class was taught with conventional learning. The main stages of learning the CTL model are observing, asking questions, collecting and communicating the topic given. Students observed the phenomenon of swimming pools that were given chlorine. The teacher involved students in asking questions and seeking information on the topic. Data collection based on the student worksheet on the factors that affect the reaction rate. In groups, students read and discuss/analyze the questions and then provide conclusions from the given phenomena. The next stage (association), students conclude the factors that affect the reaction rate. Each group conveys and concludes the results of joint

Commented [Author3]: Tambahkanpopulasidanteknikpengambilansampel:

discussions regarding the phenomena that have been presented in the worksheet. Finally, students pay attention to the teacher's explanation of the factors that affect the rate of reaction.

The research design used Pretest Posttest-~~only~~ control. The data for the two classes were collected using ~~observation, documentation,~~questionnaire~~,~~ and test. The questionnaire used was intended to determine student responses to the use of the contextual teaching learning (CTL) model on the reaction rate topic (**Table 1**~~Table 1~~). Students' creative thinking skills are obtained through a written test instrument with 9 items of reaction rate material. This instrument refers to the four indicators of students' creative thinking aspects proposed by (Purwaningrum, 2016); fluency, flexibility, originality, and elaboration.

Table 1. Questionnaire on the implementation of the contextual teaching and learning model.

Code	Statemants
S1	The teacher conveys the learning objectives well
S2	Each case given by the teacher in learning the material on the rate of reaction can be done either individually or in groups.
S3	I can cooperate better with a group of friends when working on tasks related to everyday life.
S4	The understanding of the reaction rate material becomes better after the teacher explains the material related to everyday life.
S5	The results of my study of the material my reaction rate increased.
S6	The atmosphere in the classroom is more conducive and fun when the teacher explains the reaction rate material associated with everyday life.
S7	The presentation of the display of questions explained by the teacher and associated with everyday life, adds to understanding.
S8	After explaining the reaction rate material by relating it to everyday life, I dared to communicate with my friends and teachers during the learning process.
S9	The presentation of the material explained by the teacher by relating it to everyday life may increase my desire to explore the material, especially the reaction rate material.
S10	I think that the CTL method applied by the teacher in the classroom, especially in learning the reaction rate material, is very appropriate.

In this study, the measurement of students' creative thinking skills used a written test instrument. The instrument in the study refers to the four indicators of the creative thinking aspect of students proposed by (Purwaningrum, 2016). The criteria for assessing students' creative thinking abilities can be seen in Table 2~~Table 2~~.

Table 2. Creative Thinking Skills Grid

Skills	Indicators	Items
Fluency	Students can compose answers that are relevant to the information given about the reaction rate topic.	1, 5, 6
Flexibility	Students can solve problems with varied answers and according to their experience	2, 4, 7, 8
Originality	Students can solve problems according to their own ideas	9
Elaboration	Students can make an answer model according to the problem or information obtained on the reaction rate material.	6, 3

Analysis of observational data was carried out by observing students' creative thinking skills during the learning process. Then the data were analyzed and described to determine the effect of the contextual teaching and learning (CTL) model. Meanwhile, the data analysis of the test instrument was carried out through a validity test using the product moment correlation technique (significant level = 0.05), Liefors normality test, homogeneity of variance test and t-test. Data of the LTC implementation questionnaire and instrument test were converted into percent and categorized by value as shown in **Table 3**~~Table 2~~.

Commented [Author4]: Perbaiki Nama desainpenelitianuntuk true experimental design

Commented [Author5]: Tidak ada datanya

Formatted: Font: Not Bold

Table 3. Questionnaire Categories and Student's Creative Thinking

Value Range (%)	Category
0 – 20	Very less
21 – 40	Not enough
41-60	Enough
61- 80	Good
81- 100	Very good

Testing the hypothesis in this study using a t-test, with the design:

$$H_o: t_{count} \leq t_{table}$$

$$H_1: t_{count} > t_{tabel}$$

where

H_0: there is no positive effect of using the CTL model on students' creative thinking skills

H_1: there is a positive effect of using the CTL model on students' creative thinking skills.

3. Result and Discussion

3.1. Implementation of the CTL contextual learning model

The use of the contextual teaching and learning (CTL) model on the reaction rate material obtained a very good response from most students as the results of the questionnaire shown in S1, S3, S4, S7, and S10 in Figure 1~~Figure 1~~. Students were able to work well with the tasks given by the teacher. The teacher conveys the learning objectives well and presents the material in an interesting way, which was related to everyday life. In addition, the curiosity and communication arising from the students resulted in a conducive classroom atmosphere as well as the support for presentations from S2, S5, S6, S8, and S9. There are a small number of students who respond negatively to this CTL model, especially cooperation (S3) and curiosity (S9). The CTL learning model applied to this reaction rate material has met the requirements and the data obtained can be used in this study and compared the results with conventional learning.

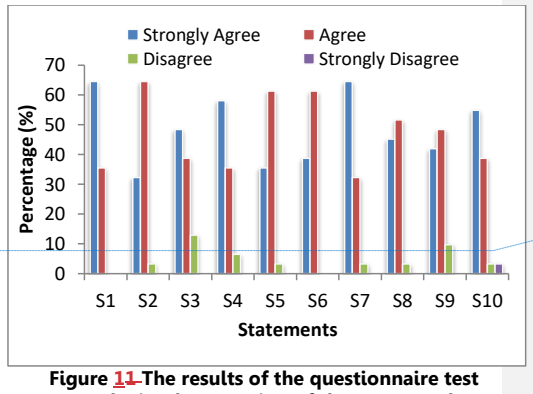


Figure 11 The results of the questionnaire test on the implementation of the contextual teaching and learning (CTL) learning model

Nugraheni (2015) reports that the CTL modelcan make students care about the environment compared to conventional learning. This research not only makes students care about the environment but students also care about learning as expressed in the passion and cooperation between students.

3.2. Data Test

Normality

The normality test in this study used the Liliefors formulawith a significant level of 0.05. The results obtained from the two classes can be seen in Table 4~~Table 3~~.

Table 4. Normality Test Results

Class	Group	N	L_{count}	L_{table}	Status
Expt.	Pre-test	31	0.16	0.24	Normal
	Posttest	31	0.14		
Control	Pre-test	30	0.10		
	Posttest	30	0.11		

The results of the normality test of the pre-test and posttest for the experiment class (XI MIA 2) and the control class (XI MIA 3) showed that the L_{table} at the significant level of 0.05 was 0.242. This value was smaller than the value of L_{count} ($L_{count} < L_{table}$) so that H_o was accepted, the data was normally distributed.

Commented [Author6]: Tambahkan teknik analisis data untuk menguji hipotesis

Formatted: Font: Not Italic

Formatted: Font: 11 pt, Not Bold, Font color: Black

Formatted: Font: 11 pt, Not Bold

Homogeneity

The homogeneity test used Fisher (F) test with a significant level of = 0.05. The results of the homogeneity test obtained from the two classes can be seen in **Error! Reference source not found.**~~Table 4~~.

Table 5. Homogeneity Test Results

Class	Variance	F_{count}	F_{table}	Concl.
Expt.	115.35	1.091	1.854	Homoge-
Control	105.69	1.091	1.854	neous

The data shows that the $F_{count} < F_{table}$ (1.091 < 1.854) so H_0 was accepted, which indicated that the variance of the two samples was homogeneous.

Hypothesis

The results of the calculation of the normality test and the homogeneity of variance at the pretest and posttest showed that the two samples (classes) were normally distributed and homogeneous, so that the hypothesis testing requirements in this study were met with the t-test. H the results of the calculation obtained the value of t_{count} = 2.240 and t_{table} = 2.042 with a significant level of = 0.05. Because $t_{count} > t_{table}$, then H_0 wasrejected or H_1 was accepted. This means that the application of the contextual teaching and learning (CTL) modelhas a positive influence on students' creative thinking skills on the reaction rate topic.

3.3. Students' Creative Thinking Skills

The achievement of creative thinking skills of experimental class and control class students were shown in Figure 2~~Figure 2~~. The results of the control class students' creative thinking were very low for all indicators, with an average score of 30.7%. Otherwise, the creative thinking ability of experimental class students who were taught using the CTL model was high, with an average score of 73.70%. Specifically for the experimental class, 3 students scored in the high category (85), 20 students in the medium category (between 70 and 85), and 8 students scored low, 70.

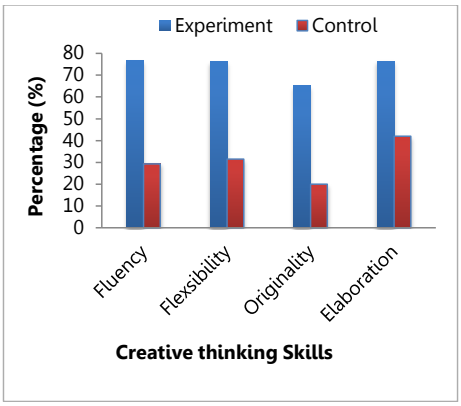


Figure ~~22~~. Percentage of achievement of each indicator of students' creative thinking based on the posttest results of the Experiment class (XI MIA2) and Control class (XI MIA3).

Fluency skill of experimental class studentsshowed that students could think fluently, generate opinions or solve problems, and always think of more than one answer, with an ability level of 76.77%. In the second aspect, flexibilityskill has score of 76.40%, meaning that students were able to generate ideas, answers or can look for many different problem solving alternatives. Creative thinking were also a habit of a person to turn on an imagination, express and create amazing new points of view and unexpected ideas (Purwaningrum, 2016) . The elaboration skill of students was 76.45 % where students can enrich and develop an idea that details the details of a situation so that it is more interesting. Meanwhile, students' originality skill decreased to 65.16% compared to the other three thinking skills. The achievement in the originality aspect was low compared to the fluency, flexibility, and elaboration thinking aspects. In the control class, the ability to think creatively from fluency, flexibility, originality, and elaboration was successively29.3%, 31.5%, 20%, and 42%. ~~(~~Pikoli et al., (2022)reported that students' multiple representations in understanding the concept of reaction rate were still very low at the submicroscopic level where the three mental models from the initial, synthetic, and scientific models were 36.2, 29.4 and 34.4%,

Commented [d7]: Sudah jelas datanya dari pretes tdan postest

Formatted: Font: 11 pt, Not Bold, Font color: Black

respectively. Even the type 00 mental model (both answer and reason were wrong) was found in many students in determining the graph of the relationship between the rate and the concentration of the reactants(Setiawati, 2020).This shows that conventional learning on the reaction rate material was not able to explore students' creative thinking skills. Conventional learning encourages students to only memorize instead of understanding which can cause students to lack understanding of chemistry because the creativity potential of students does not rise (Hasanah et al., 2020; Laliyo et al., 2020; Subawa et al., 2018). The inquiry learning model and scientific approach were effective in improving students' critical thinking skills on the reaction rate material (Agustin et al., 2016; Ilaah, 2015).

Students' thinking ability is also reflected in the pre-test and posttest learning outcomes on topic of factors affecting the rate of reaction as shown in Figure 3~~Figure 3~~.

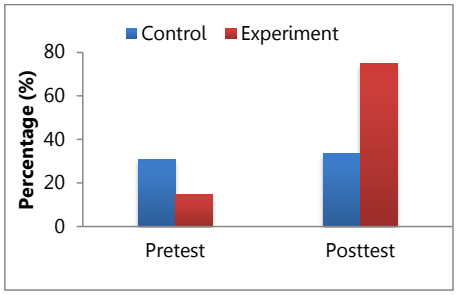


Figure 3~~3~~. Average of pretest and posttest for experimental and control class

Based on **Figure 3**~~Figure 3~~, the pretest results of the experimental class (XI MIA 2) students obtained an average of 14.55% which was lower than the average score of the control class (XI MIA3), 30.59%. In contrast, the posttest results of experimental class students after the implementation of the contextual teaching and learning (CTL) modelexperiencedan increase with an average score of 78.84%. This means that the creative thinking level of the experimental class students to complete and answer the questions has reached the minimum completeness criteria (Kriteria Ketuntasan Minimum, KKM). For the control class (XI MIA3), the posttest obtained an average score of 33.56%, there was no significant increase in the value of the pretest score. Control class students were less able to solve problems and their scores have not reached the KKM, which results in low creative thinking skills. This shows that the use of the CTL model can make students develop an idea that is detailed and interesting from a situation. This was in line with reports that CTL was proven to be effective in improving students' cognitive abilities and thinking skills both through simulations and experiments related to phenomena in everyday life (Mulyono, 2018; Salleh et al., 2012).

Students' creative thinking skill can be improved by using learning methods that are implemented in the learning process. In this case students were directly involved in solving problems so that students were likely to be able to generate new ideas (originality), broadly and diversely (Yulianti & Saputra Suhandi, 2019) . Originality in problemsolving refers to the ability of students to answer problems with several different answers that are correct or one answer that cannot be done by other students. (Jumi et al., 2018). One aspect that is predicted to increase the ability of originality is to guide students intensely in solving problems. Through the guidance process with a science process skills approach, students are directly involved, not only listening, but they can solve problems in the laboratory to gain knowledge (Ischak et al., 2020) . This was where students actually act as scientists in finding new ideas. Hasanah et al. (2020) also reported that students' innovations or new ideas in solving chemical problems related to everyday life can be improved through the STEM-Cp (Science, Technology, Engineering, Mathematics, and Contextual Problem) approach. Students' independence in learning to practice creative thinking skills can be done through STEM-Cp-based books that are associated with problems in everyday life (Hasanah et al., 2020) .

Commented [Author8]: Tambahkan hasil penelitian uang relevanteknik analisis data untuk menguji hipotesisrimental design

Formatted: Highlight

Formatted: Highlight

Formatted: Font: Not Bold

4. Conclusion

The application of the *contextual teaching and learning (CTL) learning model* positively affects students' creative thinking skills on the reaction rate material. On the other hand, conventional learning does not generate these abilities. The proof is through statistical analysis of test results from pre-test and post-test. Through CTL learning, students' creative thinking ability is high (73.70%) , although the value of originality ability is lower, 65.16%. To train students' thinking skills, especially originality, it is estimated that this can be done by self-study through the STME-Cp-based Reaction Rate book and guided learning with a process skills approach.

References

Addaini, A. S. (2020). Pengaruh Model Pembelajaran Contextual Teaching Learning (CTL) terhadap Hasil Belajar Siswa pada Materi Suhu dan Kalor. *Jurnal Riset Inovasi Pembelajaran Fisika*, *2*(2), 16–22.

Agustin, Y., Fadiawati, N., & Tania, L. (2016). Peningkatan Keterampilan Berpikir Kritis Siswa pada Materi Laju Reaksi Melalui Pendekatan Saintifik. *Jurnal Pendidikan Dan Pembelajaran Kimia*, *5*(3), 98–112.

Andi, F., Makharany, S., Wildany, D., Sari, N., & Sihombing, J. L. (2020). *Penerapan Model Pembelajaran Contextual Teaching and Learning dengan Media LKS untuk Meningkatkan Kerjasama dan Hasil Belajar Kimia*. *4*(April), 150–157.

Ariesta, N., Retno, S., & Ariani, D. (2013). Pengaruh Pembelajaran Kimia dengan Pendekatan CTL (Contextual Teaching And Learning) melalui Metode Guided Inquiry dan Proyek terhadap Siswa pada Materi Kelarutan dan Hasil Kali Kelarutan Kelas XI IPA SMA N 1 Karanganyar. *Jurnal Pendidikan Kimia*, *2*(3), 59–67.

Artini, D., Suardana, N., & Wiratini, M. (2019). Pengaruh Model Pembelajaran Kontekstual pada Pokok Bahasan Hidrokarbon terhadap Hasil Belajar Kimia. *Jurnal Pendidikan Kimia Undiksha*, *3*(1), 20–28.

Febrianti, Y., Djahir, Y., & Fatimah, S. (2016). Analisis Kemampuan Berpikir Kreatif Peserta Didik dengan Memanfaatkan Lingkungan pada Mata Pelajaran Ekonomi di SMA Negeri 6 Palembang. *Jurnal Profit*, *3*(1), 121–127.

Hasanah, N., Sutarto, S., Nuriman, N., & Budiarso, A. S. (2020). STEM-CP (Science, Technology, Engineering, Mathematics, and Contextual Problem) Based Colloid Textbook to Increase Creative Thinking Skill for Chemistry Learning in Senior High School. *Pancaran Pendidikan*, *9*(1).

Ilaah, Y. F. (2015). Critical thinking skill of student SMA Kemala Bhayangkari 1 Surabaya on reaction rates topic by implementation of inquiry learning models. *UNESA Journal of Chemical Education*, *4*(1).

Ischak, N. I., Odja, E. A., La Kilo, J., & La Kilo, A. (2020). Pengaruh Keterampilan Proses Sains Melalui Model Inkuiri Terbimbing terhadap Hasil Belajar Siswa pada Materi Larutan Asam Basa. *Hydrogen: Jurnal Kependidikan Kimia*, *8*(2), 58–66.

Jumi, W., Suleman, N., & Tangio, J. S. (2018). *Identifikasi Kemampuan Berpikir Kreatif Siswa Menggunakan Soal Tes Open Ended Problem Pada Materi Elektrokimia di SMA Negeri 1 Telaga*. *13*, 35–43.

Juniwati, & Sari, R. P. (2015). *Pengaruh Model Contextual Teaching and Learning (CTL) pada Pembelajaran IPA terhadap Keterampilan Berfikir Kritis Peserta Didik*. 38–45.

La Kilo, A. (2017). Solusi rumus derajat keasaman reaksi asam basa pada larutan penyangga dengan metode mol awal (rumus akram). *PATEN*, *8*(1065).

Laliyo, L. A. R., Kau, M., La Kilo, J., & La Kilo, A. (2020). Kemampuan siswa memecahkan masalah hukum-hukum dasar kimia melalui pembelajaran inkuiri terbimbing. *AR-RAZI Jurnal Ilmiah*, *8*(1), 1–8. https://doi.org/10.29406/ar-r.v8i1.1875

Mulyono, Y. (2018). Improving creativity of the future physics teachers through general biology learning based on CTL with experimental method. *Indonesian Journal of Science and Education*, *2*(1), 1–7.

Nugraheni, R. A. S. (2015). *Pengaruh*

Formatted: Highlight

contextual teaching and learning (CTL) terhadap sikap peduli lingkungan siswa kelas IV SD negeri selang kecamatan wonosari kabupaten gunungkidul (p. 89).

Pikoli, M., Sukertini, K., & Isa, I. (2022). Analisis Model Mental Siswa dalam Mentransformasikan Konsep Laju Reaksi Melalui Multipel Representasi. *Jambura Journal of Educational Chemistry*, *4*(1), 8–12.

Purwaningrum, J. P. (2016). Mengembangkan Kemampuan Berpikir Kreatif Matematis Melalui Discovery Learning Berbasis Scientific Approach. *Refleksi Edukatika*, *6*(2), 145–157. https://doi.org/10.24176/re.v6i2.613

Putra, R. D., Rinanto, Y., Dwiastuti, S., & Irfa, I. (2016). Peningkatan Kemampuan Berpikir Kreatif Siswa melalui Model Pembelajaran Inkuiri Terbimbing pada Siswa Kelas XI MIA 1 SMA Negeri Colomadu Karanganyar Tahun Pelajaran 2015 / 2016 The Increasing of Students Creative Thinking Ability Through of Inquiry Learni. *Proceeding Biology Education Conference*, *13*(1), 330–334.

Salleh, S. M., Tasir, Z., & Shukor, N. A. (2012). Web-based simulation learning framework to enhance students' critical thinking skills. *Procedia-Social and Behavioral Sciences*, *64*, 372–381.

Samosir, B. S., Lisna, A., & Tua, H. (2019). Pengaruh Model Pembelajaran Kontekstual terhadap Kemampun Berpikir Kreatif dan Hasil Belajar Siswa. *Jurnal Karya Pendidikan Matematika*, *6*(2), 1–7.

Saputra, H., Kurniati, T., & Fadhilah, R. (2020). *Efektivitas Metode Praktikum Indikator asam basa Berbasis Contextual Teaching Learning (CTL) terhadap hasil belajar siswa kelas XI SMA Negeri 7 Pontianak*. *8*(1), 44–51.

Setiawati, S. S. (2020). *Profil model mental siswa pada submateri hukum laju reaksi dengan menggunakan tes diagnostik model mental pilihan ganda dua tingkat*. Universitas Pendidikan Indonesia.

Siswanto, J., & Mustofa, A. W. (2012). *Pengaruh penggunaan model pembelajaran kontekstual dengan media audio-visual terhadap kemampuan berpikir kritis dan kreatif siswa 1*.

Siswo, S. (2019). Penerapan Pembelajaran Kontekstual (Contextual Teaching and Learning) dalam Pembelajaran Sistem Periodik Unsur siswa Kelas X MIPA 3 SMA Negeri 5 Jember. *Jurnal Biologi Dan Konservasi*, *1*(1).

Subawa, K., La Kilo, A., & Laliyo, L. A. R. (2018). Penerapan Model Learning Cycle pada Materi Laju Reaksi untuk Meningkatkan Hasil Belajar. *Jambura Journal of Educational Chemistry*, *13*(1), 51–58.

Taofek, I., & Rusdiana, A. (2020). Pengembangan Lembar Kerja Siswa Berbasis Contextual Teaching and Learning untuk Meningkatkan Keterampilan Berpikir Kritis Siswa pada Materi Laju Reaksi Kimia kelas XI SMA. *Journal of Chemical Education*, *9*(1), 121–125.

Winarti. (2015). *Contextual Teaching and Learning (CTL) untuk Meningkatkan Kemampuan Berpikir Kreatif Siswa*. *1*(1), 1–8.

Yulianti, Y., & Saputra Suhandi, D. (2019). Instrumen Penilaian Berpikir Kreatif Pada Pendidikan Abad 21. *Jurnal Cakrawala Pendas*, *5*(2), 40–44.

Zhafirah, T., Utami, L., Islam, U., Sultan, N., & Kasim, S. (2019). *PENGARUH PENERAPAN MODEL PEMBELAJARAN CTL DENGAN MEDIA*. *1*(2), 64–71.

Formatted: Highlight

JTK: Jurnal Tadris Kimiya 7, 1 (June 2022): 147-156
Website: http://journal.uinsgd.ac.id/index.php/tadris-kimiya/index
ISSN 2527-9637 **(online) ISSN** 2527-6816 **(print)**

Students' Creative Thinking Skills on Reaction Rate Topic through Contextual Teaching and Learning Model

Mangara Sihaloho[1], Ika Riyana Tungkagi[1], Netty Ino Ischak[2], Dewi Budi Purwati[3], Akram La Kilo[1,2]*

[1]Department of Chemistry Education, Faculty of Mathematics and Natural Sciences, Universitas Negeri Gorontalo, Jl. Prof. Dr. Ing. BJ. Habibie, Bone Bolango Regency, 96119, Indonesia
[2]Department of Chemistry, Faculty of Mathematics and Natural Sciences, Universitas Negeri Gorontalo, Jl. Prof. Dr. Ing. BJ. Habibie, Bone Bolango Regency, 96119, Indonesia.
[3]MAN Insan Cendekia Gorontalo, Jl. Harun Al Rasyid, Moutong, Kec. Tilongkabila, Gorontalo 96138
[*]E- mail : akram@ung.ac.id

Received: 06 June 2022; Accepted: 29 June 2022; Published: 30 June 2022

Abstract

This research aims to analyze the contextual teaching and learning (CTL) model on students' creative thinking skills on the reaction rate topic. This quantitative research used true experimental design of pretest posttest control. The samples used in this study were from 11th grade at SMA Negeri 1 Pinolosian. The experimental class sample was given treatment of the CTL learning model while the control class used conventional learning, respectively, were 31 and 30 students of 93 populations. Based on a questionnaire, students' creative thinking skills were obtained through observation during the learning process. The data analysis of the test instrument was carried out through a validity test using the product-moment correlation technique (significant level = 0.05), Lilliefors normality test, homogeneity of variance test and t_{test}. The CTL implementation questionnaire and instrument test data were converted into percentages and categorized. The results showed that the application of the CTL model had a positive effect on students' creative thinking abilities, evidenced by the average score of students in the experimental class before and after treatment increased from 14.55 to 74.84. Otherwise, in the control class, the scores were 30.59 to 33.56. The percentage of students' achievement in creative thinking aspects in the experimental class was good (61%-80%) while the control class was less good (21%-40%). The creative thinking abilities of both classes are very different, which is also reflected in the learning outcomes. The value of t_{count} (2.240) was greater than t_{table} (2.042) at the significant level = 0.05, and the hypothesis of H_0 was rejected, or H_1 was accepted. The application of the CTL learning model positively influenced students' creative thinking skills on the reaction rate material. Students' low originality abilities compared to fluency, flexibility, and elaboration abilities were also discussed.

Keywords: contextual teaching and learning, creative thinking skill, the reaction rate

DOI: https://doi.org/10.15575/jtk.v7i1.18326

1. Introduction

The standard of 21st century education is to have creative thinking skills. Every teacher plays an important role in achieving an educational goal. One of the main goals of this century's education is to emphasize students' ability to think creatively. Creative thinking is an activity to solve a problem that is carried out through an unconscious experiential process which includes fluency in generating a number of ideas, flexibility in using time in producing various types of solutions obtained, novelty of ideas or solutions produced (Coon

& Mitterer, 2014). In the 2013 curriculum, the learning process is expected to encourage students to be able to ask questions, reason, and explain the subject matter that has been obtained so that the learning process is more meaningful (Syuhada et al., 2020, Osman et al., 2015). Creative thinking is the ability to develop an unusual discovery of new ideas, as well as quality of ideas (Febrianti et al., 2016) . The ability to think creatively is also a person's process of thinking and expressing new relationships, seeing events from a new perspective, and being able to combine two new concepts that were previously known (Putra et al., 2016). Students must have the ability to acquire, choose, criticize, be systematic, be logical, be creative and the ability to work together effectively (Samosir et al., 2019). The creative thinking process is convergent to capture the situation, make evaluations and consider the consequences of the chosen solution (Winarti, 2016; Daud et al., 2012).

One of the suitable learning models for the 2013 curriculum and in accordance with authentic assessment is Contextual Teaching and Learning (CTL) (Juniwati & Sari, 2015). This learning model can help teachers relate the material being taught to students' real world situations and encourage students to be able to connect their knowledge with its application in everyday life (Ariesta et al., 2013). In delivering the material, the selected context or example must be in accordance with the daily life and cognitive level of students. Therefore, the selection of appropriate examples can help students to think and take responsibility for their ideas or opinions. Students become more actively involved in discussions so that they are more confident in expressing their opinions and asking questions about things related to the material being studied (Artini et al., 2019) .

The CTL model can improve student learning outcomes because students work and experience, not just receiving material from the teacher (Addaini & Alvina, 2020) . This model can also build conducive interactions between students and teachers (Suryono, 2019) and motivate students to understand the meaning of each material through connectivity with everyday life (Zhafirah & Utami, 2019; Yamin, 2013). These activities indirectly affect students' ability to think critically and creatively in solving various problems they experience (Putra et al., 2016). This model can make students more active in learning, asking more questions, and following learning well (Saputra et al., 2020).

The results of the initial observation at the Senior High School in Bolaang Mongondow Selatan showed that not all of the basic chemistry competencies for 11^{th} grade was taught to students. The teacher only chooses basic competencies related to material at an advanced level and phenomena can be found by students in everyday life. The learning is carried out from home because of the Covid-19 pandemic. Students tend to learn by memorizing, not understanding, and there are many students who feel bored. La Kilo (2017) reported that many students do not understand chemistry because their tendency is to memorize without understanding. This way of memorizing has a bad effect on students' creative thinking skills in processing information from chemistry subject which has an abstract concept. Reaction rate is one of chemistry materials that is abstract and difficult for students to understand (Taofek & Agustini, 2020) . The learning process that takes place in schools is still oriented to the teacher who delivers the material, while students only act as recipients of information (Siswanto & Mustofa, 2012) .

This study aims to study CTL model on students' creative thinking skills of the reaction rate topic. The creative thinking abilities of students studied consist of four aspects, namely fluency, flexibility, originality, and elaboration.

2. Research Method

This research was conducted at SMA Negeri 1 Pinolosian (Pinolosian Public High School 1) on second-grade of science students 2 and science students 3, respectively, as the experimental class (31 students) and the control class (30 students). The samples were taken from 93 populations (three classes) by simple random sampling. The CTL model was applied in the experimental class for three meetings (2 x 45 minutes per meeting) while the control class applied a conventional model. The main stages of the CTL model are observing, asking questions, collecting and communicating the topic given. Students observed the phenomenon of swimming pools that were given chlorine. The teacher involved students in asking questions and seeking information on the topic. Data collection was based on student worksheets regarding factors affecting the reaction rate. In groups, students read and discuss/analyze the questions and then provide conclusions from the given phenomena. The next stage (association), students conclude the factors that affect the reaction rate. Each group conveys and concludes the results of joint discussions regarding the phenomena that have been presented in the worksheet. Finally, students pay attention to the teacher's explanation of the factors that affect the rate of reaction.

The research design used pretest-posttest control. The data for the two classes were collected using questionnaire and test. The questionnaire used was intended to determine student responses to the use of the CTL model on the reaction rate topic (Table 1). Students' creative thinking skills were obtained through a written test instrument with nine items of reaction rate material. This instrument refers to the four indicators of students' creative thinking aspects proposed by (Purwaningrum, 2016); fluency, flexibility, originality, and elaboration.

Table 1. Questionnaire on the Implementation of the CTL Model

Code	Statements
S1	The teacher conveys the learning objectives well
S2	Each case given by the teacher in learning the material on the rate of reaction can be done either individually or in groups.
S3	I can cooperate better with a group of friends when working on tasks related to everyday life.
S4	The understanding of the reaction rate material becomes better after the teacher explains the material related to everyday life.
S5	The results of my study of the reaction rate material increased.
S6	The atmosphere in the classroom is more conducive and fun when the teacher explains the reaction rate material associated with everyday life.
S7	The presentation of the questions displayed relating to daily life described by the teacher, adds to the understanding.
S8	After explaining the reaction rate material associated with daily life, I became bold in communicating with my friends and teacher during the learning process.
S9	The explanation of the reaction rate material associated with daily life presented by the teacher may increase my desire to explore the material, especially the reaction rate material.
S10	I think that the CTL method applied by the teacher in the classroom, especially in learning the reaction rate material is very appropriate.

In this study, the measurement of students' creative thinking skills used a written test instrument. The instrument refers to four indicators of the creative thinking aspect of students proposed by (Purwaningrum, 2016). The criteria for assessing students' creative thinking abilities can be seen in Table 2.

Table 2. Creative Thinking Skills Grid

Skills	Indicators	Items
Fluency	Students can compose answers that are relevant to the information given about the reaction rate topic.	1, 5, 6
Flexibility	Students can solve problems with varied answers and according to their experience	2, 4, 7, 8
Originality	Students can solve problems according to their own ideas	9
Elaboration	Students can make an answer model according to the problem or information obtained on the reaction rate material.	6, 3

Analysis of observational data was carried out by observing students' creative thinking skills during the learning process. Then the data were analyzed and described to determine the effect of the CTL model. Meanwhile, the data analysis of the test instrument was carried out through a validity test using the product moment correlation technique (significant level = 0.05), Lilliefors normality test, homogeneity of variance test and t_{test}. Data of the CTL implementation questionnaire and instrument test were converted into percent and categorized by score as shown in Table 3.

Table 3. Questionnaire Categories and Student's Creative Thinking

Score Range (%)	Category
0 – 20	Very less
21 – 40	Not enough
41-60	Enough
61- 80	Good
81- 100	Very good

Testing the hypothesis in this study used a t_{test}, with the design:

$$H_0 = t_{count} \leq t_{table}$$
$$H_1 = t_{count} > t_{table}$$

Description:

H_0 = there is no positive effect of using the CTL model on students' creative thinking skills

H_1 = there is a positive effect of using the CTL model on students' creative thinking skills.

3. Result and Discussion

3.1. Implementation of the CTL model

The use of the CTL model on the reaction rate material obtained a very good response from most students as the results of the questionnaire shown in S1, S3, S4, S7, and S10 in Figure 1. Students were able to work well with the tasks given by the teacher. The teacher conveyed learning objectives well and presented the material in an interesting way, which was related to everyday life. In addition, the curiosity and communication arising from the students resulted a conducive classroom atmosphere as well as the support for presentations from S2, S5, S6, S8, and S9. There were a small number of students who responded negatively to this CTL model, especially cooperation (S3) and curiosity (S9). The CTL model applied to this reaction rate material has met the requirements and the data obtained can be used in this study as well as the results can be compared with conventional learning.

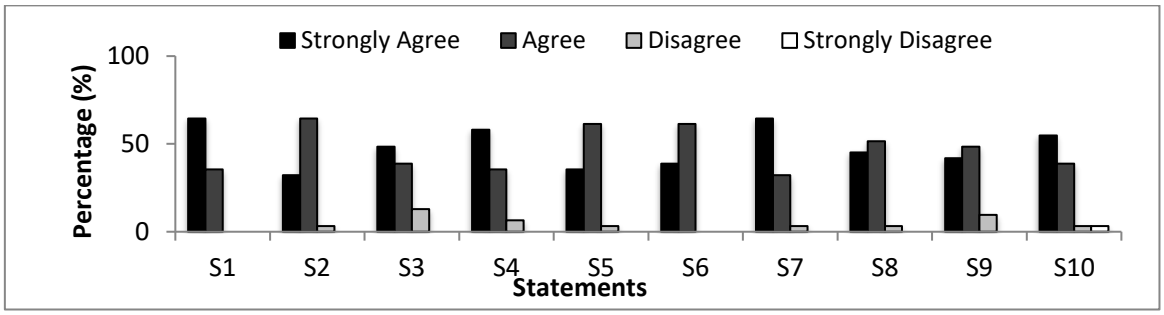


Figure 1. The Results of the Questionnaire Test on the Implementation of the CTL Model

Nugraheni (2015) reported that the CTL model can make students care about the environment compared to conventional learning. This research not only made students care about the environment but students also care about learning as expressed in the passion and cooperation between students.

3.2. Test Data

3.2.1. Normality

The normality test in this study used the Liliefors formula with a significant level of 0.05. The results obtained from the two classes can be seen in Table 4.

Table 4. Normality Test Results

Class	Group	N	L_{count}	L_{table}	Status
Expt.	Pretest	31	0.16		
	Posttest	31	0.14	0.24	Normal
Control	Pretest	30	0.10		
	Posttest	30	0.11		

The results of the normality test of the pretest and posttest for the experimental class (second-grade of science students 2) and the control class (second-grade of science students 3) showed that the L_{table} at the significant level of 0.05 was 0.242. This score was greater than the score of L_{count} ($L_{count} < L_{table}$) so that H_o was accepted, the data were normally distributed.

3.2.2. Homogeneity

The homogeneity test used Fisher (F) test with a significant level of = 0.05. The results of the homogeneity test obtained from the two classes can be seen in Table 5.

Table 5. Homogeneity Test Results

Class	Variance	F_{count}	F_{table}	Concl.
Expt.	115.35	1.091	1.854	Homoge-
Control	105.69	1.091	1.854	neous

The data showed that the $F_{count} < F_{table}$ (1.091 < 1.854) so H_0 was accepted which indicated that the variance of the two samples was homogeneous.

3.2.3.Hypothesis

The results of the calculation of the normality test and the homogeneity of variance at the pretest and posttest showed that the two samples (classes) were normally distributed and homogeneous, so that the hypothesis testing requirements in this study were met with the t_{test}. H as the results of the calculation obtained the value of t_{count} = 2.240 and t_{table} = 2.042 with a significant level of = 0.05. Because $t_{count} > t_{table}$, then H_0 was rejected or H_1 was accepted. This means that the application of the CTL model has a positive influence on students' creative thinking skills on the reaction rate topic.

3.3. Students' Creative Thinking Skills

The achievement of creative thinking skills of experimental class and control class students were shown in Figure 2. The results of the control class students' creative thinking were very low for all indicators, with an average score of 30.7%. Otherwise, the creative thinking ability of experimental class students who were taught using the CTL model was high, with an average score of 73.70%. Specifically, for the experimental class, three students scored in the high category (85), 20 students in the medium category (between 70 and 85), and eight students scored low, 70.

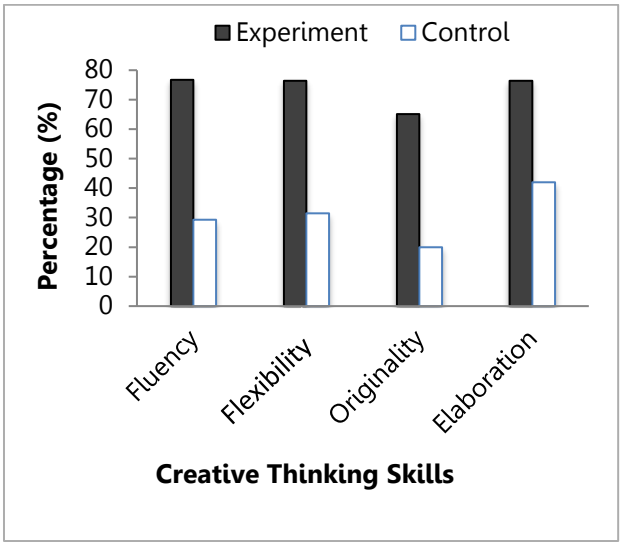


Figure 2. Percentage of Achievement of Each Indicator of Students' Creative Thinking Based on the Posttest Results of the Experimental Class and Control Class

Fluency skill of experimental class students showed that students can think fluently, generate opinions or solve problems, and

always think of more than one answer, with an ability level of 76.77%. In the second aspect, flexibility skill got score of 76.40%, meaning that students are able to generate ideas, answers or can look for many different problem-solving alternatives. Creative thinking are also a habit of a person to turn on an imagination, express and create amazing new points of view and unexpected ideas (Purwaningrum, 2016) . The elaboration skill of students was 76.45% which means students can enrich and develop ideas that lay out the details of a situation so that it is more interesting. Meanwhile, students' originality skill decreased to 65.16% compared to the other three thinking skills. The achievement in the originality aspect was low compared to the fluency, flexibility, and elaboration thinking aspects. In the control class, the ability to think creatively from fluency, flexibility, originality, and elaboration was successively 29.3%, 31.5%, 20%, and 42%. Pikoli et al. (2022) reported that students' multiple representations in understanding the concept of reaction rate were still very low at the submicroscopic level namely the three mental models from the initial, synthetic, and scientific models were 36.2, 29.4 and 34.4%, respectively. Even the type of mental model (both answer and reason were wrong) was found in many students in determining the graph of the relationship between the rate and the concentration of the reactants (Setiawati, 2020). It shows that conventional learning on the reaction rate material is not able to explore students' creative thinking skills. Conventional learning encourages students to only memorize instead of understanding which can cause students to lack understanding of chemistry because the creativity potential of students does not rise (Hasanah et al., 2020; Laliyo et al., 2020; Subawa et al., 2018). The inquiry learning model and scientific approach are effective in improving students' critical thinking skills on the reaction rate material (Agustin et al., 2016; Ilaah, 2015).

Students' thinking ability was also reflected in the pretest and posttest outcomes on topic of factors affecting the rate of reaction as shown in Figure 3.

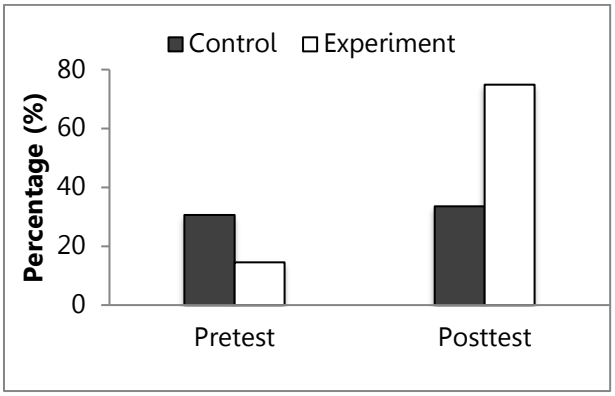


Figure 3. Average of Pretest and Posttest for Experimental and Control Class

Based on Figure 3, the pretest results of the experimental class obtained an average of 14.55% which was lower than the average score of the control class 30.59%. In contrast, the posttest results of experimental class after the implementation of the CTL model increased with an average score of 78.84%. This means that the creative thinking level of the experimental class students to complete and answer the questions has reached the minimum completeness criteria (*Kriteria Ketuntasan Minimum/KKM*). For the control class, the posttest obtained an average score of 33.56%, there was no significant increase from the pretest score. Control class students are less able to solve problems and their scores have not reached the *KKM* which show low creative thinking skills. It shows that the use of the CTL model can make students develop a detail and interesting idea from a situation. This is in line with reports that CTL is proven to be effective in improving students' cognitive abilities and thinking skills both through simulations and experiments related to phenomena in everyday life (Mulyono, 2018; Salleh et al., 2012).

Students' creative thinking skills can be improved by using learning methods that are implemented in the learning process. In this case, students are directly involved in solving problems so that students are likely to be able to generate new ideas (originality), broadly and diversely (Haryanti & Saputra, 2019). Originality in problem solving refers to the ability of students to answer problems with

several different answers that are correct or one answer that cannot be done by other students (Jumi et al., 2018). One aspect that is predicted to increase the ability of originality is to guide students intensely in solving problems. Through the guidance process with a science process skills approach, students are directly involved, not only listening, but they also can solve problems in the laboratory to gain knowledge (Ischak et al., 2020) . Here students really act as scientists in discovering new ideas. Hasanah et al. (2020) also reported that students' innovations or new ideas in solving chemical problems related to everyday life can be improved through the STEM-Cp (Science, Technology, Engineering, Mathematics, and Contextual Problem) approach. Students' independence in learning to practice creative thinking skills can be done through STEM-Cp-based books that are associated with problems in everyday life (Hasanah et al., 2020).

4. Conclusion

The application of the CTL model positively affects students' creative thinking skills on the reaction rate material. On the other hand, conventional learning does not generate these abilities. This was proven through statistical analysis of test results from pretest and posttest. Through CTL learning, students' creative thinking ability was high (73.70%), although the score of originality ability was lower, 65.16%. To train students' thinking skills, especially originality, it is estimated that this can be done by self-study through the STME-Cp-based reaction rate book and guided learning with a process skills approach.

References

Addaini, A., & Alvina, S. (2020). Pengaruh Model Pembelajaran Contextual Teaching Learning (CTL) terhadap Hasil Belajar Siswa pada Materi Suhu dan Kalor. *Jurnal Riset Inovasi Pembelajaran Fisika,* *2*(2), 16–22. https://doi.org/10.29103/relativitas.v3i1.2536

Agustin, Y., Fadiawati, N., & Tania, L. (2016). Peningkatan Keterampilan Berpikir Kritis Siswa pada Materi Laju Reaksi Melalui Pendekatan Saintifik. *Jurnal Pendidikan Dan Pembelajaran Kimia*, *5*(3), 98–112. Retrieved from http://jurnal.fkip.unila.ac.id/index.php/JPK/article/view/12420

Ariesta, N., Ariani, D., Retno, S., & Haryono, H. (2013). Pengaruh Pembelajaran Kimia Dengan Pendekatan CTL (Contextual Teaching and Learning) Melalui Metode Guided Inquiry Dan Proyek Terhadap Prestasi Belajar Ditinjau Dari Kemampuan Matematik Siswa Pada Materi Kelarutan Dan Hasil Kali Kelarutan Kelas XI IPA SMA. *Jurnal Pendidikan Kimia Universitas Sebelas Maret, 2*(3), 59-67. Retrieved from https://www.neliti.com/id/publications/126088/pengaruh-pembelajaran-kimia-dengan-pendekatan-ctl-contextual-teaching-and-learni

Artini, D., Suardana, N., & Wiratini, M. (2019). Pengaruh Model Pembelajaran Kontekstual pada Pokok Bahasan Hidrokarbon terhadap Hasil Belajar Kimia. *Jurnal Pendidikan Kimia Undiksha*, *3*(1), 20–28. https://doi.org/10.23887/jjpk.v3i1.21156

Coon, D., & Mitterer, J. O. (2014). *Psychology: Modules for active learning.* Cengage Learning.

Daud, A. M., Omar, J., Turiman, P., & Osman, K. (2012). Creativity in science education. *Procedia-Social and Behavioral Sciences, 59*, 467-474. https://doi.org/10.1016/j.sbspro.2012.09.302

Febrianti, Y., Djahir, Y., & Fatimah, S. (2016). Analisis Kemampuan Berpikir Kreatif Peserta Didik dengan Memanfaatkan Lingkungan pada Mata Pelajaran Ekonomi di SMA Negeri 6 Palembang. *Jurnal Profit*, *3*(1), 121–127. Retrieved from

https://ejournal.unsri.ac.id/index.php/jp/article/view/5561

Haryanti, Y. D., & Saputra, D. S. (2019). Instrumen penilaian berpikir kreatif pada pendidikan abad 21. *Jurnal Cakrawala Pendas, 5*(2), 58-64. http://dx.doi.org/10.31949/jcp.v5i2.1350

Hasanah, N., Sutarto, S., Nuriman, N., & Budiarso, A. S. (2020). STEM-CP (Science, Technology, Engineering, Mathematics, and Contextual Problem) Based Colloid Textbook to Increase Creative Thinking Skill for Chemistry Learning in Senior High School. *Pancaran Pendidikan*, *9*(1). https://doi.org/10.25037/pancaran.v9i1.274

Ilaah, Y. F. (2015). Critical thinking skill of student SMA Kemala Bhayangkari 1 Surabaya on reaction rates topic by implementation of inquiry learning models. *UNESA Journal of Chemical Education*, *4*(1). Retrieved fro https://ejournal.unesa.ac.id/index.php/journal-of-chemical-education/article/view/10854

Ischak, N. I., Odja, E. A., La Kilo, J., & La Kilo, A. (2020). Pengaruh Keterampilan Proses Sains Melalui Model Inkuiri Terbimbing terhadap Hasil Belajar Siswa pada Materi Larutan Asam Basa. *Hydrogen: Jurnal Kependidikan Kimia*, *8*(2), 58–66. Retrieved from http://e-journal.undikma.ac.id/index.php/hydrogen/article/view/2748-6847-1

Jumi, W., Suleman, N., & Tangio, J. S. (2018). Identifikasi Kemampuan Berpikir Kreatif Siswa Menggunakan Soal Tes Open Ended Problem Pada Materi Elektrokimia di SMA Negeri 1 Telaga. *Jambura Journal of Educational Chemistry, 13*(1), 35-43. Retrieved from https://www.neliti.com/publications/277442/identifikasi-kemampuan-berpikir-kreatif-siswa-menggunakan-soal-tes-open-ended-pr

Juniwati, J., & Sari, R. P. (2019). Pengaruh Model Contextual Teaching and Learning (CTL) pada Pembelajaran IPA Terhadap Keterampilan Berfikir Kritis Peserta Didik. KATALIS: *Jurnal Penelitian Kimia dan Pendidikan Kimia, 2*(2), 38-45. Retrieved from https://ejurnalunsam.id/index.php/katalis/article/view/1844

La Kilo, A. (2017). Solusi rumus derajat keasaman reaksi asam basa pada larutan penyangga dengan metode mol awal (rumus akram). *PATEN*, *8*(1065). Retrieved from https://www.academia.edu/download/58857177/Rumus_Akram_dan_hakinya.pdf

Laliyo, L. A. R., Kau, M., La Kilo, J., & La Kilo, A. (2020). Kemampuan siswa memecahkan masalah hukum-hukum dasar kimia melalui pembelajaran inkuiri terbimbing. *AR-RAZI Jurnal Ilmiah*, *8*(1), 1–8. https://doi.org/10.29406/ar-r.v8i1.1875

Mulyono, Y. (2018). Improving creativity of the future physics teachers through general biology learning based on CTL with experimental method. *Indonesian Journal of Science and Education*, *2*(1), 1–7. https://doi.org/10.31002/ijose.v2i1.621

Nugraheni, R. A. S. (2015). *Pengaruh Contextual Teaching and Learning (CTL) terhadap Sikap peduli Lingkungan Siswa Kelas IV di SD Negeri Selang Kecamatan Wonosari Kabupaten Gunungkidul.* Thesis, Lumbung Pustaka Universitas Negeri Yogyakarta. Retrieved from https://eprints.uny.ac.id/23454/1/SKRIPSI.pdf

Osman, S. Z. M., Jamaludin, R., & Iranmanesh, M. (2015). Student Centered Learning at USM: What Lecturer and Students Think of This New Approach?. *Journal of Education and Practice, 6*(19), 264-277. Retrieved from https://eric.ed.gov/?id=EJ1079536

Pikoli, M., Sukertini, K., & Isa, I. (2022). Analisis Model Mental Siswa dalam Mentransformasikan Konsep Laju Reaksi Melalui Multipel Representasi. *Jambura Journal of Educational Chemistry*, *4*(1), 8–12. https://doi.org/10.34312/jjec.v4i1.13515

Purwaningrum, J. P. (2016). Mengembangkan Kemampuan Berpikir Kreatif Matematis Melalui Discovery Learning Berbasis Scientific Approach. *Refleksi Edukatika*, *6*(2), 145–157. https://doi.org/10.24176/re.v6i2.613

Putra, R. D., Rinanto, Y., Dwiastuti, S., & Irfa, I. (2016). Peningkatan Kemampuan Berpikir Kreatif Siswa melalui Model Pembelajaran Inkuiri Terbimbing pada Siswa Kelas XI MIA 1 SMA Negeri Colomadu Karanganyar Tahun Pelajaran 2015 / 2016 The Increasing of Students Creative Thinking Ability Through of Inquiry Learni. *Proceeding Biology Education Conference*, *13*(1), 330–334. Retrieved from https://jurnal.uns.ac.id/prosbi/article/view/5738

Salleh, S. M., Tasir, Z., & Shukor, N. A. (2012). Web-based simulation learning framework to enhance students' critical thinking skills. *Procedia-Social and Behavioral Sciences*, *64*, 372–381. https://doi.org/10.1016/j.sbspro.2012.11.044

Samosir, B. S., Lisna, A., & Tua, H. (2019). Pengaruh Model Pembelajaran Kontekstual terhadap Kemampun Berpikir Kreatif dan Hasil Belajar Siswa. *Jurnal Karya Pendidikan Matematika*, *6*(2), 1–7. Retrieved from https://jurnal.unimus.ac.id/index.php/JPMat/article/view/5037

Saputra, H., Kurniati, T., & Fadhilah, R. (2020). Efektivitas Metode Praktikum Indikator asam basa Berbasis Contextual Teaching Learning (CTL) terhadap hasil belajar siswa kelas XI SMA Negeri 7 Pontianak. *Ar-Razi Jurnal Ilmiah, 8*(1), 44–51. http://dx.doi.org/10.29406/ar-r.v8i1.1824

Setiawati, S. S. (2020). *Profil model mental siswa pada submateri hukum laju reaksi dengan menggunakan tes diagnostik model mental pilihan ganda dua tingkat*. Doctoral dissertation, Universitas Pendidikan Indonesia. Retrieved from http://repository.upi.edu/id/eprint/54582

Siswanto, J., & Mustofa, A. W. (2012). Pengaruh Penggunaan Model Pembelajaran Kontekstual Dengan Media Audio-Visual Terhadap Kemampuan Berpikir Kritis Dan Kreatif Siswa. *Media Penelitian Pendidikan, 6*(1), 1-9. Retrieved from http://journal.upgris.ac.id/index.php/mediapenelitianpendidikan/article/view/358

Subawa, K., La Kilo, A., & Laliyo, L. A. R. (2018). Penerapan Model Learning Cycle pada Materi Laju Reaksi untuk Meningkatkan Hasil Belajar. *Jambura Journal of Educational Chemistry*, *13*(1), 51–58. Retrieved from https://media.neliti.com/media/publications/277384-penerapan-model-learning-cycle-pada-mate-9095d31a.pdf

Suryono, S. (2019). Penerapan Pembelajaran Kontekstual (Contextual Teaching And Learning) Dalam Pembelajaran Sistem Periodik Unsur Siswa Kelas X Mipa 3 Sma Negeri 5 Jember. B*IO-CONS: Jurnal Biologi dan Konservasi, 1*(1), 17-27. Retrieved from http://jurnal.unipar.ac.id/index.php/biocons/article/view/227/233

Syuhada, F. A., Dalimunthe, M., Sari, W. S. N., & Sihombing, J. L. (2020). Penerapan Model Pembelajaran Contextual Teaching and Learning dengan Media LKS untuk Meningkatkan Kerjasama dan hasil Belajar Kimia Siswa. *JS (Jurnal Sekolah), 4*(2), 150-157. Retrieved from file:///C:/Users/asus/Downloads/17971-

40147-1-SM.pdf

Taofek, I., & Agustini, R. (2020). Pengembangan Lembar Kerja Siswa berbasis Contextual Teaching and Learning untuk Meningkatkan Keterampilan Berpikir Kritis Siswa pada Materi Laju Reaksi Kimia Kelas XI SMA. *UNESA Journal of Chemical Education, 9*(1), 121-126. Retrieved from https://ejournal.unesa.ac.id/index.php/journal-of-chemical-education/article/view/32066

Winarti, W. (2016). Contextual teaching and learning (CTL) untuk meningkatkan kemampuan berpikir kreatif siswa. *Jurnal Pendidikan Fisika Dan Keilmuan (JPFK*), *1*(1), 1-8. http://doi.org/10.25273/jpfk.v1i1.4

Yamin, M. (2013). *Strategi dan metode dalam model pembelajaran.* Jakarta: GP Press Group.

Zhafirah, T., & Utami, L. (2019). Pengaruh Penerapan Model Pembelajaran CTL Dengan Media Lingkungan Terhadap Motivasi Belajar Siswa Pada Materi Koloid. *JEDCHEM (JOURNAL EDUCATION AND CHEMISTRY), 1*(2), 64-71. Retrieved from http://ejournal.uniks.ac.id/index.php/JEDCHEM/article/view/137/133