ECLÉTICA QUÍMICA

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Peer Review Reports

Effects of small-scale chemistry STEM integrated with local contexts for enhancing grade 11 students' learning achievement and learning and innovation skills

The article went through 2 rounds of review and all 3 reviewers agreed in advance to publish their review reports anonymously.
The authors agreed to disclose the reviewer's reports and their responses to the reviewers' comments.

Disclaimer: The peer review report content is the entire copy of the reviewers' and authors' comments. Typing and punctuation errors are not edited.

ROUND 1

Reviewer A
Recommendation: Revisions Required

1) Title: This research should use terms consistently from title to conclusion. The title of the research should describe the content of the research. Actually, how many dependent variables is this research?
2) Graphical Abstract: It's best to put it in the right place.
3) Methodology:
- The learning model resulting from the development needs to be described, its principles, phases, and students' learning experiences in each phase;
- Developed Learning Model: The relevance of the developed learning model to the expected learning outcomes needs to be explained explicitly;
- The dependent variable of this research is also less systematic, 2 variables [Chemical Kinetics Achievement and "Learning & Innovation Skills"], 3 variables [Chemical Kinetics Achievement, Learning Skills, and Innovation Skills (Communication and Teamwork or Collaboration Skills)], or 4 variables [Chemical Kinetics Achievement, Critical Thinking Skills, Creative Thinking for Innovation Skills, and Innovation Skills]? These dependent variables need to be reorganized and stated explicitly and consistently so they are easy to understand.

Reviewer B
Recommendation: Revisions Required

1) Abstract: The Learning and Innovation Skills you mentioned consist of:
- Critical Thinking Skills;
- Creative Thinking for Innovation Skills;
- Communication and Collaboration Skills.

Must be consistent.
2) Keyword 4 "educational needs": replace with Learning achievement.
3) Graphical Abstract: Image placement. Should this image be made? An explanation of this image is already in the manuscript.
4) Literature Review: Which did the researcher use in this study? needs to be explained
5) Data collection:
- Not consistent with what is written in the Abstract;
- Each situation has only 4 questions. Why are there 16 questions in total? It's confusing.

6) Conclusion: Academic performance was not reported in this study. what exists is learning achievement.
7) References: Please add references to the latest research

Reviewer C
Recommendation: Revisions Required

1. The title of this research is too long and complex
2. The research objectives are not clear
3. The research method used is R&D but in the results & discussion using t-test there are control and experimental classes
4. This research uses class XI in 2019, 2020, 2021?
Are there any increases in the variables being assessed this third year?
5. If you use 3 years, why is only 1 discussed, which year's data? the latest research is carried out
6. add highlight 3-5 sentences less than 85 words
7. The image is not placed in the abstract section
8. Use active sentences when writing sentences and don't repeat sentences in other paragraphs. Between sentences and between paragraphs must be connected
9. Write citations in sentences using the ACS references template
10. The citation name is not too long
11. Add the latest references and come from Scopus articles outside Thailand. not too old years 1999, 2000 ect
12. Add research questions in introduction according to the results and discussion
13. Don't explain things too long that are not in accordance with the sub-theme topic
14. add conclusions/analysis from Table 1. Common teaching steps of STEM education
15. the method presented is unclear. Please rewrite it in a structured manner and there are no duplicates. create a schematic so that it is easy to read and understand. Separate sub-discussions with letters or numbers
16. The methods section is too complex and confusing because data collection, data analysis, population are repeated. create tables/schemes so they are easy to understand
17. table 2 uncler. What's the problem and need? Please write clearly not only the mean and SD results
18. There is no discussion of each table presented
19. Table 4. Summarized teaching steps of CSSC-STEM Model in each column there is no citation and the last column contains different syntax from the other columns. where did this syntax come from?
20. on page 12 steps of CSSC-STEM model make it in table/scheme form to make it more communicative and informative
21. In table 5 the contents of the table should not be the mean and SD but the total score of each expert
22. pg 14 add numbering to each subtitle
23. Video clips 1-3 do not have pictures. It is better to provide an example of the video and the discussion is arranged neatly in a table/scheme
24. page 15 practical activities are best in the form of pictures/schemes
25. STEM discussion page 16 is best in table/scheme form
26. Table 6-19 is less understandable because this research uses a development method but uses a t-test and there are pre-post values.
why is the table only mean and SD? Please look at table 6-19 again and combine it if possible so that it is easy to analyze and read the table
27. Focus on the reaction rate material, don't add other chemical materials
28. The conclusion contains the results of the research, limitations, and recommendations for further research
29. References use ACS format. remove the word Thai and additional references from several Scopus articles other than Thailand. add journal/doi link.

ANSWERS TO ROUND 1

Thanks for your good effort in addressing my feedback.

Section	Comments	Revision made/ Response
Title	1. The title of this research is too long and complex	The title was shortened from: Effects of Small-Scale Chemistry STEM integrated with Local Contexts for Enhancing Grade 11 Students' Learning Achievement and Learning and Innovation Skills in the Rate of Chemical Reactions Topic To: Effects of Small-Scale Chemistry STEM integrated with Local Contexts for Enhancing Grade 11 Students' Learning Achievement and Learning and Innovation Skills
Research objectives	2. The research objectives are not clear	I add research objectives as: 1.2 Research Objectives This study aimed to; a) create the context-based small-scale chemistry STEM (CSSC-STEM) Model; and b) examine the effects of CSSC-STEM model on Grade 11 students' learning achievements and learning and innovation skills.
Research method	3. The research method used is R&D but in the results & discussion using t-test there are control and experimental classes	In R2D2 and R3D3, the researchers used quasi-experimental research as a research design for R2 and R3; so that why *t*-test was utilized. Also, there were two classes joined; one control and one experimental class in a quasi-experimental design.
Method	4. This research uses class XI in 2019, 2020, 2021? Are there any increases in the variables being assessed this third year?	The variables are the same.
Discussion	5. If you use 3 years, why is only 1 discussed, which year's data? the latest research is carried out	I add discussion in the third year already.
Highlights	6. add highlight 3-5 sentences less than 85 words	Highlight was added as: Highlights • STEM education, Small Scale Chemistry and Context-based Learning (CBL) are integrated into a new teaching model so called Context-based Small Scale Chemistry STEM (CSSC-STEM) model • CSSC-STEM model and its lesson plans are qualified by a panel of experts • CSSC-STEM model can practically enhance Grade 11 students' learning achievements and learning and innovation skills in the Rate of Chemical Reactions topic.
Graphical abstract	7. The image is not placed in the abstract section	From the instruction provided, the graphical abstract must be submitted as *.jpg, *.jpeg, *.tif or *.ppt files as supplementary file. So, the authors separated it from the manuscript. Anyway, I added the graphical abstract in the manuscript at the place marked.
Throughout manuscript	8. Use active sentences when writing sentences and don't repeat sentences in other paragraphs. Between sentences and between paragraphs must be connected	I check all sentences and revise to be active sentences. Only some passive sentences are left to show the tone of passive voice. For example, Active sentence: Chemistry lecturers initially applied SSC to teach organic chemistry experiments for students. The researchers conducted R1D1 in the 2019 academic year. Finally, the researchers carried out R3D3 in the first semester of the academic year 2021. A panel of five experts checked the congruence between the questions and the objectives (Index of Item-Objective Congruence: IOC) of the teachers and students' perspective on current state, problems and needs of teaching and learning about chemistry questionnaires. The Cronbach's alpha coefficient of student version questionnaire was 0.81 that was in acceptable level.
References	9. Write citations in sentences using the ACS references template	I revise all references to align with ACS references.
References	10. The citation name is not too long	I check and the titles are correct. It is long because the original version is long also.

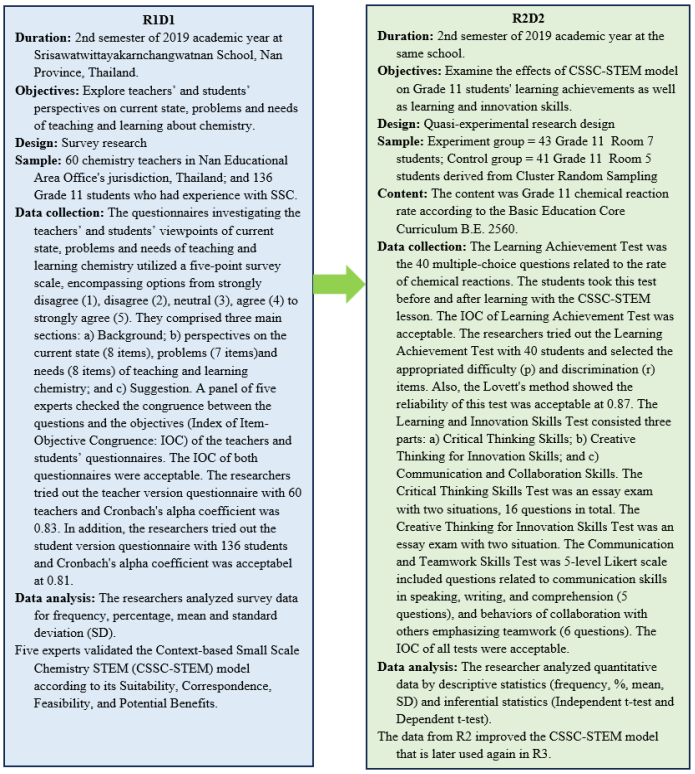
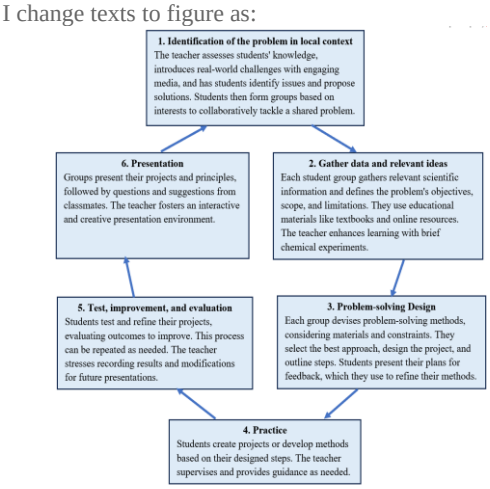
References	11. Add the latest references and come from Scopus articles outside Thailand. not too old years 1999, 2000 ect	I include some old references because they are so important as a basis for educational reform in Thailand such as National Education Act, Basic Core Education Curriculum.
Research questions	12. Add research questions in introduction according to the results and discussion	I add research questions as: 1.1 Research Questions The research questions for this study were; a) What are the characteristics of the context-based small-scale chemistry STEM (CSSC-STEM) Model; and b) What are the effects of CSSC-STEM model on Grade 11 students' learning achievements and learning and innovation skills.
Throughout manuscript	13. Don't explain things too long that are not in accordance with the sub-theme topic	I check and revise some long sentences and shorten them.
Table 1	14. add conclusions/analysis from Table 1. Common teaching steps of STEM education	I add conclusion of Table 1 as: There were six common teaching steps of STEM education, that is, Identification of the problem in local context; Gather data and relevant ideas; Problem-solving Design; Practice; Test, improvement and evaluation; and Presentation.
Method	15. the method presented is unclear. Please rewrite it in a structured manner and there are no duplicates. create a schematic so that it is easy to read and understand. Separate sub-discussions with letters or numbers	
Method	16. The methods section is too complex and confusing because data collection, data analysis, population are repeated. create tables/schemes so they are easy to understand	I revised the method section and add figure to summarize the research process as:  **R1D1** **Duration:** 2nd semester of 2019 academic year at Srisawatwittayakarnchangwatnan School, Nan Province, Thailand. **Objectives:** Explore teachers' and students' perspectives on current state, problems and needs of teaching and learning about chemistry. **Design:** Survey research **Sample:** 60 chemistry teachers in Nan Educational Area Office's jurisdiction, Thailand; and 136 Grade 11 students who had experience with SSC. **Data collection:** The questionnaires investigating the teachers' and students' viewpoints of current state, problems and needs of teaching and learning chemistry utilized a five-point survey scale, encompassing options from strongly disagree (1), disagree (2), neutral (3), agree (4) to strongly agree (5). They comprised three main sections: a) Background; b) perspectives on the current state (8 items), problems (7 items)and needs (8 items) of teaching and learning chemistry; and c) Suggestion. A panel of five experts checked the congruence between the questions and the objectives (Index of Item-Objective Congruence: IOC) of the teachers and students' questionnaires. The IOC of both questionnaires were acceptable. The researchers tried out the teacher version questionnaire with 60 teachers and Cronbach's alpha coefficient was 0.83. In addition, the researchers tried out the student version questionnaire with 136 students and Cronbach's alpha coefficient was acceptabel at 0.81. **Data analysis:** The researchers analyzed survey data for frequency, percentage, mean and standard deviation (SD). Five experts validated the Context-based Small Scale Chemistry STEM (CSSC-STEM) model according to its Suitability, Correspondence, Feasibility, and Potential Benefits. **R2D2** **Duration:** 2nd semester of 2019 academic year at the same school. **Objectives:** Examine the effects of CSSC-STEM model on Grade 11 students' learning achievements as well as learning and innovation skills. **Design:** Quasi-experimental research design **Sample:** Experiment group = 43 Grade 11 Room 7 students; Control group = 41 Grade 11 Room 5 students derived from Cluster Random Sampling **Content:** The content was Grade 11 chemical reaction rate according to the Basic Education Core Curriculum B.E. 2560. **Data collection:** The Learning Achievement Test was the 40 multiple-choice questions related to the rate of chemical reactions. The students took this test before and after learning with the CSSC-STEM lesson. The IOC of Learning Achievement Test was acceptable. The researchers tried out the Learning Achievement Test with 40 students and selected the appropriated difficulty (p) and discrimination (r) items. Also, the Lovett's method showed the reliability of this test was acceptable at 0.87. The Learning and Innovation Skills Test consisted three parts: a) Critical Thinking Skills; b) Creative Thinking for Innovation Skills; and c) Communication and Collaboration Skills. The Critical Thinking Skills Test was an essay exam with two situations, 16 questions in total. The Creative Thinking for Innovation Skills Test was an essay exam with two situation. The Communication and Teamwork Skills Test was 5-level Likert scale included questions related to communication skills in speaking, writing, and comprehension (5 questions), and behaviors of collaboration with others emphasizing teamwork (6 questions). The IOC of all tests were acceptable. **Data analysis:** The researcher analyzed quantitative data by descriptive statistics (frequency, %, mean, SD) and inferential statistics (Independent t-test and Dependent t-test). The data from R2 improved the CSSC-STEM model that is later used again in R3. **Figure 1.** R1D1 and R2D2 research process
Table 2	17. Table 2 unclear. What's the problem and need? Please write clearly not only the mean and SD results	To make clearer, I add this: The teachers highlighted issues related to students' low learning achievement and deficiencies in learning and innovation skills. They also emphasized the need for a new teaching model that integrates STEM with context-based learning and Small Scale Chemistry.

Table 4	19. Table 4. Summarized teaching steps of CSSC-STEM Model in each column there is no citation and the last column contains different syntax from the other columns. where did this syntax come from?	The previous topics already show the teaching steps of STEM, CBL and SSC; so, there is no citation in this table. I revise Table 4 as: **Table 4.** Summarized teaching steps of CSSC-STEM Model. Concept and Principle of STEM Education / Concept and Principle of SSC / Concept and Principle of context-based learning / Summarized teaching steps of CSSC-STEM Model Identification of the problem in local context / Identify content to use SSC / Link content with situations closely related to the students' real-life contexts / **Identification of the problem in local context** Gather data and relevant ideas / Explore targeted content / Identify the problem in the context / **Gather data and relevant ideas** Problem-solving Design / Design SSC / Plan / **Problem solving design** Practice / Practice with SSC / Solve local context problem / **Practice** Test, improvement and evaluation / Analyze and conclude / Learning from diverse contexts interconnected with chemistry knowledge / **Test, improvement and evaluation** Presentation / Presentation / transfer these understandings to other situations or events / **Presentation**
CSSC-STEM model	20. on page 12 steps of CSSC-STEM model make it in table/scheme form to make it more communicative and informative	I change texts to figure as:  1. Identification of the problem in local context: The teacher assesses students' knowledge, introduces real-world challenges with engaging media, and has students identify issues and propose solutions. Students then form groups based on interests to collaboratively tackle a shared problem. 2. Gather data and relevant ideas: Each student group gathers relevant scientific information and defines the problem's objectives, scope, and limitations. They use educational materials like textbooks and online resources. The teacher enhances learning with brief chemical experiments. 3. Problem-solving Design: Each group devises problem-solving methods, considering materials and constraints. They select the best approach, design the project, and outline steps. Students present their plans for feedback, which they use to refine their methods. 4. Practice: Students create projects or develop methods based on their designed steps. The teacher supervises and provides guidance as needed. 5. Test, improvement, and evaluation: Students test and refine their projects, evaluating outcomes to improve. This process can be repeated as needed. The teacher stresses recording results and modifications for future presentations. 6. Presentation: Groups present their projects and principles, followed by questions and suggestions from classmates. The teacher fosters an interactive and creative presentation environment. **Figure 1.** Teaching steps of CSSC-STEM Model
Table 5	21. In table 5 the contents of the table should not be the mean and SD but the total score of each expert	Because I interpret the results of expert evaluation of CSSC-STEM model in term of mean and SD, so this table presents mean and SD.
Results	22. pg 14 add numbering to each subtitle	Revised
Results	23. Video clips 1-3 do not have pictures. It is better to provide an example of the video and the discussion is arranged neatly in a table/scheme	I already describe the VDOs in detailed.
Results	24. page 15 practical activities are best in the form of pictures/schemes	I describe the activities in detailed already.
Results	25. STEM discussion page 16 is best in table/scheme form	Revised.
Results	26. Table 6-19 is less understandable because this research uses a development method but uses a t-test and there are pre-post values. why is the table only mean and SD? Please look at table 6-19 again and combine it if possible so that it is easy to analyze and read the table	I use t-test to check the difference between pre- and post-scores; so, I have to show pre-score men and post-score mean as well.
Results	27. Focus on the reaction rate material, don't add other chemical materials	This is the SSC on reaction rate topic. The content specialist already checked the SSC process.

Conclusion	28. the conclusion contains the results of the research, limitations, and recommendations for further research,	I add limitation as: The limitation of this study may deal with a small sample in survey research at the initial phase.
References	29. references use ACS format. remove the word Thai and additional references from several Scopus articles other than Thailand. add journal/doi link	I use the ACS format for all references. I remove the word Thai.

ROUND 2

Reviewer A
Recommendation: Accept Submission

Thanks for your good effort in addressing my feedback.

Reviewer B
Recommendation: Accept Submission

Thanks for the proper responses.

Reviewer C
Recommendation: Accept Submission

Some paragraphs are too short, and some are too long, so please adjust the paragraphs again.