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Development and Feasibility Evaluation of a Chemo-Entrepreneurship-Oriented Student Worksheet on Reaction Rates

Deis Reni[1*], Asrial Asrial[2], Diah Riski Gusti[3], and Haryanto Haryanto[4]

[1,2,3,4]*Chemistry Education S2-Study Program, Universitas Jambi, Jambi*

Email: deisreni06@gmail.com

Abstract: *This study aimed to develop a Chemo-Entrepreneurship (CEP)-based Student Worksheet (LKPD) on reaction rate materials and evaluate its feasibility, practicality, and effectiveness in improving students' learning outcomes. The research employed an R&D method using the ADDIE model (Analysis, Design, Development, Implementation, and Evaluation), involving eleventh-grade students at MAN 3 Jambi City. The product was validated by chemistry teachers, media experts, and subject-matter experts, followed by individual, small-group, and large-group trials. Data were collected through validation sheets, response questionnaires, and learning outcome tests. The results showed high feasibility, with content and media validity scores of 95.63% and 96.31%, respectively. Teacher and student responses also indicated excellent practicality. Furthermore, students' average scores increased from 65.50 to 79.83. The paired-sample t-test showed a significant difference (Sig. = 0.000 < 0.05), with an N-Gain score of 0.5067, categorized as moderate. Therefore, the CEP-based LKPD is feasible, practical, and effective for improving chemistry learning outcomes.*

Keywords: *Chemo-entrepreneurship; student worksheet; reaction rate; entrepreneurial self-efficacy; ADDIE model*

INTRODUCTION

The fast-paced evolution of science and technology has prompted schools to focus on equipping students with entrepreneurial skills that will help them succeed in their future careers, in addition to the traditional academic competence. To better equip students to deal with economic issues and to provide job prospects, entrepreneurial education has grown in importance (Bae et al., 2014; Kuratko, 2005). An individual's conviction in their own abilities to effectively complete entrepreneurial activities is reflected in entrepreneurial self-efficacy, which is a crucial factor in this context.

One of the most robust indicators of both entrepreneurial intent and action is entrepreneurial self-efficacy (Ajzen, 1991; Krueger et al., 2000; Zhao et al., 2005). Students who believe in their own abilities to start and grow a company are more likely to be proactive in seeking out new possibilities, finding creative solutions to challenges, taking measured risks, and putting their own unique spin on things. Consequently, there is

a critical need for educational initiatives that foster the growth of entrepreneurial self-efficacy.

Through hands-on, product-focused chemistry instruction, students have several chances to incorporate entrepreneurial ideals. Chemo-Entrepreneurship (CEP) is one method that helps with this integration. Students may learn scientific principles and build their entrepreneurial abilities with the help of the CEP method, which links chemistry with entrepreneurial operations. Students are motivated to use what they learn in chemistry class to create goods that might have monetary worth via CEP-based learning.

Learning with CEPs may boost interest in entrepreneurship, creativity, and drive to study, according to a number of earlier research. Despite this, there is a dearth of research that focuses on the ways in which CEP-oriented learning materials, especially those dealing with response rate concerns, foster entrepreneurial self-efficacy. In addition, there is a dearth of CEP-focused student workbooks that methodically combine entrepreneurial experiences with chemical ideas. Recent development studies and a systematic review likewise report that CEP-based materials connect chemistry to real products and strengthen creativity and entrepreneurial character (Ni'mah & Suwardi, 2023; Wildana et al., 2022; Yulita & Prayitno, 2023).

Students often see reaction rate as an abstract chemistry subject because of its conceptual and quantitative nature (Çakmakçı, 2010; Jusniar et al., 2020; Kolomuç & Tekin, 2011). So, to help students grasp response rate principles and have meaningful learning experiences, we need new and creative learning materials. Because they direct students through organised learning tasks and promote active engagement, student worksheets (LKPD) may be useful learning aids. Several worksheet developments on this topic, such as a scientific-approach-based worksheet and a project-based e-LKPD, have been reported to improve learning outcomes and creative thinking (Seputri et al., 2025; Syahdi et al., 2021).

Taking all of this into account, the purpose of this research was to design a Chemo-Entrepreneurship-oriented Student Worksheet (LKPD) using reaction rate materials and then assess its viability, usefulness, efficacy, and impact on students' confidence in their own entrepreneurial abilities.

LITERATURE REVIEW

Development of Student Worksheets (LKPD) and Chemo-Entrepreneurship-Oriented Learning

Numerous studies have investigated the development of Student Worksheets (*Lembar Kerja Peserta Didik* – LKPD) as instructional media to improve learning outcomes and entrepreneurial competencies. In their study on salt hydrolysis education, Milaningsih et al. (2023) created an e-LKPD that combined the Chemo-Entrepreneurship (CEP) method with the Flipbook and Liveworksheet platforms. Both the material experts (90.83%) and the media experts (88.13%), who graded the study's validity, gave it good marks. Students' entrepreneurial interest increased from 66.45% to 83.62% after implementing the e-LKPD, and the learning effectiveness was deemed moderate with an N-gain of 0.62.

Similarly, Juniar et al. (2022) created a LKPD that included CEP and was orientated toward Problem-Based Learning (PBL). Both the material experts (91.55%) and the media experts (87-93%) rated the validity of their results as excellent. Students' interest in entrepreneurship, practical skills, learning attitudes, and cognitive accomplishment were all positively affected by the created worksheet, reaching a very strong category of 85.01%.

Desmarani et al. (2022) investigated how student creativity in chemistry was impacted by E-LKPD in an inquiry-flipped classroom. The findings showed that E-LKPD greatly enhanced students' capacity for

creative thinking, with students' self-efficacy also being a major factor in this regard.

Students' occupational life skills, competitiveness, and work ethics were greatly enhanced by Project-Based Learning combined with the CEP method, according to Ishak et al. (2021). These results provide credence to the idea that chemistry education with an entrepreneurial focus might help students develop marketable skills. Yulita and Prayitno (2023) similarly reported, in a quasi-experimental study at MAN 1 Rembang, that CEP-based learning improved vocational skills (N-gain 0.55 vs. 0.31) and learning outcomes (N-gain 0.53 vs. 0.04) compared with a control class.

The CEP strategy has a favourable effect on entrepreneurial attitudes and inclinations, as shown in several research. The use of CEP-oriented worksheets to improve students' capacity for creative thought was proven by Hartini and Azizah (2019). Students who are hard of hearing may benefit greatly from using CEP-based worksheets to enhance their entrepreneurial abilities, according to research by Nurjanah and Poedjiastoeti (2017). In addition, Rahmawanna et al. (2016) found that students' views toward chemistry and entrepreneurial curiosity were greatly enhanced by the CEP strategy.

Overall, previous studies indicate that CEP-based instructional materials, particularly LKPD, can effectively enhance learning outcomes, creative thinking skills, entrepreneurial attitudes, and entrepreneurial interest among students.

Learning Theories Underpinning the Development of LKPD

Learning theories such as behaviorism, cognitivism, and constructivism provide support for the creation of educational resources in this research (Ertmer & Newby, 2013).

Behaviorism Theory

According to behaviorism, as we learn, our behavior changes as a direct consequence of the feedback loop between our inputs and our reactions. This view maintains that children learn by seeing and responding to their surroundings. Punishment decreases unwanted behaviors and positive reinforcement increases good ones. So, observable changes in behavior are the evidence of learning.

Cognitive Learning Theory

The focus of cognitive learning theory is on internal mental operations rather than externally visible actions. Processing information, building knowledge, solving problems, and comprehending are all part of the learning process. Learners may construct meaningful understanding with the support of this theory because it emphasises the significance of context, background knowledge, and higher-order cognitive abilities.

Constructivist Learning Theory

The core tenet of constructivism is that students build their own knowledge by engagement with the world around them. Exploration, problem-solving, and reflection are the three pillars upon which learning rests. Activities centred on students, social contact, real evaluation, and in-depth conceptual comprehension are the tenets of a constructivist classroom. This research is primarily grounded on constructivist theory since its main objective is to help students become more self-reliant learners who may get entrepreneurial ideas.

Student Worksheets (LKPD)

In order to get students more involved in the learning process, teachers often use student worksheets, also known as LKPD. Guided student discovery of ideas and problem-solving is the goal of the learning goals, instructions, information, exercises, and activities included in LKPD.

Trianto (2011) states that LKPD is used to direct activities related to exploration and problem-solving. According to Prastowo (2014), LKPD are resources that are designed to help students study on their own by giving

them activities to do. Proper content, clear language, structure, and visual presentation are all technical, didactic, and constructive criteria that should be met by effective LKPD.

The primary functions of LKPD include:

1. Encouraging active student participation.
2. Facilitating concept understanding.
3. Providing opportunities for practice and problem-solving.
4. Assisting teachers in implementing learning activities effectively.

The main components of LKPD generally include learning objectives, instructions, supporting information, learning activities, worksheets, and evaluation tasks.

Chemo-Entrepreneurship (CEP)

Chemo-Entrepreneurship (CEP) is an instructional approach that integrates chemistry concepts with entrepreneurial activities. CEP connects chemical knowledge with real-life applications and encourages students to transform raw materials into economically valuable products.

Through CEP-oriented learning, students not only understand chemistry concepts but also develop creativity, innovation, and entrepreneurial awareness. The approach promotes practical experiences, problem-solving abilities, and product development skills that can support future entrepreneurial endeavors.

Previous studies have shown that CEP-oriented learning enhances students' scientific process skills, entrepreneurial interest, creativity, and vocational competencies. By linking chemistry concepts to everyday life and economic opportunities, CEP makes chemistry learning more meaningful and relevant.

Self-Efficacy

One's confidence in one's own abilities to carry out a task and attain a goal is known as self-efficacy. Motivation, perseverance, effort, and performance are all affected by one's sense of self-efficacy, says Bandura (1977, 1997; Pajares, 1996; Zimmerman, 2000).

Confidence, tenacity, and resilience are traits often associated with students who have high levels of self-efficacy. On the other hand, those who doubt their own abilities tend to shy away from challenging activities and give up quickly when faced with difficulties. Self-efficacy has also been shown to be positively related to chemistry learning outcomes among high school students (Susanti et al., 2022; Uzuntiryaki & Çapa Aydın, 2009), and students' self-efficacy level has been reported to differ significantly in creative thinking within worksheet-supported learning (Desmarani et al., 2022)

Entrepreneurial Self-Efficacy

A person's belief in their own abilities to carry out entrepreneurial endeavours effectively is known as entrepreneurial self-efficacy. When starting a firm or making important decisions as an entrepreneur, it is essential. Those who believe in their own abilities to succeed as entrepreneurs are more likely to seize chances, persevere through setbacks, and achieve their dreams.

A multi-faceted concept, entrepreneurial self-efficacy includes:

1. Confidence in developing new products and identifying market opportunities.
2. Ability to cope with change and uncertainty.
3. Capability to manage and utilize available resources.
4. Confidence in setting entrepreneurial goals.
5. Innovative thinking and problem-solving abilities.
6. Ability to establish networks and relationships with stakeholders.

Students possessing high entrepreneurial self-efficacy are generally less fearful of failure and more likely to engage in

entrepreneurial activities (Chen et al., 1998; McGee et al., 2009; Wilson et al., 2007).

Reaction Rate Concept

Reaction rate is a fundamental topic in chemical kinetics that examines the speed at which chemical reactions occur. Reaction rate is defined as the change in concentration of reactants or products over time.

Several key concepts in reaction rate include:

1. Rate Law

The rate law expresses the relationship between reaction rate and reactant concentrations:

$$Rate=k[A]^x[B]^y \quad 1)$$

where k is the rate constant, while x and y represent the reaction orders determined experimentally.

2. Reaction Mechanism

In order to turn reactants into products, a reaction mechanism lays out the basic stages in the process. Important roles in deciding reaction paths are played by intermediate species that may develop throughout the process.

3. Collision Theory

Reactant particles collide with enough energy and the right orientation, according to collision theory. This causes a chemical reaction to take place. Reaction times are affected by how often and how hard accidents happen.

4. Activation Energy

The bare minimum of energy needed for reactants to proceed through a chemical reaction is known as the activation energy. Product creation can only take place in the event of collisions with energies higher than the activation energy.

Factors Affecting Reaction Rate Several factors influence reaction rates:

1. Nature of reactants.
2. Reactant concentration.
3. Temperature.
4. Presence of catalysts.

Increasing concentration and temperature generally accelerates reaction rates, while catalysts lower activation energy and provide alternative reaction pathways, thereby increasing reaction speed.

Previous Studies and Research Gap

Several studies have investigated the development of CEP-oriented instructional materials. Milaningsih et al. developed an electronic worksheet integrated with CEP for salt hydrolysis learning and found that the product was highly valid and effective in increasing students' entrepreneurial interest. Juniar et al. reported similar findings, demonstrating that a problem-based CEP-oriented worksheet improved learning outcomes, practical skills, and entrepreneurial attitudes. Wildana et al. (2022) likewise designed CEP-oriented teaching materials using the ADDIE model and reported very valid materials, positive teacher and student responses, and high entrepreneurial creativity. A systematic review of CEP studies from 2016 to 2023 also concluded that CEP is implemented effectively when learning media are integrated with various learning models (Ni'mah & Suwardi, 2023).

Although previous studies have confirmed the effectiveness of CEP-based learning materials in enhancing entrepreneurial interest, creativity, and learning achievement, limited research has specifically focused on the development of CEP-oriented worksheets designed to improve entrepreneurial self-efficacy in reaction rate learning. Most studies have concentrated on entrepreneurial interest rather than students' confidence in performing entrepreneurial activities.

Furthermore, reaction rate remains a challenging chemistry topic that requires contextual and student-centered learning approaches. The integration of CEP principles into reaction rate learning has not been

extensively explored, particularly in the context of enhancing entrepreneurial self-efficacy. Existing worksheet studies on reaction rate, such as Syahdi et al. (2021) on the scientific approach and Seputri et al. (2025) on project-based learning and creative thinking, did not integrate entrepreneurial contexts.

Therefore, this study seeks to address this gap by developing and evaluating a CEP-oriented LKPD for reaction rate topics that is specifically designed to foster students' entrepreneurial self-efficacy while simultaneously improving their understanding of chemistry concepts.

Conceptual Framework

Based on the reviewed literature, the development of a CEP-oriented LKPD on reaction rate material is expected to facilitate meaningful learning experiences, enhance students' understanding of chemistry concepts, and foster entrepreneurial self-efficacy. Through constructivist learning activities integrated with entrepreneurial contexts, students are encouraged to actively construct knowledge, develop problem-solving skills, and build confidence in entrepreneurial activities. This framework underlies the development and implementation of the proposed instructional material.

METHODS

Research Design

The ADDIE development model, which includes the phases of analysis, design, development, implementation, and evaluation, was used as a research and development (R&D) approach in this work (Branch, 2009; Sugiyono, 2022). Over the course of the 2024–2025 school year, researchers from MAN 3 Jambi City collected data.

During the analysis stage, curriculum requirements, student characteristics, and learning needs related to reaction rate materials were identified. The design stage focused on preparing the worksheet structure, learning activities, assessment instruments, and entrepreneurial integration components. Creating the first LKPD draft and having it reviewed by experts were part of the development stage. Prior to deployment, revisions were made in response to validators' suggestions.

Trials with individuals, small groups, and big groups made up the implementation stage. Data were collected using validation sheets, response questionnaires, entrepreneurial self-efficacy questionnaires, and learning outcome tests. Entrepreneurial self-efficacy was measured using indicators adapted from Bandura's dimensions, namely Magnitude, Strength, and Generality. Data were analyzed using descriptive statistics and effectiveness analysis through learning outcome improvement measures.

Participants

The study was conducted at MAN 3 Jambi City, Indonesia. The research participants consisted of eleventh-grade science students (Grade XI IPA). Product testing was carried out progressively through individual trials, small-group trials representing high-, medium-, and low-achieving students, and a large-group field trial involving 30 students from one Grade XI science class.

Data Collection Instruments

Both qualitative and quantitative data were collected. Qualitative data included teacher interview results, expert validation comments, and teacher suggestions for product improvement. Quantitative data consisted of validation scores from experts and teachers, student response questionnaires, entrepreneurial self-efficacy questionnaires, and students' pretest and posttest scores.

The research instruments included:

1. Teacher Interview Guide

Structured interviews were conducted with chemistry teachers to gather information regarding curriculum implementation, students' learning difficulties, instructional media currently used, entrepreneurial learning

practices, and the need for CEP-oriented instructional materials.

2. Student Needs Analysis Questionnaire

A needs analysis questionnaire was administered to identify students' learning challenges, learning resource requirements, and perceptions regarding the integration of chemo-entrepreneurship and self-efficacy in chemistry learning. The instrument consisted of 18 items covering learning problems, learning resource needs, and the suitability of learning materials with students' characteristics.

3. Expert Validation Instruments

The developed LKPD was evaluated by material experts and media experts.

- The material validation instrument assessed content accuracy, relevance to curriculum objectives, presentation quality, entrepreneurship integration, and language appropriateness. The instrument contained 32 items.
- The media validation instrument evaluated worksheet size, cover design, layout, typography, illustrations, and overall visual presentation. The instrument consisted of 38 items.

4. Teacher Evaluation Questionnaire

A teacher evaluation questionnaire containing 14 items was used to assess the attractiveness, usability, content quality, language clarity, and potential of the LKPD to improve students' entrepreneurial self-efficacy.

5. Student Response Questionnaire

Following implementation, students completed a response questionnaire to evaluate the attractiveness, usability, content quality, language clarity, and perceived effectiveness of the developed LKPD. The questionnaire also measured learning self-efficacy dimensions, including magnitude, strength, and generality.

6. Entrepreneurial Self-Efficacy Questionnaire

Entrepreneurial self-efficacy was measured using a 12-item instrument adapted from Bandura's self-efficacy dimensions, including:

- Magnitude – confidence in completing entrepreneurial tasks of varying difficulty levels;
- Strength – resilience and confidence in overcoming entrepreneurial challenges;
- Generality – confidence in applying entrepreneurial abilities across different situations and business contexts.

Learning Achievement Test

Students' understanding of reaction rate concepts was measured using essay-based pretest and posttest assessments administered before and after the implementation of the developed LKPD.

Data Analysis

Descriptive and inferential statistical analyses were employed.

Feasibility Analysis

Validation scores from material experts, media experts, teachers, and students were converted into percentages using a five-point Likert scale. Product feasibility was classified into five categories: very feasible, feasible, moderately feasible, less feasible, and not feasible.

The percentage score was calculated using:

$$Percentage = \frac{Obtained\ Score}{Maximum\ Score} x100 \qquad 2)$$

Student Response Analysis

Student responses were analyzed descriptively using percentage scores. The interpretation criteria were categorized as very good (81–100%), good (61–80%), fair (41–60%), poor (21–40%), and very poor (0–20%).

Learning Effectiveness Analysis

The effectiveness of the developed LKPD was evaluated through pretest and posttest scores.

First, a normality test using the chi-square method was conducted to determine whether the data were normally distributed. Subsequently, a paired-sample t-test was performed using SPSS version 26 to examine significant differences between pretest and posttest scores.

To determine the magnitude of learning improvement, the Normalized Gain (N-Gain; Hake, 1998) was calculated using:

$$= \frac{postest\ scores - pretest\ sc}{maximum\ score - pretest\ sc} \quad 3)$$

The N-Gain values were interpreted as follows:

- High: $g \geq 0.70$
- Moderate: $0.30 \leq g < 0.70$
- Low: $g < 0.30$

Ethical Considerations

Participation in this study was voluntary, and all collected data were used solely for research purposes. Students and teachers were informed about the objectives of the study prior to data collection.

RESULT AND DISCUSSION

Product Feasibility

The feasibility of the developed CEP-oriented worksheet was evaluated by material experts and media experts. The validation results are presented in Table 1.

Table 1. Expert Validation Results

Validator	Percentage (%)	Category
Material Expert	95.63	Very Feasible
Media Expert	96.31	Very Feasible

According to Table 1, the worksheet was deemed a highly practicable learning resource as it received a score of 95.63% from the material expert and a score of 96.31% from the media expert. These outcomes show that the worksheet is suitable with regard to the correctness of its information, its presentation, its language, and its visual design.

The Chemo-Entrepreneurship (CEP) method, which combines chemistry with business, explains why the feasibility score is so high. Students learn most effectively when they can make connections between what they've learned in the classroom and their own lives, says constructivist theory of learning. The worksheet facilitates this process by providing contextual activities that encourage students to apply reaction rate concepts in entrepreneurial situations.

The findings are consistent with previous studies reporting that CEP-based learning materials are highly feasible and effective in supporting chemistry learning. Previous research found that CEP-oriented instructional materials improved students' engagement and promoted meaningful learning experiences. Therefore, the present study strengthens existing evidence regarding the applicability of CEP in chemistry education. For example, CEP-oriented worksheets on salt hydrolysis obtained material expert scores of 90.83% and 91.55% and media expert scores of 88.13% and 87.93% (Juniar et al., 2022; Milaningsih et al., 2023), and CEP-oriented teaching materials developed with ADDIE were also rated very valid (Wildana et al., 2022).

Product Practicality

The practicality of the worksheet was evaluated through teacher and student responses during the implementation stage. Both groups provided positive responses toward the developed worksheet, indicating that the learning activities were easy to understand and implement.

The positive responses suggest that the worksheet successfully facilitated active learning and student participation. The entrepreneurial tasks incorporated into the worksheet encouraged students to engage in problem-solving activities and explore the practical application of chemistry concepts. Such learning experiences are aligned with student-centered learning principles, which

emphasize active participation and contextual understanding.

These findings support previous studies indicating that worksheets designed with contextual and entrepreneurship-oriented activities can enhance student engagement and motivation. Similar results have been reported in chemistry education research where CEP-based learning resources were perceived positively by both teachers and students. Wildana et al. (2022) found positive teacher and student responses to CEP-oriented materials, and Seputri et al. (2025) and Syahdi et al. (2021) reported strong student and teacher responses to reaction rate worksheets.

Product Effectiveness

The effectiveness of the developed worksheet was measured through pre-test and post-test scores. The results are presented in Table 2.

Table 2. Students' Learning Outcomes

Test	Mean Score
Pre-test	65.50
Post-test	79.83

Table 2 shows that the CEP-oriented worksheet improved students' learning results. Between the pre- and post-tests, the average score rose from 65.50 to 79.83. This increase is illustrated in Figure 1.

We used a paired-sample t-test to find out how big of an impact the change had. The results of the study demonstrated a statistically significant disparity between the scores obtained before and after the test, with a significance value of 0.000 ($p < 0.05$). Even more so, the N-Gain score was 0.5067, which is considered moderate.

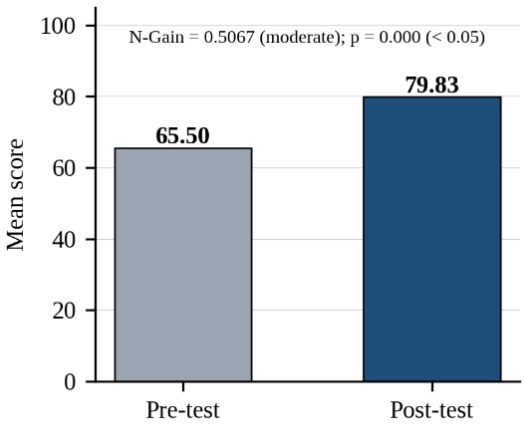


Figure 1. Mean pre-test and post-test scores of students in the large-group trial (n = 30).

The improvement in learning outcomes may be attributed to the contextual learning experiences provided by the worksheet (Gilbert, 2006). The CEP approach encourages students to relate abstract chemistry concepts to real-world entrepreneurial activities, thereby enhancing conceptual understanding and knowledge retention. The significance of actively building one's own knowledge via real-world experiences is heavily emphasised in constructivist philosophy, which is in line with this discovery.

Consistent with other research, this study found that students' academic performance improved after participating in an entrepreneurial-oriented chemistry course. Several researchers have reported that contextual and project-based chemistry learning promotes deeper conceptual understanding and improves learning outcomes compared to conventional instruction (Freeman et al., 2014). The N-Gain of 0.5067 in this study falls in the same moderate category as CEP-oriented worksheets for salt hydrolysis (0.54 and 0.62; Juniar et al., 2022; Milaningsih et al., 2023) and as the project-based e-LKPD on reaction rate developed at the same school (0.65; Seputri et al., 2025), and close to the gain of 0.53 obtained by CEP-based learning in an Islamic senior high school (Yulita & Prayitno, 2023). A higher gain of 0.73 was reported for

a scientific-approach worksheet on reaction rate (Syahdi et al., 2021).

Entrepreneurial Self-Efficacy Improvement

The implementation of the CEP-oriented worksheet also contributed to the improvement of students' entrepreneurial self-efficacy. Through product-oriented learning activities, students were encouraged to identify opportunities, generate ideas, and evaluate the economic value of chemistry-based products.

According to Social Cognitive Theory, self-efficacy develops through mastery experiences and successful task completion (Bandura, 1977; Britner & Pajares, 2006). The worksheet provided opportunities for students to actively participate in entrepreneurial problem-solving activities, thereby strengthening their confidence in performing entrepreneurial tasks. As a result, students demonstrated greater confidence in applying chemistry knowledge within entrepreneurial contexts.

This finding supports previous studies that identified entrepreneurship-based learning as an effective strategy for enhancing entrepreneurial self-efficacy (Oosterbeek et al., 2010; Piperopoulos & Dimov, 2015; Wilson et al., 2007). The present study extends previous findings by demonstrating that entrepreneurial self-efficacy can be fostered through a CEP-oriented worksheet specifically developed for reaction rate materials. This is in line with the positive relationship between self-efficacy and students' chemistry learning outcomes (Susanti et al., 2022) and with reviews that discuss the antecedents and outcomes of entrepreneurial self-efficacy (Newman et al., 2019).

The developed CEP-oriented LKPD was designed to facilitate students' understanding of reaction rate concepts through contextual entrepreneurial activities. The worksheet integrated chemistry concepts with product-oriented learning experiences that encouraged students to explore the economic relevance of chemistry in everyday life.

The created worksheet fulfilled very realistic requirements, according to the findings of the expert evaluation. The information was deemed scientifically accurate, relevant to students' learning requirements, and linked with curricular goals, according to material validators. The media validators praised the worksheet's well-organised lessons, appealing visual design, and suitable layout.

Teachers and students alike responded positively to the practicality exam. Three students' entrepreneurial self-efficacy obtained an excellent level of 80.74% in the individual experiment. 10 students participated in the small-group experiment, and their entrepreneurial self-efficacy rose to 92.22%, which is also considered very excellent. Students seemed to like the entrepreneurial tasks that were included in the worksheet, according to these data. The expert validation and entrepreneurial self-efficacy scores are summarized in Figure 2.

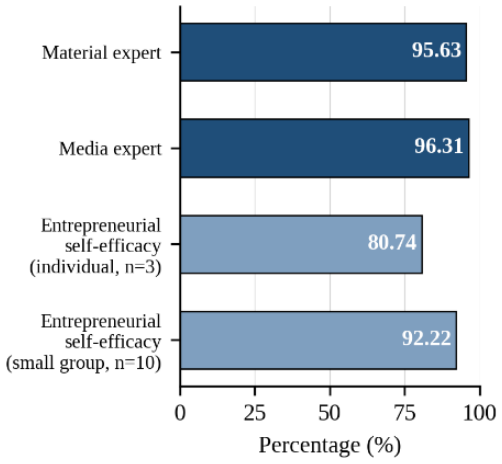


Figure 2. Expert validation scores and entrepreneurial self-efficacy scores of the CEP-oriented LKPD.

The large-group implementation demonstrated improvements in students' understanding of reaction rate materials. Students became more actively engaged in learning activities, participated in discussions, and demonstrated greater confidence in proposing ideas and solving problems. The

integration of entrepreneurial contexts helped students connect chemistry concepts with practical applications, making learning more meaningful.

The findings support the theoretical perspective that learning experiences emphasizing mastery experiences and authentic problem-solving can strengthen entrepreneurial self-efficacy. Through CEP-oriented activities, students gained opportunities to develop confidence in applying scientific knowledge to entrepreneurial situations. This finding is consistent with previous studies reporting that CEP-based learning contributes positively to entrepreneurial attitudes, creativity, and learning outcomes.

CONCLUSION

The Chemo-Entrepreneurship-oriented Student Worksheet (LKPD) on reaction rate materials was successfully developed using the ADDIE model. The developed worksheet met highly feasible criteria based on expert validation and demonstrated high practicality according to teacher and student responses. The implementation results indicated improvements in students' learning outcomes and entrepreneurial self-efficacy. Therefore, the developed LKPD can serve as an alternative learning resource for chemistry instruction while supporting the development of entrepreneurial competencies among students.

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