Chemoentrepreneurship-based learning: Influence on social and vocational skills

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The Sustainable Development Goals (SDGs) are global action plans that aim to address various problems globally in the social, economic, cultural, energy, and environmental fields. One of the global problems is the significant open unemployment rate due to the gap between graduates and available jobs. Therefore, we need an innovation in learning to train students to develop their competencies. Competency development can be done through chemoentrepreneurship-based chemistry learning (CEP). CEP-based learning is chemistry learning through projects in product manufacturing and marketing. This study aims to measure students' social and vocational skills through CEP learning. This research was conducted at Islamic Senior High School in Rembang, Indonesia. The research subjects were 47 students. The results of the N-gain test showed that the social skills of the experimental and control groups experienced an increase in the low/effective less category. The N-gain value of the experimental group's social skills was 50.06, while the control group was 41.32. The results of the N-gain test for vocational skills in the experimental group were better than those in the control group. The increase in the vocational skills of the experimental group was in the medium/quite effective category (58.32), while the control group experienced a very low/ineffective increase in the category (33.47).

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1 Introduction

The Sustainable Development Goals (SDGs) are a global action plan that addresses various problems globally in the social, economic, cultural, energy, and environmental fields (Gusdwisari, 2020). Some of the goals set out in the SDGs are similar to the problems happening in Indonesia, one of which is unemployment. Based on data from the Central Statistics Agency in the last two years, the open unemployment rate is dominated by people who graduate from Vocational High School (Figure 1). Some of the causes of a large number of unemployed graduates from Vocational High Schools (VHS) are a) limited teaching infrastructure because the development of industrial infrastructure is faster and more developed than educational infrastructure, b) the curriculum is not following regional conditions, c) a lack of coordination between stakeholders, d) no clear and definite mapping of the

number of Human Resources needed in the world industry, e) a lack of employment opportunities for SHS graduates, so that many works as operators even though they do not have the skills that match their educational background, f) limited employment according to their expertise so that many VHS graduates still work outside the field expertise and not refuse to work as an operator like an SHS graduate, and g) specifications of the expertise program that are not following the needs of the company (Soesilowati, 2009; Azman et al., 2020).

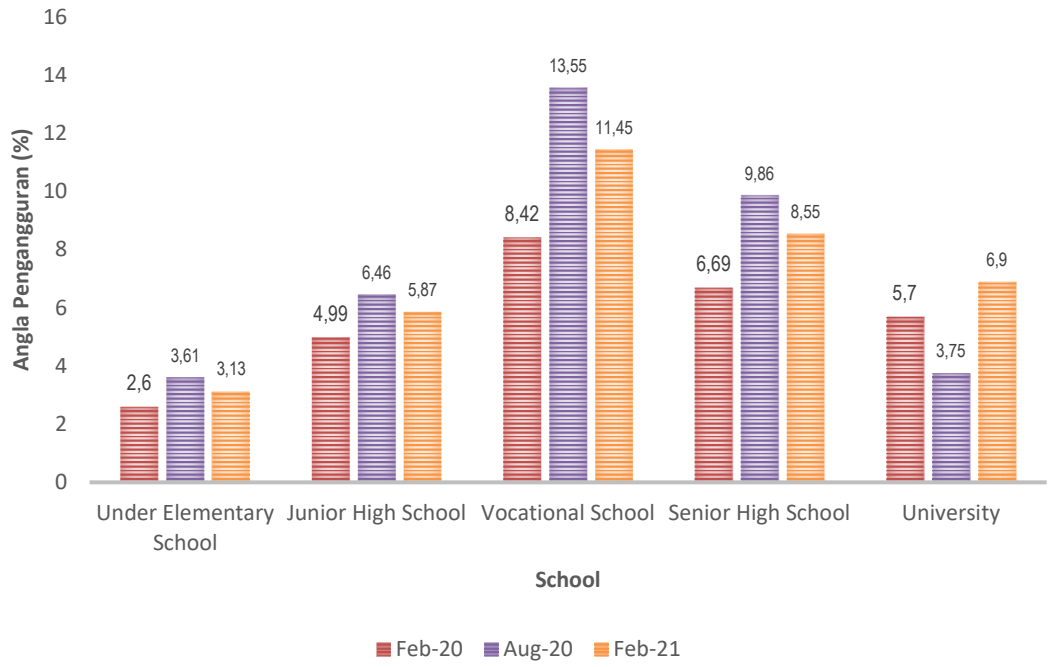

Figure 1. TPT by Highest Education Level (percent) in August (Central Bureau of Statistics, 2021)

The high open unemployment rate for Vocational High School and Senior High School graduates is a challenge for schools to improve the quality of learning implementation. The quality of implementing learning in schools can be improved with various strategies, such as competency-based education and training.

Regarding competency-based education and training, schools must find alternative solutions to prepare students for work. One way schools can implement competency-based education and training is to equip students with skills. It aims to provide opportunities for students to develop their self-concept as human beings with dignity and provide the ability and courage to face life's problems (Monteiro & Shetty, 2016).

Providing skills education to students does not have to be done outside of class hours but can also be integrated into specific subjects. One of the subjects that can be

included in life skills education is Chemistry. Life skills education inserted into chemistry subjects is often called Chemoentrepreneurship (CEP). CEP is an approach/method used in Chemistry learning by inserting entrepreneurship related to Chemistry material (Dewi & Mashami, 2019; Zia Ulhaq et al., 2021; Wijayati & Rengga, 2009). Entrepreneurship that is inserted in Chemistry lessons starts from product manufacturing planning to product marketing (Prayitno et al., 2020). Science learning that is integrated with entrepreneurship can increase students' interest in entrepreneurship, motivation, and curiosity (Arfin et al., 2018; Sumarti et al., 2018) and improve science process skills (Purnama et al., 2020) and students' cooperation and communication (Paristiowati et al., 2015).

CEP-based chemistry learning is an understanding of chemistry material followed by product manufacture and marketing. Manufacturing and marketing products will indirectly influence students' social and vocational skills. During CEP-based chemistry learning, students are trained to communicate and cooperate to create good social interaction. Chemoentrepreneurship-based learning can train students a) to be disciplined by doing a project according to the specified time; b) to be skilled in using tools according to their function and use; c) to understand Occupational Health, Safety, and Security; and d) to have a good work attitude, such as working responsibly and not disturbing other students' work.

CEP-based chemistry learning will train students to get used to cooperating and communicating well (Pinta & Putra, 2018). Communication habits positively impact entrepreneurship (Chienwattanasook & Jermsittiparsert, 2019). In addition, CEP-based chemistry learning will add students' experience in developing and innovating related to the manufacture of chemical products. In this study, the control group carried out conventional learning activities while the experimental group carried out CEP-based learning activities.

Based on the background, this study aims to determine the improvement of students' social and vocational skills, including cooperation, communication, accuracy in work, skills in using tools, work safety and security, and work attitudes through CEP learning. The CEP learning steps include material delivery, CEP practices (making dish soap, shampoo, and others), packing products, marketing products to teachers or other people, and reporting activity results. This study provides information on the importance of learning models that can equip students' life skills, mainly social and vocational skills, introduces a fun learning model in

chemistry learning, and motivates students to learn independently, be creative, and develop themselves by conducting experiments that can equip life skills.

2 Chemoentrepreneurship

Entrepreneurship studies one's abilities and behavior in facing life's challenges, and how to obtain opportunities with various risks they may face. Purnama et al. (2020) define entrepreneurship as creating something new involving time, effort, risk, finance, and psychological and social development.

Entrepreneurship is not always synonymous with the character or characteristics of entrepreneurs alone because this trait is also owned by someone who is not an entrepreneur, such as farmers, employees, government employees, students, teachers, project leaders, researchers, and other professionals. The entrepreneurial characteristics exist in people with creative and innovative abilities and everyone who likes change, progress, and challenges.

Entrepreneurship education aims to develop one's attitudes and qualities, including the ability and courage to take the initiative, be creative, take risks, be confident, and the ability to collaborate with social skills, learn basic subjects and skills through the use of entrepreneurial work methods, and learn knowledge and skills about business development and innovative process (Johansen & Schanke, 2012).

Entrepreneurship can be integrated into science, such as chemistry, physics, and biology. Entrepreneurship integrated into chemistry is usually called chemoentrepreneurship, a contextual learning approach associating science with everyday phenomena. In chemoentrepreneurship learning, students can create a product with economic value under the studied material. Therefore, chemoentrepreneurship learning aims to motivate and equip students to be skilled and creative in making and marketing products (Dewi, 2019).

The following are stages in chemoentrepreneurship-based learning: a) determining fundamental questions related to chemistry-based entrepreneurship, b) preparing project planning, c) arranging a schedule, d) monitoring student and project progress, e) assessment of results, and f) evaluation of experience. The details are presented in Table 1.

Table 1. The stages of chemoentrepreneurship-based learning

Stages	Explanation
1. Determining fundamental questions related to chemistry-based entrepreneurship	a. The teacher provides examples of chemistry-based entrepreneurship. b. The teacher asks questions about chemical products not yet on the market. c. Students determine the type of chemical entrepreneurship to be developed.
2. Preparing project planning	a. Students make a list of equipment (tools and materials) to manufacture products. b. Students make a budget for providing equipment and materials in making products. c. Students present the preparation for making products in front of the class.
3. Arranging a schedule	a. Students make a schedule for completing the project. b. Students work in groups to produce CEP projects. c. The teacher makes observations.
4. Monitoring student and project progress	a. Students present the results of the project. b. Students market their products. c. The teacher helps students manage activities while completing projects by always knowing the progress and obstacles students face.
5. Assessment of results	The teacher conducts product assessments.
6. Evaluation of experience	The teacher provides evaluations related to the results of student work.

Chemoentrepreneurship learning emphasizes active and constructive learning processes when students construct knowledge based on their experiences (Bada, 2015; Pande & Bharathi, 2020). This type of learning is under current learning demands. Trevors et al. (2016) argue that education currently demands an epistemological dimension of learning that focuses on how students can create knowledge from their experiences. Education is one's cognitive outcome based on the reality of life he experiences (Muhajirah, 2020). The emphasis on chemistry learning based on chemoentrepreneurship is how to facilitate students' understanding of the material and enrich students' thought processes by making products based on daily phenomena.

3 Methods

3.1 Research design

The research design used in this study was a pretest-posttest nonequivalent control group design, which provides a pretest before and posttest after treatment for each group. The design form is illustrated in Table 2.

Table 2. Pre-experimental Design

Subject	Pretest	Treatment	Posttest
Control	O_1	X_1	O_2
Experiment	O_3	X_2	O_4

Information: O_1 = pretest score of the control group; O_2 = posttest score of the control group; O_3 = pretest score of the experimental group; O_4 = pretest score of the experimental group; X_1 = conventional learning; X_2 = CEP learning.

Before treatment in the control and experimental groups, observations were made regarding students' social and vocational skills using observation sheets.

3.2 Participants

The population of this study was 100 students of four classes XI Science: class XI Science-1, XI Science-2, XI Science-3, and XI Science-4 Senior High School. The sample selection in this study was conducted by cluster random sampling. Class XI Science-1, with 24 students, was selected as the control class, and class XI Science-2, with 23 students, as the experimental class. There were 11 male samples and 36 female samples aged 18–19.

3.3 Data collection tool

The data collection method used in this research is observation. Before being applied, the social and vocational skills instruments are validated by experts. The instrument was validated by experts based on a Likert scale of 5 (very valid), 4 (valid), 3 (quite valid), 2 (less valid), and 1 (invalid). The results of the validator's assessment were then converted into five-scale qualitative data, as shown in Table 3.

Table 3. The Validity Criteria of The Instrument of Social and Vocational Skill

Interval (Va = validity level)	Criteria
Va > 4.21	Very valid
3.40 < Va < 4.21	Valid
2.60 < Va < 3.40	Quite valid
1.79 < Va < 2.60	Less valid
Va < 1.79	Invalid

Social and vocational skills instruments are considered valid if the minimum degree of validity is valid. If the degree of validity is less than valid, the instrument must be revised. The results obtained from the validation test of expert 1 were 4.83 and of expert 2 were 4.33, with an average validation of 4.58 with a very valid category. After experts validated the instruments, it was given to students for peer assessment. The results of peer assessment with the observation sheet were analyzed using SPSS statistics for each aspect of social and vocational skills.

The validated observation sheet was then tested for reliability using the K-R 20 statistical method (Cronbach Alpha). The value of Cronbach's Alpha reliability level (Joseph et al., 2010) is shown in Table 4.

Table 4. Cronbach Alpha Reliability Level

Alfa Cronbach Score	Reliability Level	KR-20 Test Results
0.0 – 0.20	Less reliable	
> 0.20 – 0.40	Somewhat Reliable	
> 0.40 – 0.60	Reliable enough	.721
> 0.60 – 0.80	reliable	
> 0.80 – 1.00	Very Reliable	

The reliability test results for six items of observation sheets on 21 students were 0.721 with a reliable category, as presented in Table 5.

Table 5. Item Total Statistic

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Item_1	16.71	7.914	.314	.726
Item_2	16.14	7.629	.493	.673
Item_3	16.38	6.548	.654	.616
Item_4	16.62	7.548	.462	.681
Item_5	16.81	8.762	.248	.734
Item_6	16.14	6.429	.570	.644

3.4 The effectiveness of chemoentrepreneurship

Social and vocational skills data were obtained based on observations before students were given the assignment and after students carried it out. Social and vocational skills were assessed using the observation sheet instrument that the researcher had prepared. The data obtained were then analyzed using the SPSS program. Data analysis aims to find out the effectiveness of chemoentrepreneurship learning, to know the normality of the data, to know the significance of different tests of social skills and vocational skills in the control group and the experimental group, and to know the frequency of the effectiveness of chemoentrepreneurship learning on students.

Determining the effectiveness of chemoentrepreneurship learning on social and vocational skills is carried out in several stages (Hake, 1999): a) determining the N-gain value in the control class and the experimental class (Figure 2), b) changing the N-gain score to the N-gain percentage (Table 5) to know the level of effectiveness of chemoentrepreneurship learning, c) determining the normality value based on the N-gain percentage, d) performing a significant difference test, and e) conducting a frequency test.

$$N_{-gain} = \frac{Postscore - Prescore}{100 - Prescore}$$

Figure 2. Formula N-gain Score

The modified N-gain criteria are shown in Table 6.

Table 6. Criteria for Improving Social and Vocational Skills

Percentage	Category
0 – 39	Ineffective
40 – 55	Effective Less
66 – 75	Effective Enough
76 – 100	Effective

4 Results and Discussion

Data on students' social and vocational skills were obtained based on observations of students' performance before and after chemoentrepreneurship-based chemistry learning. Observation of social and vocational skills refers to indicators and sub-indicators of social skills (Table 7) and vocational skills (Table 8).

Table 7. Indicators and Sub-Indicators Social Skills

Social Skill Indicators	Social Skill Sub-Indicators
Cooperation	- respecting when friends are speaking or explaining - listening and paying attention when other people or friends are speaking - not interrupting when other people or friends are speaking or explaining - not playing with other tools such as cell phones or calculators when talking to other people or friends - talking to other people or friends using polite and proper language (not speaking rudely)
Communication	- willing to accept the responsibility from friends - helping friends in carrying out their duties - appreciating the contributions or opinions of friends - being in the group during the activity - completing the task on time

Table 8. Indicators and Sub-Indicators Social Skills

Vocational Skill Indicators	Vocational Skill Sub-Indicators
Accuracy in work	- doing practicum under the specified time - using appropriate tools as needed - taking materials as needed - working following predetermined work steps - cleaning and returning the tools after use
Skills in using tools	- using tools according to their function or usage - holding tools according to the correct procedures - not dropping or breaking equipment during practicum - installing or assembling tools according to instructions - removing assembled tools and returning them to the cabinet appropriately
Work safety and security	- wearing shoes or gloves or masks or personal protection during practicum - being careful in using substances during practicum - paying attention to the safety and security of oneself and others or friend - maintaining cleanliness during the practicum - returning tools or substances that are no longer used in the practicum.
Attitudes at work	- praying before and after practicum - being careful in practicum - not disturbing other people or friends during practicum - maintaining conversation during practicum - keeping the lab table clean

4.1 Social Skill

The results of the analysis of the percentage of N-Gain data based on the pretest and posttest in the control and experimental groups are presented in Table 9.

Table 9. Improvement of Social Skills

Social Skills Aspect	Group	Pretest	Posttest	<g>	% <g>	Category
Cooperation	Control	78.4	84.8	0.30	-	-
	Experiment	72.2	88.7	0.59	-	-
Communication	Control	61.6	75.2	0.35	-	-
	Experiment	60	79.1	0.48	-	-
Average	Control	70	80	0.33	41.32	Effective Less
	Experiment	66.1	83.9	0.53	50.06	Effective Less

Based on the data, the average n-gain value for the control group is 41.32 (Effective Less) and 50.06 (Effective Less) for the experimental group. Differences in the effectiveness of learning social skills in the control and experimental groups can be known using the statistical difference test (parametric or nonparametric). One of the requirements for choosing a statistical test is the data normality test. The data normality test can be performed using the Kolmogorov-Smirnov or Shapiro-Wilk tests. The normality test in this study used the Shapiro-Wilk test because the number of samples was less than 50. The normality test results are presented in Table 10.

Table 10. Social Proficiency Data Normality Test

Class	Statistic	df	Sig.	Conclusion
Control	.886	24	0.011	Abnormal
Experiment	.901	23	0.026	Abnormal

The significance level < 0.05 means that the social skills data in the control and experimental groups are not normally distributed. Based on the normality test results, the statistical analysis used is nonparametric. The nonparametric analysis used in this study is Mann-Whitney. The results of the Mann-Whitney analysis obtained a sig value > 0.05, 0.287, meaning there was no significant difference between social skills in the control and experimental groups. In other words, chemoentrepreneurship-based chemistry learning is less effective in developing students' social skills at the Islamic Senior High School in Rembang, Indonesia.

Social skills are individual skills to communicate verbally and nonverbally with other people based on current situations and conditions. Social skills do not exist from birth but are acquired through learning. Social skills are built by personal intelligence: the ability to control oneself, be responsible, and be disciplined (Gaol, 2021). Developing skills that have not existed since birth requires a fairly long process. There was no significant difference in social skills in the control and experimental groups due to the limited time for making and marketing products, so social skills in the experimental group could not develop significantly.

The development of social skills cannot be done spontaneously. For this reason, a teacher must be able to choose learning methods that can develop social skills, such as forming study groups, giving students the freedom to express opinions, and giving project assignments in groups. Through the habit of learning, students must work together and master good communication (Paristiowati et al., 2015). The courage to communicate with outsiders will train students to learn to communicate with others well, express opinions well, and provide advice or assistance to others if needed (Subasree & Nair, 2014).

Although statistically, there was no significant difference, the increase (N-gain) in the experimental group's cooperation and communication was better than the control group. The increase in communication in the control group was 0.35 in the medium category, while in the experimental group, it was 0.48 in the medium category. The increase in cooperation in the control group was 0.30 in the low category while the experimental group was in the high category by 0.59. The frequency of the effectiveness of chemistry learning in the control and experimental groups is presented in Table 11.

Table 11. Frequency of Effectiveness of CEP Learning on Social Skills

	Control Class	Experiment Class
Ineffective	12	9
Less Effective	5	1
Effective Enough	3	11
Effective	4	2
Total	24	23

The improvement in the experimental group's cooperative skills, which was better than the control group, showed that CEP-based chemistry learning could encourage good cooperation among group members. Cooperation skills will foster an attitude of

empathy toward fellow students, resulting in caring behavior towards people who need help, understanding and accepting the differences of others, helping students in solving problems, and promoting good social relations (Pujar & Patil, 2016; Subasree & Nair, 2014).

4.2 Vocational skill

The results of the N-Gain data analysis based on the results of the pretest and posttest in the control and experimental groups are presented in Table 12.

Table 12. Vocational Proficiency Improvement

Aspects of Vocational Skills	Group	Pretest	Posttest	<g>	% <g>	Category
Accuracy at Work	Control	68.8	77.6	0.28	-	-
	Experiment	67	86.1	0.58	-	-
Tool use skills	Control	61.6	77.6	0.42	-	-
	Experiment	60.9	84.4	0.60	-	-
Work safety and security	Control	55.2	72.8	0.39	-	-
	Experiment	58.3	82.6	0.58	-	-
Attitude at work	Control	76	89.6	0.57	-	-
	Experiment	71.3	87.8	0.58	-	-
Average	Control	65.4	79.4	0.40	33.47	Ineffective
	Experiment	64.4	85.2	0.59	58.32	Effective Enough

The mean percentage of the n-gain value of vocational skills in the control group was 33.47 (ineffective); in the experimental group, it was 58.32 (effective enough). Differences in the effectiveness of learning on vocational skills in the control and experimental groups can be determined using the statistical difference test. Before the statistical test was carried out, the data normality test was first performed. The results of the data normality test with the Shapiro-Wilk test are presented in Table 13.

Table 13. Vocational Proficiency Data Normality Test

Class	Statistic	df	Sig.	Conclusion
Control	.886	24	0.000	Abnormal
Experiment	.901	23	0.695	Normal

Based on the data normality test results, the statistical test used to determine whether there is a significant difference between the vocational skills of the control and experimental groups is a nonparametric statistical test. The statistical test results obtained a sig value <0.05, 0.031, meaning there is no statistical difference in

vocational skills between the control and experimental groups. Although there was no significant difference, the experimental group experienced a better N-gain increase than the control group. The frequency of the effectiveness of the vocational skills of each student in the control group and the experimental group is presented in Table 14.

Table 14. Frequency of Effectiveness of CEP Learning on Vocational Skills

	Control Class	Experiment Class
Ineffective	13	3
Less Effective	4	8
Effective Enough	5	6
Effective	2	6
Total	24	23

The results also show that CEP learning can improve students' vocational skills, including accuracy in work, skills in using tools, work safety and security, and attitudes at work. The results of data analysis showed that the average vocational skill of the experimental group students was 58.32 in the Effective enough category while the control group was 33.47 in the ineffective category.

The improvement of vocational skills in the experimental group is better than that of the control group because the CEP learning approach not only learns theory but also emphasizes experiments related to learning concepts and provides opportunities for students to demonstrate their knowledge and skills in life so that they are motivated to follow in learning activities (Ekwueme et al., 2015; Hunde & Tegegne, 2010).

The results also show that direct CEP learning can train students to be thorough and skillful in using tools, be careful at work, and maintain an attitude. CEP learning carried out directly by experiment can improve students' skills in using tools. Learning by making students as learners (student-oriented) will make learning more fun. Learning by practicing hands-on skills will increase students' interest and understanding of the knowledge being studied, ultimately resulting in high motivation and achievement in the field of learning (Hussain & Akhtar, 2013).

CEP learning is fun and interesting learning for students. Fun and interesting learning can grow students' potential, which has important implications for science education (Bulunuz, 2012). Fun learning can produce a good impression on students (Setyaningsih et al., 2021). In addition, activities that combine practice can directly influence student learning positively and can change students' perceptions of learning

(Catena & Carbonneau, 2019). Learning with the CEP approach can make students more active and creative, analyze problems, design and manufacture products, and package and market them. Learning with CEP Chemistry practicum encourages students to actively process information, solve problems, collaborate, communicate, identify, connect, formulate hypotheses, and practice skills through making practical and economical products (Sumarti et al., 2018; Hartini & Azizah, 2019).

Based on the description above, indirectly learning with the CEP approach is one of the learning models that can prepare the skills needed in the future. One of these skills can be achieved by creating new learning models and a comfortable learning environment for students by allowing them to explore their abilities (Dewi & Mashami, 2019). The skills needed in the future are (a) adaptation, (b) communication skills, (c) problem-solving, (d) management and self-development skills, and (e) systematic thinking (Kim, 2006).

5 Conclusion

a. Limitations

The limitations of this study are that it was only conducted on a limited population. The research was only conducted at the Islamic Senior High School in Rembang, Indonesia, with limited research time.

b. Implications

Chemoentrepreneurship-based chemistry learning can improve the social and vocational skills of students. Vocational skills are fundamental because they are one of the skills that someone facing the industrial revolution must own. Students with good vocational skills will not depend on the number of jobs available, but they can open jobs with their skills. Chemoentrepreneurship-based chemistry learning indirectly helps overcome problems happening in the world, especially in the 8th SDGs goal, which is to foster decent work and economic growth.

c. Suggestions

Chemoentrepreneurship-based chemistry learning is an interesting learning method to practice in schools. It provides theoretical and contextual information in applying science in everyday life, such as making soap or shampoo based on science. Through contextual learning, students can increase their knowledge through the learning

experiences they experience. This learning is suitable for science lessons that are directly related to nature.

d. Recommendations

The recommendations from this research are for educators to provide interesting learning methods for their students. One is the contextual learning method, which is science learning associated with phenomena in life.

References

Arfin, W., Latisma, L., & Oktavia, B. (2018). *A development module of chemistry learning based on chemo-entrepreneurship oriented*. *1*, 394–400. https://doi.org/10.29210/2018157

Azman, A., Simatupang, W., Karudin, A., & Dakhi, O. (2020). Link and match policy in vocational education to address the problem of unemployment. *International Journal of Multi Science*, *1*(7), 76–86. https://www.multisciencejournal.com/index.php/ijm/article/view/78

Bada, S. O. (2015). The psychogenisis of knowledge and its epistemological significance. *IOSR Journal of Research & Method in Education (IOSR-JRME)*, *5*(6), 23–34. https://doi.org/10.9790/7388-05616670

Bulunuz, M. (2012). Motivational qualities of hands-on science activities for Turkish preservice kindergarten teachers. *Eurasia Journal of Mathematics, Science and Technology Education*, *8*(2), 73–82. https://doi.org/10.12973/eurasia.2012.821a

Catena, R. D., & Carbonneau, K. J. (2019). Guided Hands-On Activities Can Improve Student Learning in a Lecture-Based Qualitative Biomechanics Course. *Anatomical Sciences Education*, *12*(5), 485–493. https://doi.org/10.1002/ase.1832

Central Bureau of Statistics. (2021). *Keadaan Ketenagakerjaan Indonesia Februari 2021*.

Chienwattanasook, K., & Jermsittiparsert, K. (2019). Impact of entrepreneur education on entrepreneurial self-employment: A study from thailand. *Polish Journal of Management Studies*, *19*(1), 106–116. https://doi.org/10.17512/pjms.2019.19.1.08

Dewi, C. A. (2019). Improving creativity of prospective chemistry teacher through chemoentrepreneurship oriented inquiry module on colloid topics. *Journal of Physics: Conference Series*, *1156*(1). https://doi.org/10.1088/1742-6596/1156/1/012017

Dewi, C. A., & Mashami, R. A. (2019). The Effect of Chemo-entrepreneurship Oriented Inquiry Module on Improving Students' Creative Thinking Ability. *Journal of Turkish Science Education*, *16*(2), 253–263.

Ekwueme, C. O., E. Ekon, E., & C. Ezenwa-Nebife, D. (2015). The Impact of Hands-On-Approach on Student Academic Performance in Basic Science and Mathematics. *Higher Education Studies*, *5*(6), 47. https://doi.org/10.5539/hes.v5n6p47

Gaol, W. D. L. (2021). Analisis Faktor Yang Mempengaruhi Kecakapan Sosial Remaja di Desa Aeknauli 1 Kecamatan Pollung. *Jurnal Pendidikan Luar Sekolah*, *2*(September), 157–168.

Gusdwisari, B. (2020). *Digital Skill Education Concept, Upaya Peningkatan Kualitas Generasi Muda dan Mengurangi Tingkat Pengangguran Menuju SDGs 2030*.

Hake, R. R. (1999). Interactive-Engagement vs. Traditional Methods: A Six-Thousand-Student Survey of Mechanics Test Data for Introductory Physics Courses. *American Journal of Physics*.

Hartini, D. Y., & Azizah, U. (2019). The Effectiveness of Worksheet With Chemo-Entrepreneurship Oriented on Colloid Matter To Train Creative Thinking Skill. *JPPS (Jurnal Penelitian Pendidikan Sains)*, *8*(2), 1699. https://doi.org/10.26740/jpps.v8n2.p1699-1705

Hunde, A. B., & Tegegne, and K. M. (2010). *Qualitative Exploration on the Qualitative Exploration on the Application of Student-centered Learning in Mathematics and Natural Sciences: The case of Selected General Secondary Schools in Jimma, Ethiopia*.

Hussain, M., & Akhtar, M. (2013). Impact of hands-on activities on students' achievement in science: An experimental evidence from Pakistan. *Middle East Journal of Scientific Research*, *16*(5), 626–632. https://doi.org/10.5829/idosi.mejsr.2013.16.05.1310

Johansen, V., & Schanke, T. (2012). Entrepreneurship Education in Secondary Education and Training. *Scandinavian Journal of Educational Research*, *57*(4).

Joseph, H., Lack, W. C., Barry J. Babin, & Rolph E. Anderson. (2010). *Multivariate Data Analysis (7th ed)*. Pearson.

Kim, K. H. (2006). Can we trust creativity tests? A review of the Torrance Tests of Creative Thinking (TTCT). *Creativity Research Journal*, *18*(1), 3–14. https://doi.org/10.1207/s15326934crj1801_2

Monteiro, R., & Shetty, L. (2016). *Introduction Of Life Skills Education In Curriculum for Creative and Positive Social Functioning Among Young Students*. www.rdmodernresearch.com

Muhajirah. (2020). Basic of Learning Theory (Behaviorism, Cognitivism, Constructivism and humanism). *International Journal of Asian Education* , *Vol.1*(June 2020), 37–42. https://media.neliti.com/media/publications/319060-basic-of-learning-theory-behaviorism-cog-05a8f817.pdf

Pande, M., & Bharathi, S. V. (2020). Theoretical foundations of design thinking – A constructivism learning approach to design thinking. *Thinking Skills and Creativity*, *36*(February), 100637. https://doi.org/10.1016/j.tsc.2020.100637

Paristiowati, M., Slamet, R., & Sebastian, R. (2015). Chemo-entrepreneurship: Learning Approach for Improving Student's Cooperation and Communication (Case Study at Secondary School, Jakarta). *Procedia - Social and Behavioral Sciences*, *174*, 1723–1730. https://doi.org/10.1016/j.sbspro.2015.01.829

Pinta, Y., & Putra, A. (2018). The Development of Chemo-entrepreneurship Oriented Practicum Guided for 10 th Grade in Senior High School. *International Journal of Progressive Sciences and Technologies (IJPSAT*, *8*(2), 280–285. http://ijpsat.ijsht-journals.org

Prayitno, M. A., Lutfianasari, U., & Nugroho, D. E. (2020). The Effectiveness of Greenpreneurship Course for Students' Communication Ability and Entrepreneurial Interest. *THABIEA: Journal of Natural Science Teaching*, *3*(2), 141–150.

Pujar, L.L., & Patil, S.S. (2016). Life Skill Development: Educational Empowerment of Adolescent Girls. *Journal of Applied Research*, *2*(5), 468–472. www.rajournals.in

Purnama, N., Hasan, M., & Syukri, M. (2020). Implementing Chemo-entrepreneurship-Based Inquiry Learning on The Acid-Base Concept to Increase Science Process Skills and Students' Interest in Entrepreneurship. *Journal of Physics: Conference Series*, *1460*(1), 1–7. https://doi.org/10.1088/1742-6596/1460/1/012098

Setyaningsih, U., Sumarti, S. S., & Sudarmin. (2021). Development of Chemo-Entrepreneurship Oriented Learning Design Based on Green Chemistry. *Journal of Innovative Science Education*, *10*(1), 28–34. http://journal.unnes.ac.id/sju/index.php/jise

Soesilowati, E. S. (2009). *Link And Match Dunia Pendidikan Dan Industri Dalam Meningkatkan Daya Saing Tenaga Kerja Dan Industri*. LIPI Press, Pusat Penelitian Ekonomi Lembaga Ilmu Pengetahuan Indonesia.

Subasree, R., & Nair, A. R. (2014). The Life Skills Assessment Scale: the construction and validation of a new comprehensive scale for measuring Life Skills. *Journal Of Humanities And Social Science*, *19*(1), 50–58.

Sumarti, S. S., Aris, S. R. S., & Aini, R. N. (2018). Chemoentrepreneurship with cooperative integrated process inquiry strategy to increase entrepreneurial interest and learning motivation. *Jurnal Pendidikan IPA Indonesia*, *7*(2), 172–180. https://doi.org/10.15294/jpii.v7i2.12206

Trevors, G., Feyzi-Behnagh, R., Azevedo, R., & Bouchet, F. (2016). Self-regulated learning processes vary as a function of epistemic beliefs and contexts: Mixed method evidence from eye tracking and concurrent and retrospective reports. *Learning and Instruction*, *42*, 31–46. https://doi.org/10.1016/j.learninstruc.2015.11.003

Wijayati, N., & Rengga, W. D. P. (2009). Implementation of Chemo-Entrepreneurship Teaching Approach for Improving Students' Life Skills. *Jurnal Ilmu Pendidikan*, *16*(2), 100–105.

Zia Ulhaq, M., Wijayati, N., & Sumarni, W. (2021). Implementation of the CTL Model with the CEP Approach to Improve Student Learning Outcomes and Entrepreneurial Interest in Matter–Properties and Changes in Vocational School. *Journal of Innovative Science Education*, *9*(3), 35–42. https://doi.org/10.15294/jise.v9i1.37986