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Investigating the Relationship between Creative Thinking and Entrepreneurial Spirit with STEMC-Based Project-Based Learning Models

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Correlation, creative thinking, entrepreneurial spirit, PjBL, STEMC

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Abstract

Creative thinking is the cornerstone of entrepreneurship to encourage innovative ideas and entrepreneurial opportunities. The research aimed to determine a significant correlation between creative thinking and entrepreneurial spirit. The study used a correlation design. The sample was selected using purposive sampling. The sample was students in class X of SMAN 3 Langsa City. Data collection used a description test to determine the student's level of creative thinking and questionnaires to determine the student's entrepreneurial spirit. The data were tested using parametric statistics in the form of Pearson Product Moment correlations, which were analyzed using SPSS 20 statistical techniques. The results obtained that the correlation coefficient was 0.518. It shows that there is a correlation with sufficient criteria with an interpretation score between 0.40 $<r \leq 0.60$. Furthermore, with df = 52, it obtained a significance level of 0.05 at 0.2732, so rxy = 0.518 > t table 0.2732. Then, Ha is accepted and Ho is rejected, which indicates a significant correlation between creative thinking and students' entrepreneurial spirit. It is recommended that in the future, educators implement entrepreneurship-based STEM learning, which focuses on creativity and fosters students' confidence to start entrepreneurship.

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INTRODUCTION

The rapid development of technology in the 21st-century globalization era has made the ability to think creatively and an entrepreneurial spirit an important part that individuals need to succeed in the world of work (Şenel & Bağçeci, 2019; Richardson & Mishra, 2018). In accordance with the demands of educational institutions, educators are required to produce generations that can adapt to the various challenges of life that are adapted to the demands of the 21st Century (Kurniahtunnisa et al., 2020; Kuncahyono & Aini, 2020; Bray et al., 2023). Students are expected to be able to find information, identify problems, be able to think creatively, work in teams (Mutakinati et al., 2018; Hanif et al., 2019; Hamed, 2012).

In addition, students continue to build intentions in entrepreneurship so that they become independent in the future (Ghafar, 2020). Entrepreneurship in chemistry learning is an interesting topic in the world of education. Learning chemistry linked to entrepreneurship is one way to strengthen understanding of chemical concepts and the potential commercial application of the chemical concepts studied. Increasing creative thinking in chemistry will lead to new discoveries that can increase efficiency in developing original ideas in entrepreneurship. Creative thinking is considered a needed skill to develop original ideas in facing challenges that require adaptive solutions (Marcos et al., 2023; Behnamnia et al., 2020). Meanwhile, an entrepreneurial spirit is built within

students to change their mindset, ability to take risks, become more independent and maximize their potential (Ula & Fauzi, 2021; Crosling et al., 2015). In the context of the entrepreneurial spirit, creative thinking is the basis for generating profitable innovative ideas and observing new opportunities in entrepreneurship.

It is hoped that building a student's entrepreneurial spirit can reduce the level of poverty in Indonesia with their creative attitude. So that, in the future, students could survive in difficult economic conditions. In line with the application of the Pancasila student profile in the Merdeka curriculum, includes building character and competence in independent and creative dimensions. The results of initial observations at SMAN 3 Langsa found that there were still many students who were not interested in entrepreneurship because their focus was on becoming a Civil Servant where there were still many of them who did not think about providing work opportunities. When students have entrepreneurial skills, they become individuals who are responsible for their lives, both personally and socially (Tantawy et al., 2021; Fretschner and Lampe, 2019; Areli, 2018).

In the world of education, the STEM (Science, Technology, Engineering, and Mathematics) approach is one of the approaches that follow the characteristics of the 21st century. Moreover, the STEM approach has become a publication with a hot topic that is very important to be applied in education (Utami et al., 2023; Zizka et al., 2021; Li et al., 2020; Jho et al., 2016). STEM education is believed to equip students with transdisciplinary knowledge and skills to deal with everyday problems and prepare for their future careers (Margot and Kettler, 2019; Le et al, 2021). Stohlmann et al., (2012) state that with the STEM approach, students can think critically so that they can solve problems well, think logically, and become more creative, independent, and literate about technology (Lestari et al., 2024).

Currently, STEM is used by Indonesia to change the educational process. The acronym STEMC stands for "Critical Thinking, Creativity, Collaboration, Communication, Computational Thinking + Character." It refers to the fact that Aceh does not only focus on the skills students but also the student's personality. It is a reason why Aceh is one of the few places in Indonesia that is committed to implementing STEM education. The application of STEM has been widely applied to schools in Banda Aceh City and its surroundings, so STEMC education is more popular in Banda Aceh and its surroundings than in other areas in Aceh. However, for other Regencies/Cities, the application of STEMC in educational practice is mostly limited, including in Langsa City District.

The application of STEMC as an approach in classroom implementation might be combined with a Project Based Learning (PjBL) model, which is known as an effective learning model for actively involving students in real-life learning. Project-based learning makes meaningful learning by combining concepts from known knowledge, field experience, and scientific disciplines to overcome real-world challenges (Santos et al., 2023; Sharma et al., 2020). PjBL has been proven to improve skills, creativity, critical thinking, and problem solving skills (Millen & Supahar., 2023; Mitasari & Hidayah., 2022; Cortázar et al., 2021; Rahmazatullaili, et al., 2017; Saenab, et al., 2019). Besides that, it encourages students to think systematically, collaborate, communicate and work in teams by involving each individual's expertise to achieve common goals (Almulla, 2020).

Based on preliminary analysis, creative thinking is considered an important aspect of creating innovation that can differentiate a business from its competitors. Understanding the relationship between creative thinking and the entrepreneurial spirit can provide insight into human resource development in organizations. Therefore, this research aims to analyze whether there is a correlation between creative thinking and entrepreneurial spirit through chemistry learning by applying the STEMC-based PjBL model.

RESEARCH METHOD

The approach used a quantitative approach to obtain objective and valid data. The type of research was pre-experimental. The design was Pre-test Post-test Control-Group (Creswell, 2012; Afriana et al., 2016).

Table 1. Desain Pre-test Post-test Control-Group

Pre-test	Treatment	Pos-test
O	X	O

Information:

O = Pretest-Postest
X = Treatment uses the PjBl-STEMC model

Participants were students from Class X SMA 3 Langsa, in the even semester of the 2021/2022 academic year. The sample was selected using a purposive sampling technique, namely a sample selection technique with certain considerations. The total sample is 52 students.

The research design used correlation. Correlation is a quantitative study between two or more variables (Creswell, 2012). The article

identified whether there is a significant correlation between creative thinking and entrepreneurial spirit.

The creative thinking ability test was developed based on 4 indicators, including Fluency, Elaboration, Flexibility, and Originality (Torrance & Allioti, 1969). Tests were given to students in the form of essay questions. Data were analyzed using descriptive statistics and calculated using the following percentage formula (Sabaniah, et al., 2019).

$$\text{Score} = \frac{\text{Student Answer Score}}{\text{Max Score}} \text{x}100\%$$

Entrepreneurial spirit is measured using a questionnaire containing statements prepared according to the criteria adopted by Karabulut (2016).

Table 2. Entrepreneurial Spirit Indicators

Indicator	Aspect	Sub Indicator
Need for Achievement	Assessing students' expectations in doing something better (Karabulut, 2016; Uysal et al., 2021; Vandor, 2021)	Willing to success in entrepreneurship Happy to complete tasks Trying to learn something new
Willingness to Take Risk	Assessing students in thinking about problems/risks that will occur (Karabulut, 2016; Vandor, 2021)	Pay attention to the risk of failure
Locus of Control	Assessing students' control over events with their own efforts (Uysal, et al., 2021; Karabulut, 2016)	Have perseverance and hard work Not easily give up believe in luck
Enterprenurial Alertness	Assessing students' awareness of entrepreneurial intentions (Karabulut; 2016)	Find out about the development of entrepreneurship Spend time thinking about ways to improve your business Thinking of new ideas
Self Confidence	Assessing aspects of students' beliefs about the ability to carry out relevant tasks and roles related to entrepreneurship (Cassar & Friedman, 2009; Uysal, et al., 2021; Liñán & Fayolle, 2015)	Have skills in starting a business Have the ability to start a business Have confidence in starting something

The questionnaire was measured using a Likert scale with a scale of 1-5. Table 3 shows details the Likert scale assessment criteria.

Tabel 3. Likert Score Criteria

Name of Style	Likert scale
Strongly agree	5
Agree	4
Doubts	3
Don't agree	2
Strongly Disagree	1

(Creswell., 2012: Yusrizal., 2016)

Calculation of the percentage score of students' entrepreneurial spirit are;

$$\text{Percentage (\%)} = \frac{the\ total\ score\ obtained}{maximum\ total\ score}\ x\ 100\%$$

Also, the study uses student's observation sheets to support the link between creative thinking and entrepreneurial spirit by using the following equation;

$$\text{P} = \frac{f}{N}\ x\ 100\%$$

Information:
P = Percentage number
f = Frequency of student activity whose percentage is being calculated

N=The total number of activities

Table 4. Criteria for Observing Student's Activity Observations

Percentage (%)	Category
76 – 100%	Very high
51 – 75%	Height
26 – 50%	Low
0 – < 25%	Very Low

(Badlisyah & Amsa, 2018)

$$rXy \frac{n\sum xy - (\sum x)(\sum y)}{\sqrt{\{n\Sigma x^2 - (\Sigma x)^2\}\{n\Sigma y^2 - (\Sigma y)^2\}}}$$

Information:

r_{xy} : The coefficient between the variables x and y
n : Number of respondents
X : Item score questions
Y : Score total

RESULT AND DISCUSSION

The instrument is validated by Expert Judgment. The validity of the instrument was analyzed using Cronbach's alpha. The test results showed that the instrument was valid. Meanwhile, the reliability results show a value of 0.748 (reliable) in the high category**.**

Table 5. Average Aspects of Creative Thinking

Aspect	Percentage
Elaboration	60
flexibility	97
Fluency	91
Originality	83
Average	82.75

Table 5 concluded that the creative thinking score data based on the creative thinking indicators shows an average score of 82.75**.**

The instruments for measuring the student's entrepreneurial spirit in this research are questionnaires and observation sheets developed by Karabulut (2016) with the aspects of Need for Achievement, Willingness to Take Risk, Locus of Control, Entrepreneurial Alertness, and Self Confidence.

Table 6. Average Aspects of the Entrepreneurial Spirit Questionnaire

Aspects	Percentage
Need for Achievment	80
Risk Tolerance	80
Locus of Control	86
Entreprenurial Alertness	76
Self Confidence	82
Average	81

Based on Table 6, the data of entrepreneurial spirit indicator score shows an average score of 81. The research results were calculated using the Pearson Product Moment correlation formula, which was analyzed with SPSS. Variable X in the form of creative thinking is measured through tests in the form of essays. Meanwhile, variable Y in the form of entrepreneurial spirit is measured through questionnaires. The following are the results of the correlation test of creative thinking and entrepreneurial spirit.

Table 7. Correlation Test Results for Creative Thinking with Entrepreneurial Spirit

		Creative Thinking	Entrepreneurial Spirit
Creative Thinking	Pearson Correlation	1	0.518
	Say. (2-tailed)		0.000
	N	52	52
Entrepreneurial Spirit	Pearson Correlation	0.518	1
	Say. (2-tailed)	0.000	
	N	52	52

The results of the correlation test significantly shows that there is a correlation between creative thinking ability and entrepreneurial spirit. Based on a significance value of 0.000 <0.005 with a positive degree of relationship based on a Pearson value of 0.518, means that the higher the creative thinking

ability, the higher the entrepreneurial spirit. It is supported by Murad et al., (2021) who found a positive influence between creativity and entrepreneurial spirit. Other research shows that creativity has a positive correlative to entrepreneurial activities (Jiatong et al., 2021; Wiyono et al., 2020; Ghasemi et al., 2011), entrepreneurial learning achievement (Afifah & Panggabean, 2019).

The score of the correlation between creative thinking and tiered entrepreneurial spirit at an interpretation score between $0.40 < r \leq 0.60$ proves that the correlation coefficient is in the moderate correlation category. Observations are made of student activities to support the correlation of creative thinking and entrepreneurial spirit. The following are the average results of observations on the entrepreneurial spirit observed by 3 observers.

Table 8. Observation Results of Student Activities Based on Entrepreneurial Spirit Indicators

Aspect	Rate-rate
Need For Achievment	87.5
Risk Tolerance	87
Locus of Control	88.3
Self Confidence	80
Entreprenurial Alertness	82.5

The average data for each indicator of creative thinking ability and entrepreneurial spirit using the STEMC-based PjBL model shows a fairly high average, as presented in Table 5 and 6. The increase in each indicator of creative thinking ability shows that STEMC-based PjBL creates a constructivist learning environment that actively involves students in learning activities, thereby increasing students' mindset in solving problems from different points of view, understanding concepts, and relating information obtained in real life and producing innovations. The STEMC approach would instill the values that exist in the student's entrepreneurial spirit.

However, the correlation results are still in the "enough" category because the entrepreneurial spirit is a new thing for students. Even though students can think creatively, students are not yet experienced and fully understand how to do entrepreneurship, so students lack confidence in entrepreneurship, as presented in table 8. Based on this research, the entrepreneurial spirit is something new for students. Even though students have can think creatively, students do not have experience and fully understand how to do entrepreneurship, so students are not confident in entrepreneurship. It is seen from the 30-40% percentage of students' answers who still experience difficulties when completing tasks related to entrepreneurship and thinking about new ideas in entrepreneurship. Several previous research stated that the creative process is carried out by people who have an entrepreneurial personality, attitude and behavior, but the factors that tend to influence entrepreneurial intentions are motivation to be independent, demands in the economy, and personality traits such as self-confidence, responsibility, a tendency to take risks, commitment, and like challenges (Al-Harrasi et al., 2014; Sukirman, 2017; Fuller et al., 2018; Neneh, 2019). Supported by Cubero et al. (2022) states that entrepreneurial personality is a combination of entrepreneurial education, personality, initiative and open-mindedness. And, the family environment is the most determines factor for the attitude of young entrepreneurs.

CONCLUSION

Based on the findings and discussion, it concluded that the data is t count 0.518 > t table 0.2732, with a significance value of 0.000 <0.005. The results showed that Ha was accepted. It means that there is a significant positive correlation between creative thinking and students' entrepreneurial spirit. The correlation between creative thinking and tiered entrepreneurial spirit at an interpretation score between $0.40 < r \leq 0.60$ proves that the correlation coefficient is in the moderate correlation category. Based on research and discussions, suggest that students continue to be involved in entrepreneurship-based learning that focuses on creativity. So, students are trained and increase students' self-confidence in entrepreneurship. This research still has limitations in terms of the sample used. Therefore, further research is needed to confirm and expand the findings.

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