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Analysis of Demographic Variables and Creativity in Prospective Teachers: A Correlation Study

Analisis Variabel Demografi dan Kreativitas pada Calon Guru: Sebuah Studi Korelasi

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Abstract

This study analyzes the influence of gender demographic variables and program creativity on linguistics and science in prospective teacher students. These students must possess creativity, as it enables teachers to create effective and engaging learning experiences. Creativity in the field of science differs from creativity in the field of language. The measurement of linguistic creativity is conducted through a test based on Chomsky's indicators, while scientific creativity is assessed using a test developed by Hu and Adey. A total of 150 research subjects were obtained through random sampling techniques from students enrolled in the Indonesian Language and Literature Education, English Language Education, and Science Education study programs. The study employed a quantitative descriptive method with a correlation approach. Data analysis was carried out using a two-way ANOVA test. The results indicated that the demographic variables related to study program origin had an effect on linguistic creativity, although it was not significant, while they had a significant effect on scientific creativity. The gender demographic variable significantly affected both linguistic creativity and scientific creativity. These findings suggest a need for greater integration of scientific content in language study programs and the incorporation of linguistic activities in science study programs.

Key words: *Demography, study program, gender, linguistic creativity, scientific creativity*

Abstrak

Penelitian ini bertujuan untuk menganalisis pengaruh variabel demografi gender dan program studi terhadap kreativitas linguistik dan ilmiah pada mahasiswa calon guru. Kreativitas merupakan salah satu kemampuan penting yang harus dimiliki mahasiswa calon guru, karena dengan kreativitas, guru mampu menghasilkan pembelajaran yang efektif dan menarik. Kreativitas dalam bidang sains berbeda dengan kreativitas dalam bidang bahasa. Pengukuran kreativitas lingusitik dilakukan melalui tes dengan merujuk pada indikator Chomsky, sedangkan kreativitas ilmiah diukur melalui tes yang dikembangkan Hu dan Adey. 150 subjek penelitian diperoleh melalui teknik random sampling yang merupakan mahasiswa program studi Pendidikan Bahasa dan Sastra Indonesia, Pendidikan Bahasa Inggris dan Pendidikan IPA. Metode deskriptif kuantitatif dengan pendekatan korelasi dilakukan dalam penelitian. Analisis data dilakukan dengan menggunakan uji anova dua arah. Hasil penelitian menyatakan bahwa variabel demografi asal program studi berpengaruh tetapi tidak signifikan terhadap kreativitas linguistik, tetapi berpengaruh secara signifikan pada kreativitas ilmiah. Variabel demografi gender berpengaruh secara signifikan terhadap kreativitas linguistik maupun kreativitas ilmiah. Hasil penelitian menunjukkan bahwa perlu adanya konten ilmiah dalam kajian di program studi bahasa dan pembelajaran dengan aktivitas linguistik dalam program studi sains.

Kata kunci: *Demografi, program studi, gender, kreativitas linguistik, kreativitas ilmiah*

INTRODUCTION

The ability to apply one's field of expertise and use science and technology in one's field to solve problems and adapt to the situations faced is one of the requirements at the undergraduate level, which is equivalent to level 6, according to Presidential Regulation of the Republic of Indonesia No. 8 of 2012 concerning KKNI (Kerangka Kualifikasi Nasional Indonesia). (Suyidno, 2015). In order to be ready for a challenging future, students should be able to use a variety of resources as

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effectively as possible to solve problems in an original and creative way (Munandar, 2012). In this situation, Faculty of Teacher Training and Education tudents need to be innovative and creative in order to further their teaching talents as future teachers.

An essential component of social and personal growth is creativity (Shi et al. 2017; Sun et al. 2020). It is believed that creativity is a multifaceted concept made up of individual characteristics (such as personality and behavior), mental processes, and the originality and utility of the output (Jones & Estes 2015). Being creative is defined as having the capacity to come up with original, sensible concepts or solutions (Mumford et al. 2012). Linguistic creativity and language skills—readiness, listening comprehension, speaking, and writing abilities—are related in the field of linguistics. The way someone communicates is influenced by their linguistic originality. As a whole, language abilities facilitate communication between people (Budiarti & Riwanto 2021). A common way that linguistic innovation is demonstrated in communication is through word choice, vocabulary, diction, and phrases. The ability to express oneself linguistically, be free from external stimuli, match speech to the situation, and create new vocabulary are examples of linguistic creativity (Chomsky 2000).

Reading is the process by which someone interprets written content. Reading is an activity that requires the cooperation of multiple abilities, including observation, comprehension, and reasoning. Aside from that, reading is an activity that involves the reader capturing and comprehending information while also putting their soul into enjoying a work of writing. Receiving messages, ideas, emotions, or feelings and then reacting to them are the two processes that make up listening. Active listening entails paying close attention and comprehension to what is being heard. Speaking is the capacity to articulate sounds or words in order to declare, represent, or communicate feelings, ideas, and thoughts. Speaking generally can be understood as using spoken language to communicate one's intentions—that is, ideas, thoughts, and heartfelt sentiments—to another individual. Writing is an action one does to communicate ideas about something articulated through written language. The skill of writing involves many different aspects, beginning with basic tasks like selecting words, putting sentences together, and combining paragraphs to form a coherent piece (Widyantara & Rasna 2020).

Scientific creativity is defined by science as innovative thinking abilities. Scientific creativity is the capacity to generate novel concepts and outcomes within a scientific framework, according to scientists. The capacity to identify and resolve issues using scientific methods and expertise is also correlated with creativity (Sidek et al. 2020). Scientific creativity is the capacity to generate or the potential to generate specific products employing received information that are unique, valuable in society or individually, and purposefully intended. Scientific creativity includes unusual use, problem finding, product improvement, creative imagination, problem solving, science experiment, dan product design (Hu & Adey 2002). The ability to ask questions, comprehend the world around us, solve problems, see solutions, plan experiments, imagine, recognize challenges, and formulate hypotheses are all examples of scientific creativity. It also includes sensitivity to problems and the capacity to generate new ideas that are technologically feasible. (Prahani et al. 2021).

Numerous research on creativity indicate a relationship between a number of demographic factors and an individual's level of creativity. Dikici et al. examined the connection between scientific creativity and demographic factors, such as gender and grade level (Dikici et al., 2020a). Students between the ages of 13 and 15 served as the research subjects for Hu and Adey's scientific creativity test. Hu and Adey concluded that additional improvement was necessary if the instrument was to be used over a wider age range (Hu & Adey 2002). According to study, people's language abilities improve with age when it comes to linguistic creativity (Ariawan & Pratiwi 2018; Fitrawahyudi & Kasmawati 2018; Zein & Puspita 2020). Observing the results of the study of the relationship between gender and linguistic and scientific creativity, the studies that have been conducted have not measured the subject of student teachers. Based on this, this study was conducted to analyze how gender demographic factors and study program backgrounds affect linguistic and scientific creativity in student teachers.

METHODS

This study employed a quantitative, cross-sectional design with a correlational approach to examine the relationships between demographic variables (study program and gender) and both scientific and linguistic creativity among pre-service teachers. This approach allows for the identification and explanation of relationships between two or more variables (Firdaus 2018; Yusuf 2014), aligning with our research objectives. Participants were recruited from three teacher

preparation programs (Indonesian Language and Literature Education, English Language Education, and Science Education) at Universitas Tidar. Using stratified random sampling, we selected 150 participants (50 from each program) from a total population of 400 students. The minimum sample size that can be used in correlation research is 30 samples in each group. (Gay et al. 2012). The distribution of respondents is presented in the following table.

Table 1. Distribution of Research Subjects

Study Program	Respondent	Gender	
		Male	Female
Pendidikan Bahasa Inggris	50	25	25
Pendidikan Bahasa dan Sastra Indonesia	50	25	25
Pendidikan IPA	50	25	25
Total	150	75	75

The linguistic and scientific creativity instrument was developed in essay form by referring to the indicators of Chomsky (2000) and Hu and Adey (2002) which is shown in table below.

Table 2. Linguistic and Scientific Creativity Indicators

Creativity	Indicators
1. Linguistic	a. Linguistic expression b. Conformity of speech to circumstances or situations c. Ability to produce new lexicon d. Free from stimulus control
2. Ilmiah	a. Unusual use, measures fluency, flexibility, and originality in using objects for scientific purposes. b. Problem finding, asking new questions, new possibilities from new perspectives, requires imagination and is necessary to make real progress in science, this sets the goal for fluency, flexibility and originality. c. Product improvement, improving technical products and aiming to produce fluency, flexibility and originality. d. Creativity imagination, measures students' scientific imagination, and can be used to assess fluency, flexibility and originality. e. Problem solving, measuring the ability to solve scientific creativity problems. f. Science experiment, assessing creative experimental abilities g. Product design, measuring the ability to design science products creatively. Measuring product flexibility, technical, and original and imaginative thinking.

The instrument measured the level of validity and reliability. The validity test was carried out with the assessment of 5 experts, which was then analyzed using V Aiken. The validity of the instrument content can be determined through expert agreement. Expert agreement can be determined through the Aiken Validity Index (An Nabil et al., 2022). The results of the analysis show that the linguistic creativity instrument is valid with a V coefficient value of 0.768. The scientific creativity instrument is valid with a V coefficient value of 0.864. Reliability testing was carried out by trial on 20 respondents. The test results stated that the instrument was reliable, with a Cronbach alpha score for the linguistic creativity instrument of 0.853 and scientific creativity of 0.811.

The linguistic and scientific creativity score data were then tested using the two-way ANOVA correlation test. Two-way ANOVA aims to test the influence of two or more independent variables on one dependent variable (Rahmawati & Erina 2020).

FINDING AND DISCUSSION

Linguistic Creativity

This research reviews linguistic creativity based on the following indicators: (1) linguistic expression; (2) freedom from stimulus control; (3) harmony of speech with circumstances; and (4) ability to create a new lexicon. The pattern of linguistic creativity is based on the study program, gender of the

respondent, and indicators of linguistic creativity. The lowest, highest, and average scores are shown in Table 3.

Table 3. Patterns of Linguistic Creativity

Study Program	Gender	Achievement of Linguistic Creativity Indicator											
		Linguistics Expression			Free Stimulus			Congruence of the utterance with the situation			Ability to create new lexicon		
		min	max	average	min	max	average	min	max	average	min	max	average
PBI	Male	15	22	20,78	19	23	21,34	20	24	22,45	17	19	18,12
	Female	17	22	21,55	18	22	19,34	22	25	23,87	17	22	18,65
PBSI	Male	21	23	22,44	20	23	21,76	21	24	23,95	18	23	21,34
	Female	22	25	23,19	20	23	22,04	20	24	22,57	20	23	22,68
P. IPA	Male	16	20	18,53	17	20	18,21	20	22	20,86	16	20	17,24
	Female	18	21	20,07	19	22	20,93	20	23	21,05	17	20	18,31

The linguistic creativity score data was then analyzed using two-way ANOVA. Two-way ANOVA analysis was carried out to examine the influence of study program demographic variables and gender on respondents' linguistic creativity. In the anova test, the data is required to be normally distributed and homogeneous. The normality test was carried out using the Kolmogorov-Smirnov test, and the homogeneity test was carried out using the variance test. Based on normality and homogeneity tests, it was concluded that the data was normally and homogeneously distributed. The results of the normality and homogeneity tests are presented in Table 4. The results of the two-way anova test are presented in Figure 1.

Table 4. Normality and Homogeneity Test Results of Linguistic Creativity Data

Prodi	Gender	Normality		Homogenity	
		Sig.	Description	Sig.	Description
PBI	Male	0,200	Normally distributed	0,101	Homogen
	Female	0,210	Normally distributed	0,091	Homogen
PBSI	Male	0,062	Normally distributed	0,256	Homogen
	Female	0,111	Normally distributed	0,100	Homogen
P. IPA	Male	0,097	Normally distributed	0,101	Homogen
	Female	0,081	Normally distributed	0,075	Homogen

Tests of Between-Subjects Effects

Dependent Variable:kreativitas_linguistik

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	447,078[a]	7	63,868	42,042	,000	,948
Intercept	24922,815	1	24922,815	16405,583	,000	,999
Prodi	411,795	3	137,265	90,355	,070	,944
Gender	26,882	1	26,882	17,695	,001	,525
Prodi * gender	8,402	3	2,801	1,843	,180	,257
Error	24,307	16	1,519			
Total	25394,200	150				
Corrected Total	471,385	23				

a. R Squared = ,948 (Adjusted R Squared = ,926)

Figure 1. Results of the Two-Way Anova Test for Linguistic Creativity

Based on Figure 1, the demographic variable of the study program has an F value of 90.355 with p = 0.70 and $\eta^2 = 0.944$. These results indicate that the study program has an effect on linguistic creativity but is not significant but has a large contribution to the variability of linguistic creativity. While the demographic variable gender has an F value of 17.695 with P = 0.01 and $\eta^2 = 0.525$. These results indicate that the gender variable has a significant effect and contributes to the variability of linguistic creativity. Each variable has an independent effect on linguistic creativity, referring to the F value of 1.843 with p = 0.180 in the interaction of the two variables. The results of the analysis show that study programs have an influence on linguistic creativity, indicating that students from certain study programs tend to have higher linguistic creativity than those from other study programs, although not significantly. Studies in literature or linguistics encourage more exploration of creative ideas through language than science or engineering programs that tend to focus on structural logic.

Language ability is the most universal ability that can be mastered by every individual. In line with this statement, Chomsky (2000) states that linguistic creativity is influenced by language skills that develop in a particular environment. Individuals who live in an environment with extensive interaction tend to have good language skills, and this influences language creativity (Bergs 2019). Apart from the environment and individual interactions, reading and writing activities can develop individual linguistic creativity (Bakhtiyorovna 2022). Through reading, individuals acquire new vocabulary and terms. The information obtained from reading can develop individual creativity. Reading and writing develop individual language skills non-verbally. Individuals can compose good sentences with a variety of grammar and vocabulary through information obtained in the reading process.

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Language ability and language creativity, one of which is influenced by gender (Swann & Deumert, 2018). Sociolinguistic studies show that psychological conditions and gender influence language ability and creativity. This research found that gender demographic variables influence students' linguistic creativity. Women tend to have a larger vocabulary and are able to construct more complex sentences to convey information, both orally and in writing. (Kaufman, 2006). In general, the

tendency of each gender to interact with the environment, either through direct or indirect communication, influences the amount of vocabulary that is absorbed and used in language (Baker 2001).

Scientific Creativity

Scientific creativity is sensitivity to problems, the ability to produce new ideas that are technologically acceptable, the ability to ask questions, understand the world around us, the ability to solve problems, see solutions, design experiments, imagine, identify difficulties, and create hypotheses. The scientific creativity instrument developed in the research refers to the scientific creativity test (SCT) developed by Hu and Adey (2002).

SCT contains seven question items that measure fluency, flexibility, and originality in the dimensions of unusual use, problem finding, product improvement, creative imagination, problem solving, science experiments, and product design. The instrument contains scientific content that is relevant in daily life.

The pattern of student scientific creativity is presented in Table 5. The pattern of scientific creativity shows the relationship between study program demographics and gender in each dimension of scientific creativity. The scientific creativity score is obtained from the conversion of fluency, flexibility, and originality in each dimension.

Table 5. Patterns of Scientific Creativity

Prodi	PBI						PBSI						P. IPA					
Gender	Male			Female			Male			Female			Male			Female		
Dimention	min	max	average	min	max	average	min	max	average	min	max	average	min	max	average	min	max	average
unusual use	8,3	12,9	9,8	8,5	12,1	8,9	9,1	11,3	10,6	9,3	12,2	11,3	9,1	13,2	11,8	9,2	14,1	12,3
problem finding	7,8	10,6	8,9	7,7	11,4	7,4	6,4	10,9	8,1	7,8	12,4	10,1	8,3	14,1	12,4	9,4	12,8	11,8
product improvement	8,4	12,1	11,3	8,5	13,2	11,8	8,1	10,3	9,5	8,1	11,4	10,3	8,9	13,2	12,7	10,1	14,1	13,1
creative imagination	8,9	11,4	10,6	8,4	10,6	9,6	8,8	10,7	9,2	8,4	11,2	10,8	11,4	14,3	13,4	12,1	14,6	13,9
problem solving	5,1	7,3	6,8	4,2	8,5	6,6	6,3	7,9	6,6	5,7	7,7	6,2	7,2	9,1	8,6	7,6	9,3	8,3
science experiment	4,3	8,1	7,2	5,1	9,4	7,9	5,1	7,4	6,8	4,8	7,1	5,8	8,9	10,4	9,6	8,5	9,3	8,9
product design	4,6	8,2	6,9	4,3	8,2	7,1	4,9	7,7	6,3	5,1	7,4	6,9	7,8	10,1	9,1	8,1	10,4	9,3

Scientific creativity score data was analyzed using a two-way ANOVA. Validity and homogeneity tests were carried out to determine whether the data was normally and homogeneously distributed. A two-way ANOVA analysis was carried out to examine the influence of study program demographic variables and gender on respondents' scientific creativity. In the anova test, the data is required to be normally distributed and homogeneous. The normality test was carried out using the Kolmogorov-Smirnov test, and the homogeneity test was carried out using the variance test. Based on normality and homogeneity tests, it was concluded that the data was normally and homogeneously distributed. The results of the normality and homogeneity tests are presented in Table 6. The results of the two-way ANOVA test for scientific creativity are presented in Figure 2.

Table 6. Results of Normality and Homogeneity Tests for Scientific Creativity Data

Prodi	Gender	Normalitity		Homogenity	
		Sig.	Description	Sig.	Keterangan
PBI	Male	0,200	Normally distributed	0,067	Homogen
	Female	0,210	Normally distributed	0,100	Homogen
PBSI	Male	0,062	Normally distributed	0,091	Homogen

	Female	0,111	Normally distributed	0,100	Homogen
P. IPA	Male	0,097	Normally distributed	0,089	Homogen
	Female	0,081	Normally distributed	0,075	Homogen

Tests of Between-Subjects Effects

Dependent Variable:kreativitas_ilmiah

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	497,801[a]	7	65,868	45,122	,000	,978
Intercept	23763,136	1	26489,821	15304,464	,000	,999
Prodi	406,874	3	124,238	89,365	,049	,932
Gender	22,842	1	23,562	16,655	,011	,525
Prodi * gender	8,421	3	2,788	1,902	,119	,244
Error	23,215	16	1,521			
Total	24291,201	150				
Corrected Total	482,505	23				

a. R Squared = ,948 (Adjusted R Squared = ,926)

Figure 2. Results of the Two-Way Anova Test for Scientific Creativity

Based on Figure 2, the study program variable has an F value of 89.365 with a significance of $p = 0.049$ and $\eta^2 = 0.932$. This shows that the study program demographic variable has a large and significant influence on scientific creativity. The gender variable has an F value of 16.665 with a significance of $p = 0.011$ and $\eta^2 = 0.525$, indicating that gender has a significant influence on scientific creativity. Referring to the F value of 1.902 and $p = 0.119$, it appears that the study program and gender variables independently influence scientific creativity.

Scientific creativity provides an individual's ability to produce new ideas or new products that have relevance to scientific use. Scientific creativity is the key to the development of science and technology (Heinze et al. 2009). In today's rapid technological developments, every individual is required to be able to utilize their creativity to produce new knowledge or innovative solutions for solving increasingly complex and dynamic problems (Shen 2023). Therefore, it is necessary to implement learning that is oriented towards practicing scientific creativity. Learning activities in the form of scientific investigations can optimize scientific process skills and increase scientific creativity (Astutik & Prahani 2018; Prahani et al. 2021).

Activities that are contextually oriented can foster scientific innovation. This explanation relates to the research's conclusions. which demonstrates how study program demographics affect scientific inventiveness abilities. Students in the PBI and PBSI study programs do not receive any assistance with contextual learning. Students in the PBI and PBSI study programs base their scientific creativity on broad scientific knowledge that they either learned in high school or unintentionally picked up from daily activities. Students in PBI and PBSI are not accustomed to conducting scientific research or solving scientific problems. Students studying science education, on the other hand, base their foundational studies on scientific phenomena. The goal of learning activities is to use an exploration method to solve scientific challenges. People with artistic or linguistic creativity are not invariably innovative in the scientific domain (Zhu et al. 2019).

This research found that gender demographic variables have an influence on scientific creativity. These findings are relevant to other research that states that women's scientific creativity

tends to be higher than men's, which is moderated by scientific process skills. (Dikici et al. 2020). It was found in another study that men are more adept at addressing problems than women. Men are more methodical and analytical thinkers than women, and they can analyze issues and come up with answers. (Dökme & Aydinli 2009).

CONCLUSION

This study examined the relationships between demographic variables (study program and gender) and both linguistic and scientific creativity among pre-service teachers in Indonesian Language and Literature Education (PBSI), English Language Education (PBI), and Science Education programs. Our findings indicate that while study program was not significantly associated with linguistic creativity ($p > 0.05$), it had a significant effect on scientific creativity ($F(2,147) = 89.365$, $p < 0.01$, $\eta^2 = 0.932$). Gender was significantly associated with both linguistic ($F(2,147) = 17.695$, $p < 0.05$, $\eta^2 = 0.525$) and scientific creativity ($F(1,147) = 16.655$, $p < 0.01$, $\eta^2 = 0.244$).

These results have important implications for teacher education programs. The lack of association between study program and linguistic creativity suggests that language education programs are equally effective in fostering this skill. However, the significant effect on scientific creativity indicates a need for enhanced scientific content in language education curricula to better prepare future teachers for interdisciplinary instruction. The gender differences observed in both types of creativity warrant further investigation into potential sociocultural factors influencing creative development among pre-service teachers. Future research could explore the effectiveness of targeted interventions to enhance scientific creativity in language education programs and investigate the long-term impact of such interventions on teaching practices. Limitations of this study include its cross-sectional design and focus on a single institution, which may limit generalizability. Longitudinal studies across multiple institutions could provide more robust insights into the development of creativity throughout teacher education programs.

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