Comparative Analysis of Prospective Physics Teachers' Learning Achievement in Terms of Cognitive Style (Field Dependent and Field Independent)

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Abstract – This study aims to determine the comparison between the achievement of students with field-dependent (FD) and field-independent (FI) cognitive styles. The method used in this research is a comparative descriptive method with a quantitative approach. The sample consisted of 30 physics student teachers who were studying at the University of Mataram. Research data were taken using the Group Embedded Figure Test (GEFT) and documentation of the study result card (SRC). GEFT is used to determine cognitive style while documentation is used to determine the cumulative achievement index (CAI) of students. Based on the results of the t-test at the 95% confidence level (α = 0.05) with the degree of independence (dk = $n_1 + n_n - 2$ = 28), there are significant differences in the learning achievement of FI and FD students. The average learning achievement of FI students (CAI = 3.15) tends to be better than that of FD students (CAI = 3.37).

INTRODUCTION

Education is one of the important aspects that can determine the quality of civilization of a nation. Through education, the morality and intellectuality of the nation are formed so that they are always relevant to the demands of the times. Therefore, the education system must also continue to be updated so that the output of education itself is relevant to the competencies needed in the world of work. To relevance and standardize the quality of outcomes for all levels of education in Indonesia, the government has developed a qualification framework which was later named the Indonesian National Qualifications Framework (INQF).

INQF is an instrument used to classify a person's qualifications based on a set of criteria associated with the level of learning outcomes he has obtained (Ristekdikti, 2015). In compiling or developing an educational curriculum, each level of education must refer to the INQF. The preparation of a curriculum that refers to the INQF aims to ensure that the learning outcomes or graduate profiles are truly based on the desired needs and competencies.

One of the indicators that can be used to see the quality of student achievement on graduate learning outcomes is learning achievement. Learning achievement is evidence of learning success or mastery of student competencies in learning activities according to the weights achieved (Djamaroh, 2002; Syah, 2004; Pratini, 2005; Hamdani, 2011; & Purwanto, 2013). At the tertiary level, learning achievement can be seen from the cumulative achievement index (CAI) of Students.

The level of student learning achievement is influenced by many factors. In general, the factors that affect learning achievement can be divided into two, namely external factors and internal factors (Slameto, 2013). External factors are factors that come from outside of students, such as family factors, school environment, quality of teaching and learning, and playing environment. While internal factors are factors that come from within a person such

as intelligence, interests, talents, and motivation. In addition to these two factors, other factors can affect student learning outcomes, namely cognitive style (Vergas, et. al., 2017; Payung, et.al., 2019; & Lin, et.al., 2018).

Cognitive style relates to how a person receives, processes, and uses the information to address various environmental problems or situations (Kozhevnikov, 2007). Cognitive style acts as a variable that bridges internal and external factors. That is, if the teaching and learning process (external factor) is in accordance with the student's cognitive style, it will certainly be able to increase student motivation and interest in learning (internal factor). In addition, if the process of delivering information by the lecturer during teaching and learning activities in the classroom is in accordance with the student's cognitive style, students will feel facilitated in their learning. This can certainly optimize student learning achievement.

Witkin classifies this cognitive style into two, namely the field-independent cognitive style (FI) and the field-dependent cognitive style (FD) (Kozhevnikov, 2007). Someone who has the FI cognitive style tends to think analytically, detailedly, competitively, and individualistically. He is also not easily influenced by external factors (internal references), and tends to rely on intrinsic motivation. Meanwhile, someone who has an FD cognitive style is more group-oriented, thinks globally, is sensitive to social interactions, accepts criticism, is easily influenced by external factors (external references), and tends to rely on extrinsic motivation (Ford & Chen, 2001; Altun & Cakan, 2006).

So far, researchers in Indonesia have mostly focused on seeing the extent of the influence of external factors such as the influence of the application of an approach,

method, model, and learning media on the achievement of learning outcomes. It is rare to review the extent of the influence of learning motivation, learning style, cognitive style, and other factors on student learning outcomes. Whereas according to the understanding of cognitivism, the method or learning media can essentially be regarded as a mere supporter because in reality, the use of the same method or media will have different impacts depending on the characteristics of each student. This argument is strengthened by empirical evidence from the results of previous studies. Based on the results of the preliminary study on the research results; Lou, et.al (2017), Ismuwardani, et.al., (2019), & Putri, et.al., (2019), show that the use of the same learning model can produce different effects or influences on students. Therefore, this study aims to determine the extent of the influence of differences in cognitive style on the learning achievement of physics student teachers.

RESEARCH METHODS

The method used in this study is comparative descriptive method with quantitative approach (Nazir, 2005). Descriptive research is research that aims to make a systematic, factual, and accurate description, picture, or painting of the facts, characteristics, and relationships between the phenomena being investigated. In descriptive research, researchers can compare one variable to another, and thus it is called comparative descriptive research. Comparative research is research that compares the existence of one or more variables in two or more different samples, or at different times (Nazir, 2005).

The sample used in this study consisted of 30 physics student teachers from the 2020/2021 class at University of Mataram. Research data were taken using the Group

Embedded Figure Test (GEFT) and study result card documentation (KHS). GEFT is used to determine the cognitive style of students while documentation is used to determine the cumulative achievement index (GPA) of students. The research data were then analyzed using descriptive statistics and comparative tests (t-test).

$$t_{count} = \frac{\bar{X}_1 - \bar{X}_2}{\sqrt{\frac{S_1^2}{N_1} + \frac{S_1^2}{N_2}}} \qquad (1)$$

RESULTS AND DISCUSSION
Results

Comparison of the cumulative achievement index (CAI) of FI and FD students can be seen in the following table.

Table 1. Cumulative achievement index (CAI) of FD and FI students

Cognitive Style	N	CAI	S	S^2
Field Dependent	15	3,15	0.27962	0.078188
Field Independent	15	3,37	0.23094	0.053336

The data above shows that the average cumulative achievement index (CAI) of students with FI cognitive style is greater than that of the students with FD. This shows that the average learning achievement of FI students tends to be better than that of FD. The results of the data analysis above are strengthened by the results of the t-test at 95% confidence level ($\alpha = 0.05$) with degree of independence ($dk = n_1 + n_2 - 2 = 28$) indicating that there are significant differences in the learning achievement of FI and FD students. This can be seen from the values of $t_{count} = 2.296$ and $t_{table} = 2.048$ ($t_{count} > t_{table}$).

Based on their characteristics, the courses in the physics education study program can be grouped into 4 (four) namely; (1) Personality Development Course (PDC), (2). Science and Skill Course (SSC), (3). Craft Skill Course (CSC), and (4). Community Life Course (CLC). Differences in FI and FD student achievement if classified based on the 4 groups of subjects can be seen in the following graph.
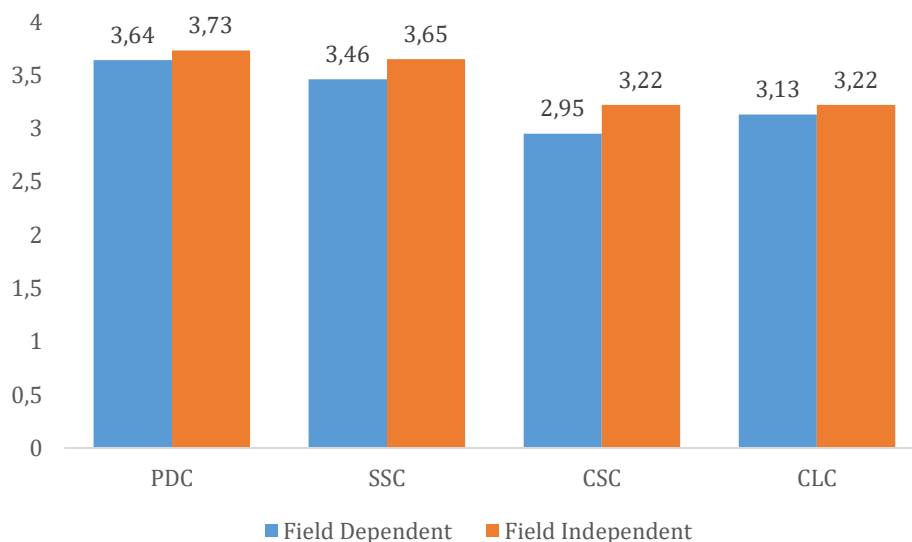

Figure 1. Average CAI of FD and FI students by subject group

The data in the graph above shows that the CAI of FI students is always higher than that of FD students in all subject groups. Furthermore, to determine the significance of the differences in learning achievement of FD and FI students in each subject group, the researcher later conducted a t-test at the 95% confidence level ($\alpha = 0.05$) with a degree of independence $(dk = n_1 + n_2 - 2 = 28)$. The results of the t-test can be seen in the following table.

Table 2. t-test results of differences in FD and FI students' achievement

Subject group	cumulative achievement index (CAI)		t_{table}	t_{count}	Category
	Field Dependent	Field Independent			
Personality Development Course (PDC)	3.64	3.73	2.048	1.786	not significant
Science and Skill Course (SSC)	3.46	3.65	2.048	2.452	significant
Craft Skill Course (CSC)	2.95	3.22	2.048	2.203	significant
Community Life Course (CLC)	3.13	3.22	2.048	0.546	not significant

The results of the data analysis in the table above show that there are significant differences in learning achievement of FD and FI students, especially in science and skill courses (SSC) and work skill courses (CSC). However, for the Personal Development Course (PDC) and Community Life Course (CLC), there is no difference in the learning achievement of the two groups of students.

Discussion

The results of the data analysis as presented above show that there are significant differences in the learning achievement of FD and FI students. The learning achievement of FI students is consistently better than that of FD for all subject groups. That is, the difference in cognitive style so far influences the acquisition of student achievement. The results of this study are in line with the research results from Wulandari & Agustika, (2018); Umbrella, (2017); Saputri, (2018); Busyairi, et.al., (2021) who discovered that cognitive style influences student learning outcomes. In addition, Sternberg & Zhang, (2001) stated that many research results show that cognitive style influences students' academic achievement. In addition,

Cooperman, 1980; Good enough & Karp, 1961; MacLeod, Jackson, & Palmer, 1986; McKenna, 1984) consistently reports that individuals with FI style tend to be more intelligent than FD individuals (Kozhevnikov, 2007).

Historically, cognitive style refers to a psychological dimension related to cognitive function, especially with regard to the way individuals obtain and process information (Ausburn & Ausburn, 1978). In addition, Messick defines cognitive style as an individual's way of understanding, remembering, thinking, and solving problems (Kozhevnikov, 2007). Based on this definition, it can be seen that cognitive style is related to the way a person receives, processes, and uses information. Furthermore, Globerson, (1989); & Waber, (1989); & Goode, et.al., (2002) explained that individual differences in cognitive style reflect the variation and efficiency of cognitive processes associated with the frontal lobe system.

In relation to the conceptual basis above, if we draw the relationship between FI and FD cognitive styles, the difference lies in the way a person thinks. Someone who has the FI cognitive style is someone

who has an impersonal orientation, prioritizes the ability to think analytically, critically, logically, systematically, detailedly, competitively and prioritizes intrinsic motivation (Onyekuru, 2015). In contrast to FI, someone with FD is a person who has a social orientation, tends to follow goals and existing information (assimilation) and tends to process less information adjustment (accommodation), lacks analytical thinking (Ford & Chen, 2001; Altun & Cakan, 2006). In relation to receiving and processing information, Goode, et.al., (2002) explains that FI tends to be better at remembering information than FD. This is based on the results of research conducted by manipulating and varying the amount and type of information that will be described and stored in working memory within a certain period of time. In his research, it was found that FI tends to have a better memory when compared to FD. The research results expressed by several experts above seem to be in line with the results of this study.

CONCLUSIONS

The results of data analysis showed that there were significant differences in the learning achievement of FI and FD students. The average learning achievement of FI students tends to be better than that of FD students for all subject groups.

This research is a preliminary study. Therefore, the researcher recommends further researchers to be able to carry out further research if it can be useful for the advancement of education in Indonesia.

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