The Effect of Students' Learning Independence and Cognitive Learning Style on Atomic Physics PEFI4421 Learning Achievement

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Abstract

In this study, the researcher explored the contributions of independence in learning and cognitive learning style towards students' learning achievement on Atomic Physics course PEFI4421 in semester 1, 2017 academic year. This study employed a double linear regression analysis. The analysis measured influences of a free variable on a bound variable. The measurement of this influence included one free variable (X) and one bound variable (Y), called the simple linear regression analysis with the following formula Y = a+bX. In this study, this formula was used for measuring the contribution of two free variables on one bound variable. Sample of this study were the students that already passed the Atomic Physics course in Open University Indonesia under 2016 (2 semesters) and 2017 (1 semester) academic year with an underlying assumption that the students were homogenous since they all had completed the course in a considerably recent time period. The results of this study showed that (1) not all of the students of Physics Education had the learning materials of Atomic Physics; (2) the students who dominantly had a field independent cognitive learning style and learning independence achieved maximum learning achievements of Atomic Physics; and (3) the students' graduation year did not determine the influence of the cognitive learning style and learning independence since their graduation years were still considered to be recent.

Keywords: cognitive learning style, independence, learning achievement, Atomic Physics

INTRODUCTION

The learning independence of Open University students in Indonesia is highly influenced by their surroundings, both internally and externally. Learning achievement is characterized by three main points, namely purpose determination, strategic selection, and cognitive as well as affective observation during an academic task completion. As the students of Atomic Physics with distance learning education system, they are required to learn independently all learning

materials provided by the university. Open University, in its capacity of serving the students, has provided supporting facilities and accessible materials. One of these is an access to student learning support in order that the students can prepare their study well and graduate with satisfying results. The learning support that is provided by the university covers online learning support and tutorial. Online tutorial can be accessed by the students once they completed the registration process. However, not all of the students are able to do this because of several reasons. One of the many reasons is the unequal connection to the internet access throughout the country and the students have unequal skills and capabilities to access the programs which are internet-based. Therefore, there are still many students who use hard-copy learning materials such as textbooks as the only resource of learning.

Every student of Open University has different motivation and characters; this also applies to their willingness and ability to study. Each student also has different levels of cognitive learning styles and independence in learning. There are students who can learn independently and do not need to have any peer discussion with their classmates and there are those who rely heavily on group discussions and interactions with their classmates to solve the difficulties in their learning. This taps into the area of cognition. Cognition is considered to be a gift that is given since the individual was born. It is naturally gifted by GOD and cannot be altered but can be influenced by the surrounding. The existing cognition is classified into two, namely independent and dependent cognition, of which one student can only have one of them and not both of them.

Besides, different students also mean different levels of learning independence, which affects the time when the students continue learning and when they decide to stop their learning. This factor relies heavily on the students themselves and the underlying motivation that they have and cannot be determined by other people. Others can only provide suggestions and motivating statements in such a way that the students can learn independently.

Therefore, in this study, the researcher wants to explore and identify further the effect of the students' learning independence and the influence of cognitive learning style of the students towards their achievements especially on Atomic Physics course. With this regards, the purpose of this research is to identify the effect of the Open University students' learning independence and cognitive learning style on their learning achievements in Atomic Physics PEFI4421.

LITERATURE REVIEW

Cognitive Learning Style

Students of Open University Indonesia are considered to have a high spirit to learn, they are required to be ready to learn independently by themselves or with peers using the learning materials provided on the student portal website related to their subject of study. Students as individuals have different characters and unique individual features one another. One of the things that determine their characters is cognition. In this regard, cognitive learning is a unique way that the students have to study either receiving or processing new information that they get as well as acting in accordance with the information and behaving in accordance with the learning environment that they encounter (James W. Keefe, 1987: 3-4) Cognitive learning style is categorized into two majors, namely independent cognition (FI) and dependent cognition (FD), and these two types are performed and able to be identified during the teaching and learning process of Physics in a classroom. In general, the students' levels of acceptance in learning Physics sometimes they can directly understand the materials after the lecturer explains to them while some of them have to work together with their peers and discuss the subject materials to understand the topics. Thus, the lecturer needs to understand his students and, especially in the face-to-face classroom setting, is required to provide options for learning strategies to develop by the students and various kinds of methods that suit the topics of the course.

Cognitive learning style is one variable of learning that becomes one important consideration in constructing a lesson plan. Knowledge about cognitive learning style is needed to plan or modify learning materials, learning outcomes, and learning methods. It is expected that the presence of interactions resulting from a high level of cognitive learning factor all the purposes, materials, and methods may boost the students' learning achievements to its maximum. This complies with some experts' belief that implies that certain learning strategies require certain learning styles. In particular, cognitive learning style reflects one's behavior in dealing with information processing. Keefe (1987) further describes that cognitive learning style is one type of learning style that represents someone's behavior to act on things which is relatively constant in receiving, thinking, and solving issues as well as saving information. Cognitive style refers to individual's characteristic in thinking, feeling, memorizing, solving problems, and making decisions. Information that is neatly and systematically arranged is easily received by certain individuals. Meanwhile, other individuals may perceive that the information which is easy to receive is that which is not quite neatly and systematically arranged. As one type of behavioral characteristic,

cognitive style is put under the track of ability and personality and manifested to supporting activities and media. Cognitive style reflects the existence of variations between individuals in their approach to a certain task, yet this variation does not necessarily represent the individuals' intelligence rate or ability. In this stance, two individuals that have a similar cognitive learning style characteristic do not mean that they also share a similar ability. Moreover, individuals that have different styles of cognitive learning tend to have much different levels of ability.

Every individual has a different style in processing information, and cognitive style is an individual step in processing information through responsive strategies towards the task assigned to them. Furthermore, Woolfolk (1993) shows that in a cognitive learning style there is an indication of differences in perceiving, addressing, and organizing information. Every individual will choose one way that they like in processing and organizing in response to the stimulation provided by the society. There are individuals that are fast-respond and those that are slow-respond. These ways of responding are also related to the personal behavior and quality, and this cognitive style is an indicator of individual variations in terms of attention, information acceptance, memory, and thought that occur and different in terms of cognition and personality (Woolfolk, 1993: 128). Then, cognitive style is a pattern shaped through individual information processing which is likely to be stable with a possibility to change. In general, cognitive learning style is achieved and shaped over a long period of time and considered to be in a continuum. Woolfolk (1993) further explains that there are various types of cognitive learning styles that attract the interest of educators and they are understood in dimensions; psychologically they are divided into field independence (FI) and field dependence (FD).

Meanwhile, Keefe (1987: 3-4) has quite a different perspective regarding the dimensions of cognition. It is stated that cognition is divided into two styles, one of them is a style in receiving information (reception style) and the other is a style in forming concept and retention (concept forming and retention style). The style in receiving information is more related to the reception and data analysis, while the style in forming concept and retention is more related to hypothesis construction, problem solving, and memory process. Keefe also adds that cognitive style is a part of learning style, and learning style is related to (but different from) intellectual ability. There is a difference between ability and style for ability refers to the content of cognition that differentiates the kinds of information to be processed, how to process, and in what form. On the other hand, style refers to the cognitive process which states that the content of information is to

be processed.

The position of cognitive style in a learning process cannot be neglected. This is in line with the perspective of Reigeluth (1993) that in teaching variables, cognitive style is one of the student characteristics which are included in the learning condition variable besides other student characteristics such as motivation, attitude, talent, interest, thinking skill, and others. As one student characteristic, the position of cognitive style in the learning process is very important to be noticed by the teacher or education manager, since a lesson plan which is designed by considering the cognitive style factor means that the lesson employs learning materials that are suitable with the student characteristics and potentials. With this well-designed planning, a suitable learning situation will be well-created since the lesson will not be perceived to be intervening student's rights. Besides, learning is adjusted with the cognition process or student cognitive development.

The activation of cognitive process is closely related with the characteristics of student cognitive process. Through this, in attempt to improving the student cognitive process, there is a need of attention on the characteristics of each individual student. In a lesson plan organization using elaboration model and text book organization, before the planning process the teacher needs to have characteristics mapping analysis on all of the students, which is mainly directed towards the identification of their cognitive style. With this cognitive style analysis, the teacher or education manager can identify the cognitive style of the students. The role of cognitive style in the learning process by referring to the experts' opinions and perspectives on the dimensions of cognitive style according to Woolfolk (1993) in regard to its implementation in the learning process highly contributes to the learning success. A student who has a field dependence (FD) cognitive style leads to a global perception and perceives a burdening effort in processing information, and this can be overcome through putting the information into its related contexts. Another student who has a psychological difference field independence (FI) leads to a fact that articulation will analytically perceive information through separating the stimuli from its context, but his perception will be weaker when there is an alteration in the contexts. However, a psychological difference can be fixed through various situation exposures. Individuals of FI usually employ internal factors as a direction to process information. They complete tasks not in a sequential procedure and work more efficiently by themselves than in groups.

Based on the above explanations about cognitive style, it can be concluded that cognitive style

can be viewed as one variable in learning. In this case, its position represents the variables of student characteristics and its existence is internal. This means that cognitive style is one capability of someone who is developing along with its intellectual development. For students, cognitive style is considered to be given and influential to their learning achievements. In this respect, students who have a certain type of cognitive style need a certain type of learning strategy as well in order to obtain maximum learning results.

Learning Independence

In the Dictionary of Indonesian (KBBI), the word "independent (Adj.)" (*mandiri*) refers to a state of being able to stand alone; not relying on others, while the word "independence (N)" is a thing that represents someone's condition of being able to stand alone and not relying on others. The definition of "independent" can also mean the attitude of not relying oneself to other's decision, and the definition of "independence" can also mean the attitude (behavior) and mental condition that allows someone to act freely, righteously and beneficially; an attempt to do all things honestly and correctly according to the inner calls and ability to manage himself, in accordance to his rights and obligations, in such a way that can solve all the issues; as well as being responsible for all the decisions he has made through careful considerations. The definition of "independent (Adj)" can also mean being able to act according to the situations without asking or depending on others. Being independent refers to the state when someone is able to and willing to realize what he desires which is reflected from his actions and real efforts to obtain something (things or services) to fulfill his own needs and other people's (Antonius, 2002: 145). The definition of "independence" according to Masrun (1986: 8), independence can be defined as one behavior that enables someone to act freely, do anything based on self-willingness and fulfill his own needs without any help from others, as well as to think and take original/creative actions, full of initiatives, be able to influence his society, have a high level of self-confidence, and be satisfied with all his efforts. An understanding of psychological and mental independence is the condition of an individual who in his own life is able to determine and do something without any help from others as this certain type of ability can only be possessed if the individual has an ability to think carefully about things that he works on or decides, either through the viewpoint of usages and benefits, negative points and losses that he may encounter (Hasan Basri, 2000: 53). Every activity that is completed by an individual to be successful as he wishes needs a high degree of independence. Meanwhile, the definition of learning in this respect is an effort that is

taken by an individual to achieve a whole new change of behavior, as a result of that individual experience in his interactions with other individuals and societies.

Student learning independence according to Stephen Brookfield (2000, 130-133) covers self-awareness and self-driven learning activities to achieve the learning purposes. Merriam & Caffarella (1999) also remarks that it is a process where an individual takes initiatives in planning, executing, and evaluating his own learning system. Then, states that learning independence is a learning process where every student or individual can take initiatives, with or without the help from other people, in diagnosing learning needs, formulating learning purposes, identifying learning resources (either in the form of people or materials), selecting and applying learning strategies that are suitable for him, as well as evaluating his own learning achievements. In addition, Desi Susilawati (2009: 7-8) posits that learning independence is marked with: (1) the student try to increase their responsibility in making various decisions; (2) independence is seen as one pre-existing feature in every person and learning situation; (3) independence does not mean separating oneself from another person; (4) independent learning can transfer his learning outcomes in the forms of knowledge and skills in different situations; (5) students who learn independently can include various resources and activities such as reading, group learning, practices, and correspondences; (6) effective teacher's role in independent learning is still possible through dialogues with the students, adding learning resources, evaluating results and developing critical thinking; (7) Several education institutions find a way to develop independent learning through open learning programs.

The term independent learning, according to an improvement of an individual in knowledge, ability, or development with every individual selects and determines the learning purposes themselves, and tries to use different methods to support these activities. Meanwhile, according to Cyril Kesten (1992), independent learning is one form of learning in which the learners (in relation with others) can make important decisions that are suitable with their own learning needs. Then, postulates that the main feature of independent learning is not the absence of a teacher or student peers, or face-to-face class meetings in a classroom. It is posited that the main feature of independent learning is the presence of student's ability development to conduct a learning process which does not rely on the presence of a teacher, student peer, classroom, or else. Metacognition is the thought of an individual about his own mind, thinking what is known, what is done, and what is thought. In independent learning, an individual learns about his own

mind, makes a plan, and takes an action. The individual produces ideas for a good decision-making and thinks about the decisions in order to get the expected outcomes. The individual also thinks about the processes that they undergo as well as solutions of the problems, and strategies to develop their abilities. Independent learning can develop their individual's competencies based on their metacognition.

The independent learning process is one method that involves the students in all activities which cover several steps, and results in the observable and non-observable outcomes; this process is called independent learning. According to Johnson (2013), independent learning provides freedom to the students to determine how the academic life suits their daily life. The students make their own decisions and accept the responsibilities that follow. They also manage and adjust their actions to achieve the desired outcomes. This process of independent learning provides the students with great opportunities to sharpen their awareness about their surroundings. Independent learning enables them to make positive choices on how they will overcome their weariness and chaos in their daily life. This pattern enables them to act based on their own initiatives to shape the environment (Johnson, 2013).

Independent learning is a condition of learning activities that is independent and does not rely on others, yet it is featured by willingness, initiatives and self-responsibilities in solving their learning difficulties. Independent learning will be realized is the students actively control themselves in doing, evaluating and planning things more meaningfully than before through the learning process and the students are also active in the learning process.

Characteristics of Independent Learning Students

University students who have a high level of independence in learning can be viewed from their learning activities, it is unnecessary for the lecturer to ask them to study since they show a high degree of initiatives to learn. In order to identify whether the students are independent in learning there is a need to determine the features of independent learning students is have formulated them as follows: (1) being able to take initiatives, (2) being able to solve problems, (3) being diligent and perseverant, (4) Obtaining satisfaction from his own efforts, and (5) willing to complete tasks without any help from others. Anton Sukarno (1989: 64) states that university students who are independent in learning possess the following features (1) the students plan and select their own learning activities, (2) they have initiatives and discipline themselves to keep learning, (3) they are required to be responsible for their own study, (4) they learn critically,

logically, and open-mindedly, (5) they learn with full confidence. Meanwhile, states that university students who are independent in learning have the following features: a) they have a responsibility in making decisions related to their own attempts of learning, b) independent learning is a characteristic which can be employed by the students in every situation, c) independent learning does not mean isolating the individuals from other people, d) individuals who are independent in learning are able to transfer their learning, either in the form of knowledge or skills, from one situation to another such as participating in groups, practices, dialogues (electronically), and writing, e) an effective role of the teacher in independent learning occurs such as conducting dialogues with the students, reviewing and selecting reliable learning resources, evaluating their learning results and critical thinking, f) some educational institutions find a way to support independent learning such as open education programs, education selection for individuals, and other innovative programs.

Features of independent learning according to Sadirman as cited by Ida Farida Achmad (2008: 45) include the students who: 1) are likely to give opinions, behave, and act based on the students' own will, 2) have a strong willingness to achieve purposes, 3) make plans and diligently attempt to realize their expectations with high perseverance, 4) are able to think and act creatively, are full of initiatives, and do not imitate others, 5) are likely to achieve positive progress in order to improve learning achievements, 6) are able to independently find things to do without expecting any guidance or direction from other people. Then, that the students who are already independent in learning: a) are able to think critically, creatively, and innovatively, b) are not easily influenced by other people's opinions, c) do not run away from or avoid problems, d) solve their own problems through meaningful thinking, e) when encountering difficulties, they will solve the issues by themselves without asking for any help from others, f) do not have any low self-esteem when they have to be different from others, g) attempt to work with full perseverance and discipline, h) are responsible for their own actions. Next, remarks that the features of students with learning independence must be a) confident, b) able to work by themselves, c) skillful and knowledgeable that are suitable with the task requirements, d) able to appreciate time, and e) responsible. Furthermore, remarks that factors that may influence independent learning are divided into two majors. First, internal factors which are indicated by the development of independent learning reflected in the following phenomena: a) responsibility attitudes to complete all the assigned tasks, b) awareness of the students' rights and obligations

about moral discipline in the form of a noble character reflected on their behaviors, c) personal maturity from the concept of oneself, motivation to the development of mind, desire, intention, and passion (gradually), d) awareness of health development and physical strength, e) self-discipline by following rules, awareness of right and obligations, safety driving, interpersonal respect, and completion of all required obligations. Second, there are also external factors. These factors are derived from other people such as family, school, and society. The external factors function as the strong support for maturity and independent learning, which involve: physical and spiritual potential represented by a strong and healthy body, environment, and natural resource, social economy, independent security and orderliness, condition and situation full of harmony in both positive and negative dynamics as opportunities and challenges that cumulatively involve cultural structure and else. These people can communicate the value of independent learning through modeling, directing and managing the desired behaviors; b) the second source involves all opportunities to practice independent learning. Students who are constantly directed by their parents and teachers cannot build their skills to learn to be independent because of the rare opportunities that they have.

In this study, the researcher concludes that the factors which influence independent learning consist of two, internal and external factors. Internal factors that influence the students' independent learning are discipline, confidence, motivation, initiative, and responsibility. Therefore, students who are said to be independent in learning are those who are confident, motivated, self-initiative, discipline and responsible. Thus, the definition of independent learning for the students refers to the students' independence in learning, not relying on others, and they are required to have a high level of self-activation and initiative to learn, behave and take actions for their nation and country. The definition of independent learning according to Haris Mujiman (2005: 1) is an active learning activity, supported by strong willingness to master a certain competence to solve a problem, and is built upon their existing knowledge and competences. The determination of competences as learning objectives and methods to achieve them - covering the set time for studying, place of study, learning rhythm, learning time, learning procedures, as well as learning evaluation - completed by the students themselves. Here, independent learning is understood as the students' attempt to complete a learning activity which is based upon their strong willingness to master certain competences.

Learning Achievement

The definition of learning according to Slavin in Catharina Tri Anni (2004) is a process of obtaining an ability from an experience. Gagne in Catharina Tri Anni (2004) explains that learning is a system in which there are intertwining elements that support behavioral changes. Then, the definition of learning according to Bell-Gredler in. Winataputra (2008) is a process completed by humans to obtain various competencies, skills, and attitude. Competencies, skills and attitude are obtained gradually and continuously from infant to elderly through a lifelong set of learning processes. Meanwhile, the definition of learning according to Moeslichatoen is a process that enables learning and the changes it makes are from the efforts paid in the process (in Abdul Hadis, 2008: 60). The learning achievements in learning Physics that have been obtained by the students are currently still far from expectations although there are already many efforts completed to increase the students' learning achievements in Physics in every level of education, such as: Physics curriculum revisions, Physics teacher workshops, learning media and infrastructure provisions, and else, the fact that the learning achievements in Physics is still present. Based on the observation results and experiences of the researcher as a Physics lecturer in the research venue, the students' learning achievements are still very low as can be seen from the students' final semester grades out of which only 65% of them passed the course and graduated with good scores, while the others had to undergo a remedial process and retake the course in the following semester. This is mainly because the students do not understand the learning materials given during the course well. Besides, during the teaching and learning processes in a classroom tutorial setting, the lecturer uses the blackboard as the only media and sometimes when the desired graphs are not available on the textbooks there is no supporting media to help the students understand the concepts. Therefore, the learning materials are difficult to be understood and the motivation and interest of the students are low.

Atomic Physics

Atomic Physics is a branch of Physics that studies atom as an isolated system from electron and atom core. Atomic Physics is related to electron configurations and processes that influence the configurations to change. This includes the relation between ion and neutral atom. The term "atomic physics" is often related to nuclear power and nuclear bomb, due to the synonym of the words "atom" and "nuclear". However, experts of Physics differentiate it by separating the branch of Physics that studies atom core and electron from the branch of Physics that studies

nuclear (nuclear Physics) which only studies atom core. Physics is science or study about nature that focuses on matter, movement, and behavior in the scope of time and place, along with other related concepts such as energy and law. As one of the most basic branches of science, the main purpose of Physics is to understand how the universe works. Physics is one of the oldest academic disciplines that have been part of science along with Chemistry, Biology and certain concepts of Mathematics, but when the Science revolution broke in the 17th century, natural science has developed to a separate research program. Physics overlaps with many other branches of scientific research such as biophysics, quantum chemistry, since no strict line to be set. New knowledge in Physics is sometimes used to explain basic scientific mechanisms of others as well as open a new breakthrough for other research fields such as Mathematics and Philosophy.

Physics also contributes a lot to technological development through theoretical thinking. For example, further understanding about electromagnetism or nuclear Physics are directly guided into developments of new products which dramatically shape modern societies, such as television, computer, domestic equipment, and nuclear weapons; developments of thermodynamics lead to industrial developments, mechanical advancement which in turn inspires calculus development.

Based on the research findings of Dini Silmi (2013) who descriptively analyzed the FD-FI cognitive styles of secondary students in Physics learning using levels of inquiry model, generally the samples had an equal share between the students with FD and FI cognitive styles. Further, the group of students who were classified to have FD cognitive styles was 38.46%, while the other group with students classified to have FI cognitive styles was 42.31%. Meanwhile, the score achievement of the former in the inquiry level was 47.37, while the latter was 67.12.

METHODOLOGY

Sample of this research consisted of the students who already passed the Atomic Physics course PEFI 4421 in Open University Indonesia within 2016 (2 semesters) and 2017 (1 semester) academic years. It was assumed that the sample is homogenous regarding the fact that they had already passed the course in a relatively short while ago. The total number of students was 127, but there were only 80 students who had filled in and returned the questionnaires. Ways of

collecting the data were through (1) post mail, (2) coming personally to their home address, (3) assigning UPBJJ research assistants to distribute the questionnaires.

This research was considered to be correlational descriptive which was aimed at exploring and identifying a certain condition or situation of the subjects being researched and testing any significant correlation between the dependent and independent variables. This descriptive explorative research was more specific in its technique of focusing on certain aspects and trying to identify the correlations that could exist between the variables. It also used double linear regression analysis. A regression analysis is an analysis that measures the influence of a free variable on a bound variable. This measurement of influence includes one free variable (X) and bound variable (Y), which is later called simple linear regression analysis, with the following formula: Y= a+bX to determine the contribution of the two free variables on one bound variable.

Winarno Surakhmad (1989:31) stated that the method was the main way to be employed to achieve purposes, such as testing a set of hypotheses using certain techniques and tools; it was used after the investigator considers the investigation purposes and situations. In this research, the method used was (1) the questionnaire filled in by the students which aimed to identify the performance of the lecturer using the lecturer evaluation questionnaire, and (2) identify the student interactions of Bidikmisi program during the tutorials, (3) the test result score sheets (DNU) of the first semester of 2017 academic year to identify the learning achievements of the students on Atomic Physics PEFI4421, and lastly (4) the Embedded Figures Test (EFT) made by Witkin (1977) to measure the cognitive style of the students. Further, the EFT is a perceptual test which uses pictures. The outside frame references to be distributed were the in the form of complicated pictures, which hid a very simple picture on every frame. The data collected was then analyzed using regression statistics model by combining the data of cognitive styles and independent learning and conducting correlational analysis with the students' learning achievements in Atomic Physics.

FINDINGS AND DISCUSSIONS

There were 80 questionnaires to be analyzed and it was found that the level of the students' independent learning was 4.8 (high) from scale 1 to 5. This proved that the students were considered to be ready to learn independently regardless the obstacles that they faced. Most of the students had already identified what they were about to learn when they stated to take this

course and tried to avoid things that might be too difficult to understand and prepare themselves to be optimally ready to study Atomic Physics. On average, the students had a belief that education is important to every individual and they already knew where to look for and obtain information needed to realize their ideal study purposes. In the learning process, the students preferred to decide themselves what and how to learn the Atomic Physics learning materials and did not feel desperate when they encountered any difficulties. The difficulties in learning were not considered to be obstacles that hinder those who were independent in learning and they were ready to take the responsibilities for this commitment. The students had already identified good learning techniques and when they had to provide more time to learn and when they had to provide less time for that, this was because the learners had already found ways to learn new things. In general, the students felt happy when they had to find the answers for the issues they had. The students had a huge curiosity in many things and had already had basic skills to understand the Atomic Physics reading materials, and were happy to try new things to enrich their knowledge. The students had considered learning issues as challenges rather than obstacles, and did things to answer them based on their own thoughts. The students had also completed group discussions well, and had a strong desire to learn new things. According to their opinion, the more they encountered new things the more they felt about the excitement of the world; hence they determined themselves to develop their potentials. The notion was that the more new things they knew the more opportunities they had to develop their potentials, since they considered themselves to be effective students either in discussion groups or independent learning individuals.

In regard to the cognitive learning style of the Physics students in general, most of them had a field independent cognitive style (78%), since they preferred to learn by themselves and did not rely on other people. The students preferred to work on the assigned tasks by themselves, since they often perceived that their tight schedule let them forget their learning environment (especially in a discussion group). While also working as teachers of Physics, the students preferred to directly go back home rather than staying at their school to chat with their peer teachers. On the other hand, there were some students who had field dependent cognitive learning style (22%). It can then be concluded that most of the students of Physics mostly did not usually hang out with the other subject teachers at their school. They were mostly introvert and busy with their own businesses. As the students of Physics, they preferred to be understood and

expected others to help analyze their problems and suggest solutions for them when they encountered learning issues. Only few of the students who were in favor to share their problems with others, especially in regard to the Atomic Physics tasks assigned which were considered to be difficult to understand alone even after they browsed for resources on the internet and they needed other students' opinions to strengthen their opinions or answers.

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.691[a]	.477	.451	9.09564

a. Predictors: (Constant), Kognitif, Kemandirian
b. Dependent Variable: UAS

The above regression results are as follows.

The resulting view of the SPSS calculation is regression, the first look in the form of statistical description of both variables in the form of mean, standard deviation and number of subjects (N). The second is a correlation between the two variables whose magnitude is r = 0.691 and the significance level sig = 0,00 (P = 0,00) is so significant, far above P 0,01. While unsolicited, the output of correlation calculations remains given because it is closely related to regression analysis. The fourth view is the model summary, this view appears because on the stats button was enabled the fit model. This view explains the effectiveness of the tested model, which is the regression analysis between the two variables above. The double correlation index (0,691), R square is the square obtained from 0,6912 = 0,885. R squared is the determinant coefficient. In this case, it shows that the dependent variable can be explained by the independent variable of 88.5% / this means the model is quite effective because of the unreachable 11.5% (100% -85.5%) and it is explained by other factors .

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	2948.286	2	1474.143	17.819	.000[b]
	Residual	3226.498	39	82.731		
	Total	6174.784	41			

a. Dependent Variable: UAS
b. Predictors: (Constant), Kognitif, Kemandirian

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-26.235	18.442		-1.423	.163
	Kemandirian	.084	.142	.070	.593	.557
	Kognitif	2.560	.452	.672	5.665	.000

a. Dependent Variable: UAS

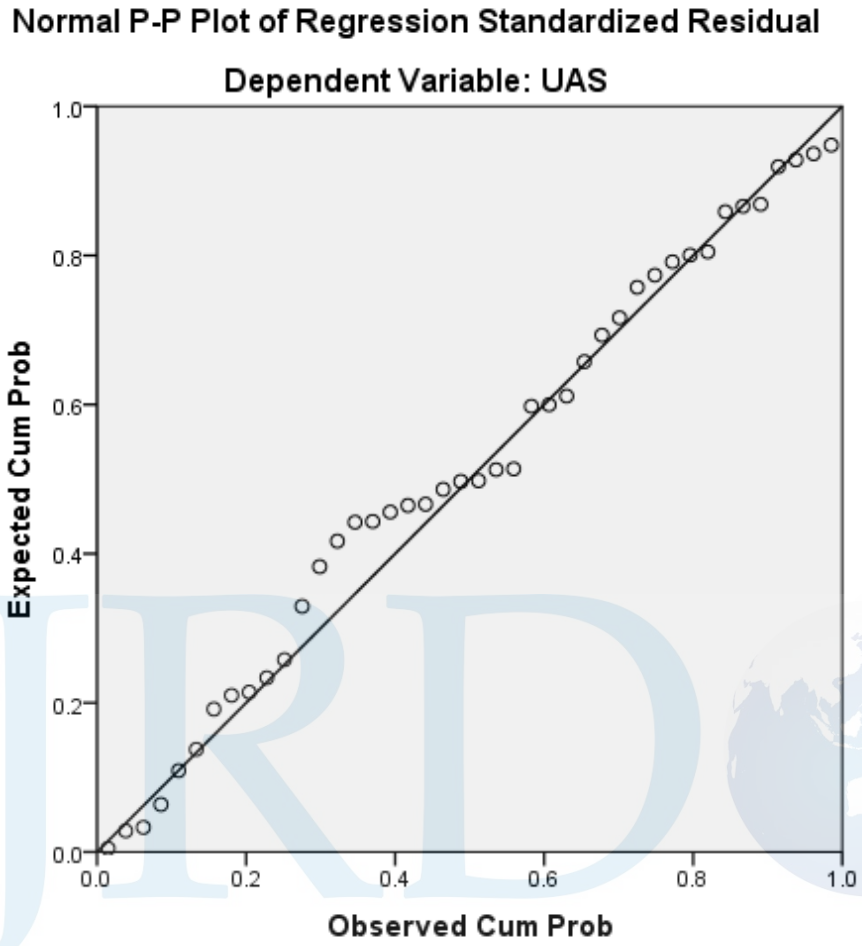
The fifth view is the result of the analysis of variance that shows the summary of Freg value test results.

(a) The F value obtained is F = 17,819 and the significance level sig = 0,000; or P = 0.01. This means that the learning independence score really affects and can be used to predict the cognitive style and learning independence affecting the students' learning outcomes for the Physics Physics course. (b) The coefficient view is the output of the regression calculation result. Equation formula at the output above it is known that the constant number a = -26,235 and b = 0.84 so the regression line equation is. Regression coefficient = 0.84 indicates that any increase in score of 1 on learning independence will increase the score of 0.84 on learning independence. Likewise, the opposite. So any increase or decrease in score of 1 learning independence is 0.84. (c) The F value obtained is F = 17,819 and the significance level sig = 0,000; or P = 0.01. This means that cognitive style scores really affect and can be used to predict cognitive style and learning independence affecting student learning outcomes for Atomic Physics courses.

Residuals Statistics[a]

	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	15.8400	49.1222	38.7643	8.47994	42
Residual	-23.61794	14.78347	.00000	8.87102	42
Std. Predicted Value	-2.703	1.221	.000	1.000	42
Std. Residual	-2.597	1.625	.000	.975	42

a. Dependent Variable: UAS



CONCLUSIONS

From the research conducted, it can be concluded that:

1. Not all of the students of Physics Education had suitable learning resources for Atomic Physics.
2. Cognitive learning style and dominant independent learning readiness positively correlated to the maximum learning achievements.
3. Different graduation years of the students did not influence their cognitive learning style and independent learning readiness since the years were not significantly different (2016 and 2017).
4. The F value obtained is F = 17,819 and the significance level sig = 0,000; or P = 0.01. This means that cognitive style scores really affect and can be used to predict cognitive style and

learning independence affecting student learning outcomes for Atomic Physics courses.

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