

Heutagogy: Empirical Study on Conceptual Understanding, Self-learning Awareness and Learning Outcomes

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Doi : <https://doi.org/10.24036/invotek.v22i1.986>

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Abstract

Some problems are attached by the online learning system such as low self-learning awareness and conceptual understanding. One of the learning approaches is the concept of heutagogy which is the development of andragogy approach. Self-learning awareness and conceptual understanding are needed either online or offline learning system, so it can improve student learning outcomes in all subjects. However, previous studies on the effect of the heutagogy approach on self-learning awareness and conceptual understanding as well as relate it to increase learning outcomes is still limited. Likewise with research on how the influence of self-learning awareness, conceptual understanding and their interaction on increasing learning outcomes has not been found. As novelty, this study aims to determine the effect of the heutagogy approach on increasing conceptual understanding and self-learning awareness and the interaction effect of self-learning awareness and conceptual understanding on course learning outcomes. This study is quasi-experiment. A total of 250 first-year students were randomly selected as samples in the pre-test and post-test. Data were collected by distributing a set of questionnaires and a set of exams via Google forms and were analyzed using Statistical Package for Social Science 23.0 (SPSS v 23.0) and SmartPLS 3.0. Findings showed that the heutagogy approach has positive and significant effect to increase conceptual understanding and self-learning awareness. Self-learning awareness has a positive and significant effect and also mediates the effect of conceptual understanding on learning outcomes. Heutagogy approach increase conceptual understanding (8.79%), self-learning awareness (10.68%), and learning outcomes (6.70%) compared with traditional method.

Keywords: learning awareness, conceptual understanding, heutagogy concept, learning outcomes, online learning

1. Introduction

Information and Communication Technology (ICT) is developing very rapidly. It triggers the transformation and transfer of conventional knowledge into a web-based or online form, both in terms of content and system. The learning system is required in Industrial Revolution 4.0 that motivates students to learn actively through digital technology. The development of ICT that is growing massively and rapidly allows one to explore data and information more effectively and practically. The development of science and technology has also brought rapid changes in aspects of human life to find and obtain information easily and not constrained by space and time. These developments have been applied in many institutions including education [1].

The Internet has huge effects that influence students as in online learning system. It offered the speed and multimedia facilities to obtain the learning material such as textbooks and videos. It can make the learning process more interesting, visual, interactive, and fun. Internet application as technology in the learning process has significant development in Industrial Revolution 4.0 era [2].

Although internet and the use of learning media and teaching materials based on academic portals has many advantages that can assist to obtain learning objectives, it also has several limitations and obstacles that must be concerned, such as: it requires an independent study culture (self-determined learning) and habits to study or attend training via computer. However, most students have low self-determined learning, moderate conceptual understanding, and low learning outcomes achievement [3]. Learning through academic portals also does not provide benefits if students do not have self-determined learning. Students who do not have high learning motivation tend to fail [2].

The heutagogy approach is one form of learning innovation to build student self-learning awareness. Heutagogy is the study of self-determined learning [4]. Heutagogy is an attempt to generate new ideas about learning and learning that is still centred on the lecturer. Previous studies on heutagogy by qualitative studies revealed that it increased self-motivated [5]–[7], self-confidence [7], [8], communication [3], [9], and collaboration among students [10]. However, studies on heutagogy lack studies carried out with large samples more than 100 students, where statistical models could help confirm and reinforce the findings of the already existing qualitative studies. Moreover, [11] confirms that previous studies on heutagogy did not focus on capability development. The study on how the influence of self-learning awareness, conceptual understanding and their interaction on increasing learning outcomes has not been found. Limited studies were conducted on the effect of heutagogy toward conceptual understanding, self-learning awareness, an empirical model of those variables to the learning outcomes. Thus as novelty, this study aims to determine the effect of the heutagogy approach to increase conceptual understanding, self-learning awareness, and learning outcomes among vocational students. It also aims to develop model interaction among conceptual understanding, self-learning awareness, and learning outcomes. This study has urgency (priority) which is to support online learning platforms that build student self-learning awareness and contribute to the learning outcomes. It is one of the efforts in readiness to meet IR 4.0 which is filled with the digital and the internet. Hypotheses of study are as following:

- H₁: Heutagogy increases conceptual understanding among vocational students significantly
- H₂: Heutagogy increases self-learning awareness among vocational students significantly
- H₃: Self-learning awareness influence learning outcome achievement significantly
- H₄: Conceptual understanding influence learning outcome achievement significantly
- H₅: Self-learning awareness influence conceptual understanding significantly
- H₆: Conceptual understanding mediate the effect of self-learning awareness to learning outcome achievement

2. Method

The method is consist of research design, sampling method, instruments, reliability of instrument and data analysis. This study is a quantitative descriptive study with a quasi-experimental method. It involves first years students of Padang State Polytechnic. The population are 1504 students. Krijcie and Morgan's method is carried out to determine the sample size. Thus, 250 students are randomly selected as samples. One set of questionnaires is applied to collect data at pre-test (traditional method) and post-test (heutagogy approach). A pre-test is a test that is taken at week fourth of the class. From first until week fourth, no heutagogy approach is applied. Post-test is the test that was taken in week ninth of the class. From week fourth until week eight, the heutagogy approach is applied.

The questionnaire is the closed type with positive items and 5 points Likert scale; 1 (Strongly disagree), 2 (disagree), 3 (neutral), 4 (agree) and 5 (strongly agree). The questionnaire has high reliability with the alpha Cronbach coefficient of 0.813. The conceptual understanding and self-learning awareness analysis use descriptive statistics (mean score) which is conducted by Statistical Package for Social Science 23.0 (SPSS v 23.0). Conceptual understanding and self-learning awareness are categorized into three levels as following:

- High level (score mean of 3.67-5.00)
- Moderate level (score mean of 2.34-3.66)
- Low level (score mean of 1.00-2.33)

T-Test pairs is also taken into consideration to determine improving conceptual understanding and self-learning awareness significantly compare to the traditional learning method (without heutagogy approached).

Hypothesis (H) is accepted if significant value (p) <0.05.

Hypothesis (H) is deny if significant value (p) >0.05.

In order to analyze the model, the Partial Least Squares technique through SmartPLS 3.0 software was applied. The measurement model (validity and reliability) and structural model (relationship between test construct) were tested by the software. This software was chosen because the analysis in this study focuses on examine effect of self-learning awareness and conceptual understanding to the learning outcome achievement through heutagogy approach. It creates measurement models from a prediction perspective. SmartPLS 3.0 is also very suitable to be used if it involves a large number of study samples without imposing a normal distribution assumption on the data [12]. Structural Equation Modeling Path Analysis (SEM) using SmartPLS 3.0 can provide a causal explanation of the model that is fostered involving mediating factors so that this study can provide research results that have novelty.

3. Result and Discussion

3.1. Profile of respondents

This study is involved 250 students that covers gender. Samples consist of 131 female students (52.4%) and 119 male students (47.6%). This results show that this study involved across gender.

3.2. Descriptive analysis

The data in this study were taken 2 times, namely before the learning process (pretest) and after the experiment (posttest). The results of the descriptive analysis are shown in Figure 1.

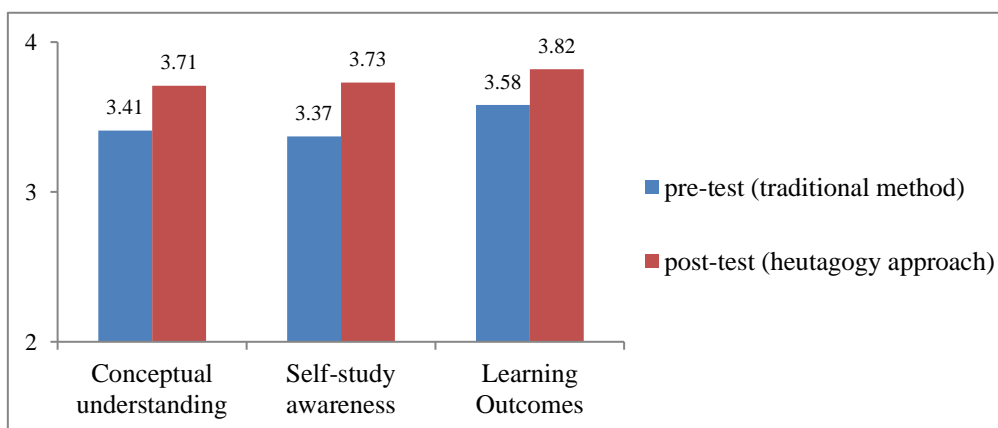


Figure 1 Result of descriptive analysis

Figure 1 shows that before the heutagogy approach is applied in the learning process, conceptual understanding (score mean = 3.41), self-learning awareness (score mean = 3.37), and learning outcomes are at a moderate level. After the heutagogy approach is applied, conceptual understanding (score mean = 3.71), self-learning awareness (score mean = 3.73), and learning outcomes (score mean = 3.82) are at a high level. Heutagogy approach increase conceptual understanding (8.79%), self-learning awareness (10.68%), and learning outcomes (6.70%) compared with traditional method.

3.3. Effect of Heutagogy to the conceptual understanding, self-learning awareness, and learning outcome

T-Test pair analysis shows that either conceptual understanding, self-learning awareness, and learning outcomes improve significantly after the heutagogy approach is applied. The heutagogy approach improves conceptual understanding, self-learning awareness, and learning outcomes significantly from the moderate level into the high level. A heutagogy approach is a holistic approach to cultivating learners' abilities. Learning is a proactive process. Learners act as the main promoters of their own learning. It creates from personal experience. Like pedagogy, in heutagogy, lecturers also promote the learning process by providing guidance and resources. However, the learning path and the learning process belong to students. Students negotiate and determine what they will learn and how they will learn [4]. Result of T-Test pairs in Table 1.

Table 1 Result of inferential analysis

Variable		Mean	Std. Deviation	Sig.(p)
Conceptual understanding	Pre-test	3.41	0.379	0.000
	Post-test	3.70	0.233	
Self-learning awareness	Pre-test	3.37	0.448	0.000
	Post-test	3.73	0.424	
Lerning Outcomes	Pre-test	3.58	0.442	0.001
	Post-test	3.82	0.337	

Self-reflection and double-loop learning are fundamental concepts of heutagogy. Heutagogy will reflect the problem-solving process and how it affects students’ knowledge and their actions. Students ought to consider the problem and the resulting actions and results. When students question and test their assumptions, it is the core of how to learn, double-loop learning occurs. Heutagogy in vocational learning method allows students to guide and determine their learning path and enable them to play an active rather than passive role in their personal learning experience [13]. Thus, heutagogy improves conceptual understanding and self-learning awareness.

The key availability of social media—connection with others, information discovery and sharing (individuals and groups), and personal collection and adjustment of information as needed—is also the availability to support autonomous learning activities. Encourage interaction, dialogue and reflection, collaboration and information sharing, as well as promote autonomy and support the creation of learner-generated content. Supported by the technical framework, heutagogy can now be seen as a further developed pedagogy: learners can continue their learning and can personalize their learning path the way they want [14].

Arguing that the heutagogy teaching method captures the need to create knowledge in a complex way. In a constantly changing environment, students need to be placed in encourage self-management and a high degree of self-efficacy at the centre of the learning process, which in most cases does not seem obvious. Heutagogy can shift in the knowledge structure. Advise students to learn from a full range of life experiences. Lecturers as guidance for development thinking instead of forcibly instilling the wisdom of others. But responsibility use heutogogy model to gain knowledge explicitly communicate with the learner.

3.4. Measurement model

Measurement assessment model specializes in the relationship between variables and indicators or statement items. It shows how each indicator relates to its latent variable. This research variable has 3 latent variables consisting of 12 indicators. This measurement model is shown in Figure 2. The tests carried out on this measurement model assessment are convergent validity and discriminant validity. The results of the convergent validity analysis is shown in Table 2. [12] explains covergent validity is the extent to which certain variable measurement items are integrated together. In the assessment of convergent validity there are four criteria that must be considered, the item is declared valid when the outer loading > 0.7 and the data is said to be reliable when Cronbach's alpha > 0.7; composite reliability > 0.7; Average Variance Extracted (AVE) > 0.5. The results of the measurement model assessment analysis in Table 2 show that all items in all predictors, namely self-learning awareness (X1), conceptual understanding (X2), and learning outcome achievement (Y1) are declared valid because they have an outer loading value > 0.7 cronbach's alpha > 0.7; composite reliability > 0.7; Average Variance Extracted (AVE) > 0.5. It indicates that the measurement variance of all predictors is a latent variable.

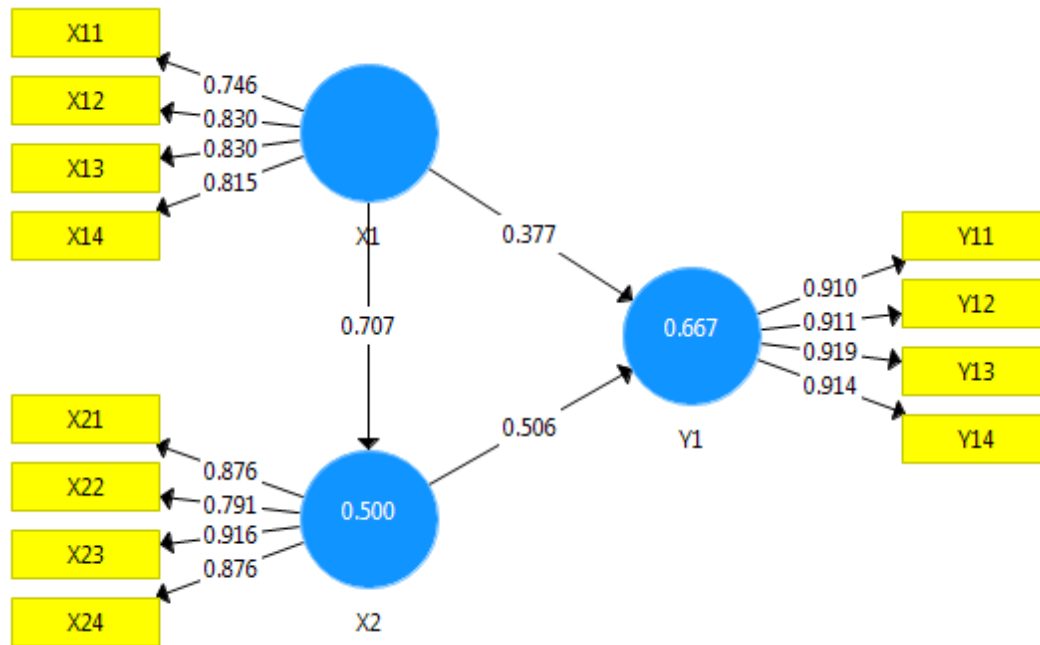


Figure 2 Research variable construct model

Where:

- X1 = Self-learning awareness
- X11 = Independent attitude
- X12 = Wakefulness
- X13 = Self knowledge
- X14 = Self evaluate
- X2 = Conceptual understanding
- X21 = explanation

- X22 = differentiate
- X24 = connect to new knowledge
- Y1 = Learning outcome achievement
- Y11 = Remembering
- Y12 = Understanding
- Y13 = Applying
- Y14 = Analyze

Table 2 Result of convergent validity

Predictor	Item	Outer Loading >0.7	Cronbach's Alpha >0.7	Composite Reliability >0.7	AVE >0.5
Self-learning awareness (X1)	X11	0.746	0.821	0.881	0.650
	X12	0.830			
	X13	0.830			
	X14	0.815			
Conceptual understanding (X2)	X21	0.876	0.888	0.923	0.750
	X22	0.791			
	X23	0.916			
	X24	0.876			
Learning outcome achievement (Y1)	Y11	0.910	0.934	0.953	0.834
	Y12	0.911			
	Y13	0.919			
	Y14	0.914			

Furthermore, the Cronbach alpha of self-learning awareness 0.821, conceptual understanding 0.888, and learning outcome achievement 0.934 as well as composite reliability of each predictor, namely from self-learning awareness 0.881, conceptual understanding 0.923, and learning outcome achievement 0.953 shows that the model proposed by this study it is reliable and consistent [15]. The results of the discriminant validity analysis can be seen in Table 3 and Table 4.

Table 3 Fornell-Larcker Criterion

Predictor	Self-learning awareness (X1)	Conceptual understanding (X2)	Learning outcome achievement (Y1)
Self-learning awareness (X1)	0.806		
Conceptual understanding (X2)	0.707	0.866	
Learning outcome achievement (Y1)	0.734	0.772	0.913

Table 4 Heterotrait-Monotrait Ratio (HTMT)

Predictor	Self-learning awareness (X1)	Conceptual understanding (X2)	Learning outcome achievement (Y1)
Self-learning awareness (X1)			
Conceptual understanding (X2)	0.817		
Learning outcome achievement (Y1)	0.825	0.846	

Measurement of model testing also considers discriminant validity which shows the uniqueness of the predictor from other predictors using the Fornell-Larcker criterion [16]. The results of Table 3 show that the Fornell-Larcker of self-learning awareness (0.806), conceptual understanding (0.866) and learning outcome achievement (0.913) exceeded the Fornell-Larcker scores of other predictors. This means that each predictor has its own uniqueness [17]. Likewise, all Heterotrait-Monotrait Ratio (HTMT) values in Table 4 are less than 0.9. It indicates a valid, unique discriminant validity that is different from other predictors. As discussed by [15], which uses the standard measurement value of 0.9 as the upper limit of the ratio, and states that the distribution of the ratio value below 0.9 is declared a valid discriminant. It indicates that convergent validity and discriminant validity of model were valid. Thus, this measurement model is valid and acceptable.

3.5. Structural Model Assessment

Structural model assessment is a structural model to predict causality between latent variables. The significance test to predict the existence of a causal relationship was carried out through bootstrapping [18]. The results of the measurement of the structural model in PLS depend on non-parametric bootstrapping procedures to test the significance of the coefficients [15]. The structural model analysis includes R square (R^2), NFI, effect size (f^2), SRMR and Rms Theta [12]. The summary of the results of the structural model analysis is presented in Table 5

Table 5 Summary of structural model assessment analysis

Predictor	R^2	NFI	SRMR	rms Theta	f^2	Size effect
Self-learning awareness (X1)					0.213	medium
Conceptual understanding (X2)	0.667	0.887	0.072	0.110	1.000	large
Learning outcome achievement (Y1)					0.383	large
Decision	Good	Model fit	Model fit	Model fit		

The structural model used in the study is shown in Figure 2 for testing using SmartPLS 3.0. The strength of the structural model in predicting can be seen from R^2 , NFI, SRMR, Rms Theta, and f^2 . The R^2 value of 0.667 indicates that the predictor of self-learning awareness, and conceptual understanding contribute 66.7% to the increasing learning outcome achievement. While the other 33.3% influence was contributed by other predictors that were not included in this study. This shows that the predictors chosen in this study have good predictions on increasing learning outcome achievement. R^2 indicates this study has good robustness [12]. The results of the analysis from Table 5 find that the NFI (0.887) and rms Theta (0.110) values are less than 0.12. This shows that the structural model fits 88.7% and is

categorized as a high fit model [15]. In addition, the effect size (f^2) is evaluated. In order to measure the size of the effect, tumb of rule of Cohen (1988) is used. Values of 0.02, 0.15 and 0.35 represent small, medium and large effects, respectively. f^2 of self-learning awareness (0.213), conceptual understanding (1.000), and learning outcome achievement (0.383) indicate medium and large effect. Based on Table 5, it can be seen that the structural model fits all the required criteria so that it can be concluded that the model's ability to explain the relationship between the variables that have been determined is categorized as good. The model also fits the existing data and the variable construct can be predicted well by using the full model.

3.6. Path analysis among construct

Path analysis was used to determine the effect of the direct and indirect relationship of exogenous variables on endogenous variables significantly and the type of mediation. This analysis is also used for hypothesis testing. The results of the path analysis presented in Table 6 are as follows.

Table 6 Summary of path analysis

Path analysis	Path coef. (Beta, β)	SD	t statistics	p value	Hypotheses result
X1->Y1	0.377	0.049	7.661	0.000	H ₃ accepted
X1 -> X2	0.707	0.046	15.309	0.000	H ₄ accepted
X2 -> Y1	0.506	0.053	9.533	0.000	H ₅ accepted
X1->X2->Y1	0.357	0.049	7.661	0.000	H ₆ accepted

SD = standard deviation

The results of the path analysis in Table 6 show the significance of each path between variables in the structural model as seen from the T-statistics and the p-value (two tailed, $p < 0.05$) between variables. It shows that all research hypotheses (H₃, H₄, H₅, H₆) are accepted. Self-learning awareness has possitive and significant effect on learning outcome achievement ($\beta = 0.377$; t statistic = 7.661, $p < 0.05$). Self-learning awareness also has possitive and significant effect on conceptual understanding ($\beta = 0.707$; t statistic = 15.309, $p < 0.05$). This study also found that conceptual understanding has possitive and significant effect on learning outcome achievement ($\beta = 0.507$; t statistic = 9.533, $p < 0.05$). It supported by [19] that self-learning awareness affected significantly to the student performance. Self-awareness to do assignments, to pay attention on lecture, to be active in the learning process, and to relearn the topic after class will increase learning outcome achievement and conceptual understanding [20], [21]. This tsudy laso found that conceptual understanding mediates and boosting effect between self-learning awareness and learning outcomes achievement ($\beta = 0.357$; t statistic = 7.661, $p < 0.05$). It indicates that self-learning awareness should equipped by conceptual understanding to boost learning outcomes achievement. Either self-learning awareness or conceptual understanding is crucial element in achieving course learning outcomes.

4. Conclusion

Heutagogy has improved self-learning awareness and conceptual understanding among vocational students. Heutagogy provides challenges for lecturers and students. By combining teaching practices, lecturers lead better learning process and learning achievement. It is a process to create life-long learning and prepare students become lifelong learners. It also cultivate student self-learning awareness that attract students to fully engaged in the subject. Since online learning requires and promotes the inherent characteristics of learner autonomy, heutagogy approches could be applied. Self-learning awareness and conceptual understanding are key component in fullfilment of course learning outcomes.

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