

An Approach to Detect Learning Types Based on Triple-Factor In e-Learning Process

¹Sfenrianto, ²Zainal A. Hasibuan, ³Heru Suhartanto, ⁴Nungki Selviandro

¹Faculty of Computer Science, STMIK Nusa Mandiri Jakarta, sfen_rianto@yahoo.com

^{2,3,4}Faculty of Computer Science, University of Indonesia, zhasibua@cs.ui.ac.id,
heru@cs.ui.ac.id, selviandro@ui.ac.id

Abstract

In previous studies, it was revealed that the importance of learning styles, motivation, and knowledge ability factors are facilitated diverse learners in e-learning. However, the overall of factors are not yet fully accommodated in e-learning process. Meanwhile, the results of preliminary study of this research indicated that the existence of these factors as the inherent structure that reflect the relationship among learning styles and motivation to the knowledge ability (Triple-Factor) in e-learning process. In order to accommodate the existence of inherent structure, this study explores the learning types based on triple-factor in e-learning process. The approach can be used as the basis for the learning recommendation and personalization in e-learning process. The approach consists of three steps: (1) identifying activity and evaluation of learning outcome, (2) forming Triple-Factor, and (3) detecting learning types based on Triple-Factor. The approach use 36 types of learning which consists of: 18 learning types that has the ability of knowledge good or very good, irrespective of the learning styles and motivation; and 18 learning types that has the ability of knowledge fail or sufficient, irrespective of the learning styles and motivation. Furthermore, the experiment for testing steps was carried by dividing two stages: the first stage did not implement the approach, second stage using learning recommendation and personalization. Result of the testing of these two stages are: step of "identifying activity and evaluation of learning outcome" at the second stage, showed that there was a significant increase on the activity of learning ($0.007 < 0.05$), and discussion forums ($0.006 < 0.05$), meanwhile the evaluation of learning outcomes ($0.227 > 0.05$) did not increase significantly. Step of "forming Triple-Factor", and "detecting learning type base on Triple-Factor" at the second stage showed: learning styles and motivation with the knowledge ability of good and very good increased from 57 to 69 students. In contrast learning styles and motivation with the knowledge ability of fail and sufficient decreased from 61 to 49. The results show that the approach used in the study successfully improve the learning process and its outcomes through learning recommendation and personalization.

Keywords: Learning Type, Triple-Factor, Learning Style, Motivation, Knowledge Abilities, E-Learning.

1. Introduction

Today e-Learning systems have been widely used by many education institutions to support the learning process. But in general, e-learning systems are still used as a media to enrich the conventional learning. In this learning model, it is usually assumed that all learners have the same learning style, motivation, knowledge ability, and others. However, the fact that each learner learns in different learning styles, motivation, and knowledge ability. Thus, the learning effectiveness becomes less optimal.

In order to optimize the process in e-learning, the system should not only be able to transfer learning materials from teachers to learners, but also the important thing is how the system is able to facilitate a variety of factors that influence in e-Learning process, such as learning styles, motivation, knowledge ability, and etc. Hence it is able to improve the quality of teaching and learning in e-Learning environment.

Some previous studies found the importance of learning style, motivation, and knowledge ability to optimize the learning process and outcomes. According Shaw (2012), different learning styles in online learning were associated with significantly different learning scores [1]. Deborah, (2004) showed that 40% failure of the learning process via e-learning is due to the lack of learning

motivation of the learner [2]. Failure of learners in online learning caused by motivational factors are also described by Muilenburg & Berge in Hartnett (2012) "Poor motivation has been-identified as a decisive factor in contributing to the high drop-out rates from online courses" [3]. Then the results preliminary study showed, there is a tendency that the higher motivation , the higher the grade the student will get [4].

Thus, in this paper we explores the learning types based on triple-factor in e-learning process. The approach can be used as the basis for the learning recommendation and personalization in e-learning process. The paper is structured in sections as follows: the influence factor in e-Learning process, an approach to detect learning types based on triple-factor, and experiment design; subsequently, experiment results; last section concludes our works.

2. The Influence Factors in e-Learning Process

Many studies explored the influence factors in learning processes (see Table 1). According to Huitt [5], a learning process has many influencing factors, such as community, family, teacher, student, school policies, and state policies. Each student has different degree of influenced factors that related to how to get and process the information in the learning process. Then in the previous study [6], we also proposed the influence factors of inherent structure in e-earning process. The result of the study indicates that the existence factors of inherent structure that reflects relationship among learning style, motivation and knowledge ability (triple-factor). Our approach integrates information about learning styles, motivation and knowledge ability factor, in order to enable e-learning system to identify triple-factor based on those factors. Thus, in the e-learning process, the triple-factor must be identified for the purpose of learning type, so that learners may learn more effectively.

Table 1. Summary of the factors used by researchers in the e-learning process

Researchers	Factors
Graf, Kinshuk, & Li (2008); Hamada, Rashad, & Darwesh. (2011); Pham, & Adina (2012). [7] [8] [9]	Learning Style
Organero & Kloos (2007); Xie, Durrington & Yen (2011); [10] [11]	Motivation
Giridharan (2010); Ragab & Bajnaid (2010); Mustafa & Sharif (2011). [12] [13] [14]	Knowledge Level
Dujaily (2007). [15]	Goals, interests and knowledge level
Somyurek (2009). [16]	User traits, background and preferences

In the context of e-learning, each student has their own type of learning. The learning type owned by learners tend to differ from one another, although there are similarities. This condition can be basis for personalized learning materials and instructional recommendations in e-learning.

Thus personalized learning materials, and instructional recommendations, that considers the learning type is important, because students have different study characteristics. It would not be optimum, when e-learning only presents the same learning materials for all learners, and without providing appropriate recommendations to the diversity of learning types based on the characteristics of individual learners. Thus, an approach for learning-type triple-factor in e-learning process is proposed for that reason.

3. An Approach to Detect Learning Types Based on Triple-Factor

This section explores an approach to detect learning types based on triple-factor in e-learning process. The approach can be used as the basis for the learning recommendation and personalization in e-learning process. As shown in Figure 1, the approach consists of three steps: (1) identifying activity and evaluation of learning outcome, (2) forming triple-factor, and (3) detecting learning types based on triple-factor.

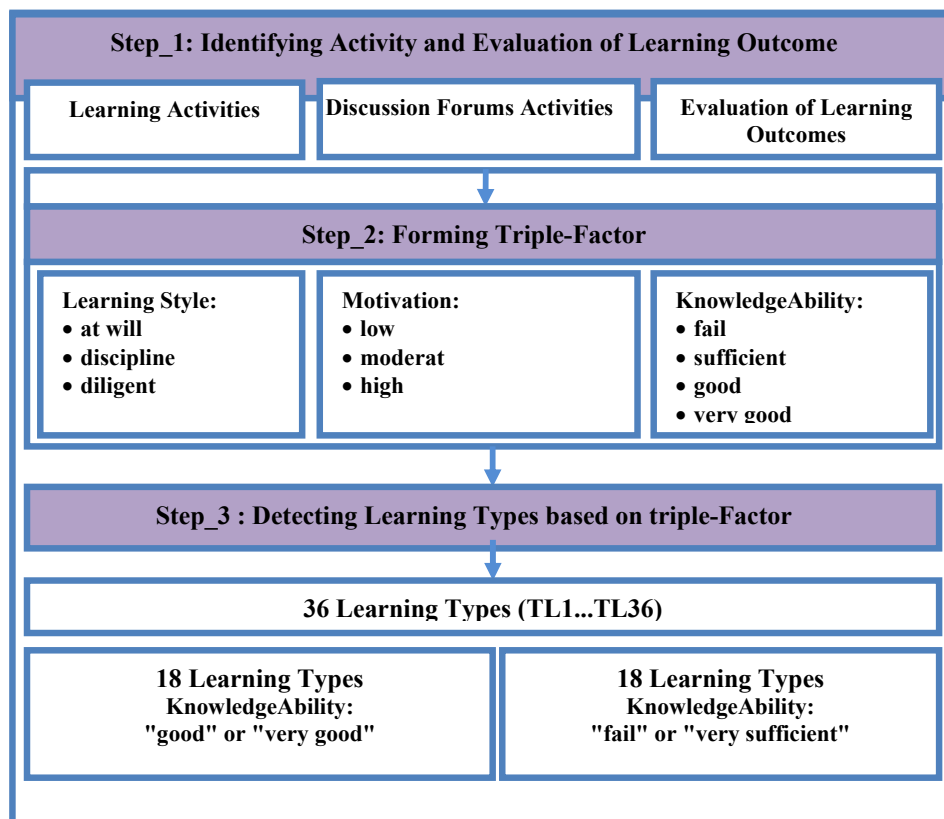


Figure 1. An approach to detect learning types based on Triple-Factor in e-learning process

The first step : “Identifying Activity and Evaluation of Learning Outcome”, is the step being used to identify: learning activities, discussion forums, and evaluation of learning outcomes. According to Sfenrianto [17], learning activities are a preference for materials, explanations, and additional (MPT). MPT preferences derived from the total number preferences: material (M), explanation (P), and additional (T); Discussion forum activities are the activities of intrinsic and extrinsic. The Intrinsic activity derived is from the activity of reading and forum posts (F1), and posting activity independently (F2). The Extrinsic activity is derived from the activity of reading and answer thread triggers (F3); While the Evaluation of learning outcomes is the final grade (NA) obtained by the learners grade assignments and quizzes.

The second step “Forming Triple-Factor” is the step being used to forming the characteristics of learning styles, motivation, and knowledge ability (Triple-Factor). According to Sfenrianto [17], the characteristics of learning styles can be categorized into three types **at will**, **discipline**, and **diligent**; Motivational characteristics can be categorized into three types **low**, **moderate**, and **high**; While the characteristics of knowledge ability can be categorized into three types **fail**, **sufficient**, **good**, and **very good**. The characteristics of Triple-Factor in an e-Learning obtained by the learners MPT, F1F2F3, and the final grade (NA) are given as follows:

- If MPT preference is below the average, then include **at will** learning style characteristic. If MPT preference is in the range the average, then include **discipline** learning style characteristic. If preference MPT is above average, then include **diligent** learning style characteristic.
- If F1F2F3 activity is below the average, then include **low** motivation style characteristic. If F1,F2,F3 activity is in the range the average, then including the **moderate** motivation style characteristic. If F1,F2,F3 activity is above average, then include the **high** motivation characteristic.
- Knowledge ability, consists of four characteristics namely: **fail**, **sufficient**, **good**, and **very good**. The identification of knowledge ability characteristics based on (NA), namely: **fail** for 0-64 range / **sufficient** for 61-80 range / **good** for 80-84 range / **excellent** for 90-100.

The third component “Detecting Learning Types based on Triple-Factor”, is the step being used to determine learning types Triple-Factor in e-learning process. According to Sfenrianto [17], There are 36 the types of learning Triple-Factor (TL1...T136) in e-learning process. It is formulated based on the combination of characteristics of each learning style, motivation, and knowledge ability. For example:

- The type of learning_1 (LT1) is a learning style "**at will**", with the motivation "**low**", and the knowledge capability is "**fail**".
.....
- The type of learning_36 (LT36) is a learning style "**diligent**", with the motivation "**high**", and the knowledge capability is "**very good**".

The learning type Triple-Factor” consists of: 18 learning types that have the knowledge capability "**good**" or "**very good**", irrespective of the learning styles and motivation. Then 18 learning types that have the knowledge capability "**fail**" or "**very sufficient**", irrespective of the learning styles and motivation.

4. Experiment Design

The experiment for testing and evaluation involved 118 students at the Faculty of Computer Science, University of Indonesia, who took "Scientific Writing" course in odd semester 2013/2014. Table 2 show testing scenario being used is the quasi experiment, which performed in serial that starts with stage I (T1). Then proceed to the second stage (T2) to provide treatment (X).

Table 2. Testing scenario and evaluation

<i>Stage I</i>	<i>Treatment</i>	<i>Stage II</i>
T ₁	X	T ₂

The testing scenario and evaluation of results were carried out in two stages. While Stage I was conducted from Week 1 to 7 through SCELE, without the use of learning recommendation and personalization. Stage II was conducted on the course from Week 8 to 12 through SCELE and SCELE-E-Learning Dynamic Personalization which facilitates learning recommendations and personalization as a treatment. Figures 2 and 3 are SCELE and SCELE PDE interface used in the experiment.



Figure 2. SCELE : Interface

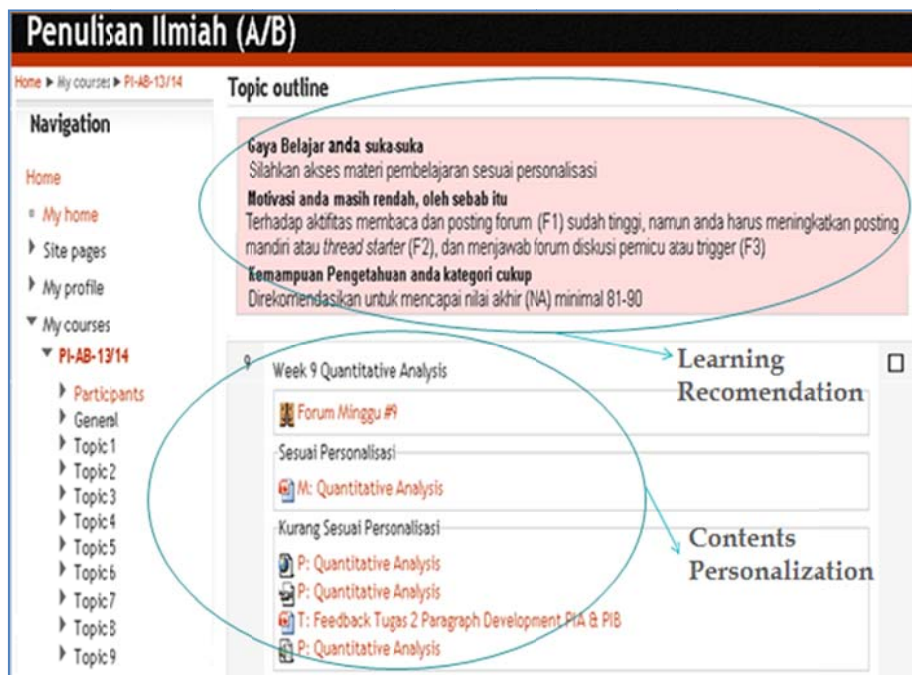


Figure 3. SCELE-PDE : Interface.

5. Experiment Results

Table 3 shows the evaluation results obtained between Stages I and II which is the result of the testing of these two stages for step of "Activities and Evaluation of Learning Outcomes". At the second stage, it is obvious that there was a significant increase on the activity of learning (0.007 < 0.05) and discussion forums (0.006 < 0.05). Meanwhile, the evaluation of learning outcomes (0.227 > 0.05) did not increase significantly.

Table 3 Result of the testing of two stages for step: "Identifying Activity and Evaluation of Learning Outcome" [17]

Component: "Activity and Evaluation of Learning Outcome"		Test Statistics	Results
Learning Activities	Preference MPT	0,007 (< 0,05)	H ₀ rejected H ₁ accepted
Discussion Forums	Activity F1F2F3	0,006 (< 0,05)	H ₀ rejected H ₁ accepted
Evaluation of Learning Outcomes	Final Grade (NA)	0,227 (> 0,05)	H ₀ accepted H ₁ rejected

Table 4 show the results of the evaluation steps of "Forming Triple-Factor, and "Detecting Learning Types based on Triple-factor" in the experiment stage I and stage II. The learning types consists of: 18 learning types based on Triple-factor that have the knowledge capability "good" or "very good" irrespective of the learning styles and motivation, and 18 learning types that have the knowledge capability "fail" or "very sufficient, irrespective of the learning styles and motivation.

Table 4. The results of the evaluation steps of "Forming Triple-Factor", and "Detecting Learning Types based on Triple-Factor" stage I and II

Types of learning	Triple-Factor			Stage 1	Stage 2	Types of learning	Triple-Factor			Stage 1	Stage 2
	Learnig Style	Motivation	Knowledge Ability				Learnig Style	Motivation	Knowledge Ability		
TL36	diligent	high	very good	2	3	TL34	diligent	high	sufficient	6	8
TL32	diligent	moderate	very good	0	0	TL22	discipline	high	sufficient	7	3
TL24	discipline	high	very good	1	4	TL10	at will	high	sufficient	3	5
TL20	discipline	moderate	very good	1	0	TL30	diligent	moderate	sufficient	2	1
TL12	at will	high	very good	0	1	TL18	discipline	moderate	sufficient	9	2
TL8	at will	moderate	very good	0	0	TL6	at will	moderate	sufficient	7	12
TL35	diligent	high	good	10	20	TL26	diligent	low	sufficient	2	1
TL23	discipline	high	good	7	13	TL14	discipline	low	sufficient	6	1
TL11	at will	high	good	2	2	TL2	at will	low	sufficient	13	12
TL31	diligent	moderate	good	5	3	TL33	diligent	high	fail	1	0
TL19	discipline	moderate	good	7	10	TL21	discipline	high	fail	0	0
TL7	at will	moderate	good	3	6	TL9	at will	high	fail	1	0
TL28	diligent	low	very good	0	0	TL29	diligent	moderate	fail	0	0
TL16	discipline	low	very good	0	0	TL17	discipline	moderate	fail	1	0
TL4	at will	low	very good	0	0	TL5	at will	moderate	fail	1	0
TL27	diligent	low	good	5	3	TL25	diligent	low	fail	0	0
TL15	discipline	low	good	8	2	TL13	discipline	low	fail	1	0
TL3	at will	low	good	6	2	TL1	at will	low	fail	1	4
Total types of learning				57	69	Total types of learning				61	49

The first 6 columns indicate that most of 18 learning type that have learning styles and motivation with the knowledge capability of **good** or **very good** are increasing, and the second 6 columns indicate that most of 18 learning types that have learning styles and motivation with the capability knowlegde of **fail** or **sufficient** are decreasing. The result was obtained based on the experimental results between stage I without the use of learning recommendation and personalization, and stage II using learning recommendation and personalization. Thus in stage II the steps of "Forming Triple-Factor", and "Detecting Learning Types based on Triple-Factor", showed the learning types that have learning styles and motivation with the knowledge capability of **good** or **very good** increased from 57 to 69 students. While the learning types that have learning styles and motivation with the capability knowlegde of **fail** or **sufficient** decreased from 61 to 49.

6. Acknowledgement

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7. Conclusions

We explained an approach to detect learning types based on triple-factor in e-learning process. The approach consists of three steps: (1) identifying activity and evaluation of learning outcome, (2) forming triple-factor, and (3) detecting learning types based on triple-factor. Each stept can be used as a base learning recommendation and personalization for optimizing processes and learning outcomes.

These three steps can be used to support an approach of Triple-Factor learning types in e-Learning. This finding was obtained from the difference between the testing results in Stage I without the use of learning recommendation and personalization, and Stage II using learning recommendation and personalization. The result of the experiment showed that our approach successfully improve the learning process and its outcomes through learning recommendation and personalization.

8. References

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