ISSN No:-2456-2165

Development of Truth-Seeking Learning Model: Validity and Reliability

Achmad Zanuar Ansori[1]
Postgraduate Students
Science Education Program
Surabaya State University, Indonesia

Muslimin Ibrahim[2], Wahono Widodo[3], Suyatno Sutoyo[4]
Postgraduate Lecturer
Science Education Program
Surabaya State University, Indonesia

Abstract:- Research papers about students' critical thinking disposition reported that truth-seeking subscale generally had the lowest score among six others. Preliminary research on high school students also supported that phenomenon. So, there was a need to propose a learning model to improve students' truth-seeking disposition. Truth-seeking Learning Model (TLM) was developed to overcome it. The learning model consists of six phases. The aim of this research was to get the validity of both content and construct and the reliability of the learning model. The data were collected through Focus Group Discussion using learning model validity sheets. The validity and the reliability were analyzed using average score, inter-rater coefficient correlation, and Cronbach's alpha. The results showed that the content and construct of the TLM were valid. The TLM was also reliable. It means that the TLM has a high quality.

Keywords:- *Learning Model, Validity, Truth-Seeking, Disposition.*

I. INTRODUCTION

The rapid changing of technology in life and work force has led students to require themselves with a range of skills and capabilities, including critical thinking [1]. Critical thinking are more required in workplace at this time than in the past [2]. Critical thinking also becomes most important skills in industrial revolution 4.0 eras [3]. Therefore, teaching critical thinking is demanded in today's global society together with communication, collaboration, and creativity [4].

In learning Biology, Indonesian senior high school students are expected becoming media literate and having critical thinking as a provision in the 21st century life (Ministry of Education and Culture [5]. The students must be able to analyze and evaluate the amount of information available [6]. It is more important since there are issues related to biology that accompany, e.g. genetic modified organism and environmental damage. Critical thinking is also applied to choose appropriate food [7]. Such topics presents in learning biology at senior high school. Thus, mastery of biological concepts will play a significant role in social construction [8]. However, a lot of people convince in truth based on what they read or hear from a single source [9].

Critical thinking skills alone are not adequate to someone to think critically [10]. Critical thinking dispositions influence in making decisions about whether or not to use critical thinking in a certain situation [11]. Critical thinking dispositions use to support someone to think critically [12]. Therefore, critical thinking dispositions are as absolutely necessary as critical thinking skills for students [13]. Truth-seeking is one aspect of critical thinking dispositions [14]. Truth-seeking is like the truth rather than falsity or fantasy and devoting oneself to search the truth in many things [15]. The truth-seeking disposition targets are *of being eager to seek the best knowledge in a given context, courageous about asking questions, and honest and objective about pursuing inquiry even if the findings do not support one's self-interests or one's preconceived opinions* [16].

Research found that truth-seeking had the lowest average score among the seven aspects of critical thinking disposition [17-22]. A preliminary study of eleventh grade students of mathematics and natural science programs showed that the truth-seeking disposition had a moderate score. This result is similar with some previous research findings. Thus, a learning model to promote students' truth-seeking disposition is necessarily developed. The objective of this study was producing a quality Truth-seeking Learning Model (TLM) that has valid both content and construct and reliable.

II. LITERATURE REVIEW

A. Characteristics of Learning Model

Learning model defined as the whole plan or design to assist students to learn specific kind of knowledge, attitudes, or skills [23]. A learning model should fulfill five major components, they are 1) syntax, 2) social system, 3) principles of reaction, 4) support system, and 5) instructional and nurturant effects [24]. As an educational intervention product, the learning model should meet three criteria, they are 1) validity, consisting of content and construct validity, 2) practicality, and 3) effectiveness [25] Content validity means that "there is a need for the intervention". Construct validity refers to that "the intervention is 'logically' designed".

B. Relevant Learning Models

There are two existing learning models that served as basic of the model being developed, Problem Based Learning (PBL) and non-directive learning. The PBL's main ideas adopted and adapted is implementation of issues or problems as an entry point for learning [26]. Meanwhile, the non-directive advantage adapted is the ability of the model in self-growth and self-development [24]. Principle of character growth also takes into account [27]. Based on the two models and growing character principle, a new model that is more specific in promoting truth-seeking disposition developed.

III. RESEARCH METHODS

The study reported here is part of research and development model from Branch as shown in Figure 1.

A. Development of Learning Model

The study reported here is part of research and development model from Branch as shown in Figure 1.

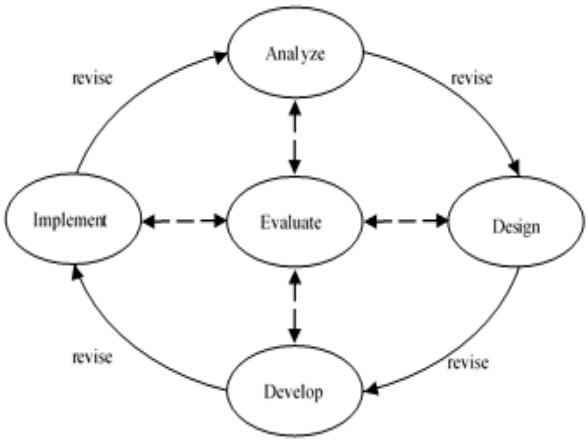

Fig 1:- The ADDIE Model [28]

In design phase, the researcher found that there was a need to build a learning model to improve students' truth-seeking disposition, namely Truth-seeking Learning Model (TLM) [29]. In develop phase, the researcher produced a book model, the TLM book model, as a main product. The book model consisted of 1) Introduction: covering rationale, aim, and advantage of the learning model, 2) Chronology of learning model development: covering distinction between the TLM and two other models *and* theoretical and empirical support, and 3) Description of the TLM: covering characteristic, purpose, syntax, social system, principles of reaction, support system, instructional and accompanist impact of the learning model; learning environment and classroom management; and evaluation process.

B. The Book Model Validation

Data gathered through Focus Group Discussion (FGD) by three validators who are professor of science education, professor of human physiology, and doctor of learning model development. The FGD was an activity in which participants asked for responding to a series of questions focused on a single topic in a small group discussion [30]. The book model and the validation sheets distributed to the validators two weeks before the FGD. In the FGD, the TLM book model, as a representation of the learning model developed, was validated by the validators. The validators gave score for each indicator questioned based on description in the book model. The validators could write their comments or suggestions and was processed qualitatively and served as a confirmation.

Instruments used were validation sheets of the TLM both content and construct. The validation sheet of the model content validity contained three components. The components were rationale for the TLM model development (3 items), the state of the art of knowledge (13 items), and follow-up model development results (2 items). The validation sheet of the model construct validity contained seven components. The components were the TLM model rationale (3 items), theoretical and empirical support (7 items), syntax (3 items), social system (2 items), principles of principle (2 items), support system (2 items), and instructional and accompanist impact (2 items). Each item has a score gradation from 1 to 4. Average validity score of each component was gained by dividing the sum of modus score of each item with number of item in the component. Single measure inter-rater correlation coefficient (ICC) was practiced for further analysis [31]. The TLM is valid if $r_\alpha > r$ table and not valid if $r_\alpha \leq r$ table. The reliability was analyzed using Cronbach's alpha coefficient [32]. The comments or suggestions treated qualitatively and used as a reference to improve or strengthen the quality of the learning model. The criteria of average validity score implemented as follow [33]

Interval	Criteria	Description
$3.00 < \bar{x}$ **Error! Bookmark not defined.Error! Bookmark not defined.Error! Bookmark not defined.Error! Bookmark not defined.Error! Bookmark not defined.** ≤ 4.00	Very valid	Can be used without revision
$2.75 < \bar{x} \leq 3.00$	Valid	Can be used with minor revision
$1.75 < \bar{x} \leq 2.75$	Less valid	Can be used with major revision
$1.00 \leq \bar{x} \leq 1.75$	Invalid	Can't be used

Tabel 1:- Criteria of average validity score

IV. RESULTS AND DISCUSSION

The TLM model quality assessment of content and construct validity results are presented in Table 2.

Components	Validity				Reliability	
	Average		r_α		α	
Content validity						
Rationale for TLM model development	3.67	very valid	0.67	valid	0.86	reliable
State-of-the-art knowledge	3.83	very valid	0.71	valid	0.97	reliable
Follow-up model development results	3.50	very valid	1.00	valid	1.00	reliable
Construct validity						
TLM model rationale	3.67	very valid	0.67	valid	0.86	reliable
Theoretical and empirical support	3.71	very valid	0.76	valid	0.96	reliable
Syntax	3.67	very valid	0.67	valid	0.86	reliable
Social system	4,00	very valid	1.00	valid	1.00	reliable
Reaction principle	3.67	very valid	1.00	valid	1.00	reliable
Support system	3.67	very valid	1.00	valid	1.00	reliable
Instructional impact and accompanist impact	3.33	very valid	1.00	valid	1.00	reliable

Table 2:- Results of the TLM quality assessment

Table 2 shows that the content validity has average scores of 3.67, 3.83, and 3.50 respectively and therefore all categorized as very valid. Further analyzes of ICC also reveals that all components are valid with r_α = 0.67, 0.71, and 1.00 which are greater than the r table value. Therefore, each component declares as valid and the model being constructed is really needed and based on the state of the art of knowledge [25]. The reliability scores of the three components are 0.86, 0.97, and 1.00 respectively. So, the all components are reliable. Particularly for follow-up model development results component which both validity and reliability value is 1.00. That means the model being developed can be continued so it can be operationalized in the field.

Table 2 exhibits that the average scores of the validity of the components are 3.67; 3.71; 3.67; 4.00; 3.67; 3.67; and 3.33 respectively that means all components are declared very valid. More statistical analysis of ICC reveals that the last four components have value of 1.00. It means that the model being designed is high logically. The reliability of the components reach α = 0.86; 0.95; 0.86; 1.00; 1.00; 1.00; and 1.00 respectively that means each component is reliable.

The qualitative data were analyzed, summarized, and grouped based on the three components of content validity and seven components of construct validity. The data used to correspond with the statistical data and are presented at Table 3

Component	Qualitative data
Content Validity	
Rationale for TLM model development	All validators stated that the rationale proposed was valid
State of the art of knowledge	The state of the art of knowledge for TLM was valid. The validators said that there was a need to develop such a model. Thus, the TLM was novel and could improve students' truth-seeking disposition in learning Biology.
Follow-up model development results	The validators asserted that the TLM model developed was valid. The model could be followed by further research and applied to learning.
Construct Validity	
TLM model rationale	The validators said that the TLM rationale was valid. The model fulfilled all provisions which consisted of aim, syntax, principles of reaction, social system, and support system.
Theoretical and empirical support	The validators stated that theoretical and empirical support was valid. There was strong compatibility between the TLM and learning and growing character both theoretically and empirically.
Syntax	The validators asserted that the syntax of the TLM was valid. The phases in the syntax were composed logically. Interconnection among phases of the syntax was supporting each other and reflecting a sequence of activities to achieve the learning objective.
Social system	The validators stated that the social system has been described clear and valid. Teacher and students' activities explained very clear.
Principles of reaction	How the teacher gave attention and treated the students has been explained in the book model very clear. Therefore, the principles of reaction were valid.
Support system	Support systems that include learning facilities, materials, and tools for implementing TLM are expressed logically in the model book. Thus, support system was valid.
Instructional and accompanist impact	The instructional impact and accompanist of the TLM was clearly and logically stated in the model book. It means that this component was valid.

Table 3:- Summary of the qualitative data for the TLM quality assessment

The all components of content validity of the TLM are classified as valid. The model developed bases on the results of previous researches and also meets the demands of the times according to the latest Indonesian curriculum which is to make students active in finding the valid information [25]. The model also has a novelty which focuses on improving truth-seeking disposition of students' in learning Biology. The TLM design is also supported by state of the art of knowledge. They are educational psychology; character formation; and learning theory which is consisting of information processing theory [34], Gestalt psychology [35], constructivism [36], and motivational theory [23].

The seven components of model construct validity are also valid. It means that the model is designed logically and all model components link consistently to each other [25]. The consistency of the model can be seen at order of the syntax phases arranged. The consistency can also be looked at the theoretical and empirical support underlying used. The model components consistency refers to interrelation among rationale of the model, social system, principles of reaction, support system, *and* instructional and accompanist impact. The name of each phase, students' activities and truth-seeking disposition targets can be seen on Table 4.

Note = 1. Eager to find the best knowledge based on contexts; 2. Dare to ask questions; 3. Honest and objective in doing observation or investigation; 4. Tend to adjust beliefs according to relevant and powerful facts and reasons; 5. Receive important considerations related to facts, reasons and other perspectives; 6. Continuously evaluating new information and evidence; 7. Foster a new orientation towards truth-seeking dispositions

Student' activities	Targets
Phase Exploration of issues: (1) Listening to the teacher's explanation; (2) Reading a text containing biological issue; (3) Responding and asking questions about the text.	2
Phase Problem identification: (1) Identifying biological concepts *and* unclear, understandable, and scientifically incorrect statements (potentially an issue); (2) Composing problem identification and problem formulation.	2, 6
Phase Gathering information: Gathering information from books, internet, and doing observation or investigation	1, 3
Phase Clarification of issues: (1) Discussing in group to clarify the issue; (2) Presenting the results of group discussions.	4, 5, 6
Phase Evaluation: (1) Evaluating learning process with the teacher; (2) Receiving feedback from the teacher (3) Conducting reflection with the teacher	4, 6
Phase Integration: (1) Listening to the teacher's explanation; (2) Composing follow-up questions related to the material.	7

Table 4:- The students' activity and target of truth-seeking disposition in the TLM

V. CONCLUSIONS

The results show that TLM has content and construct validity, and is reliable too. The TLM is a high quality product. The implication is that the TLM can be practiced to improve students' truth-seeking disposition in learning Biology. The six phases of the TLM are exploration of issue, problem identification, searching information, clarification, evaluation, and reflection. Further research could be conducted to test the practicality and effectiveness of the TLM.

REFERENCES

[1]. Lamb, S., Maire, Q., & Doecke, E. *Key skills for the 21st century: an evidence-based review.* Department of Education, NSW, 2017.
[2]. Sendag, S., & Odabasi, F. Effects of an online problem based learning course on content knowledge acquisition and critical thinking skills. *Computers & Education*, 53(1)**,** 132–141. https://doi.org/10.1016/j.compedu.2009.01.008, 2009.
[3]. Lee, M., Yun, J.J., Pyka, A., Won, D., Kodama, F., Schiuma, G., & Zhao, X. How to respond to the fourth industrial revolution, or the second information technology revolution? Dynamic new combinations between technology, market, and society through open innovation. *Journal of Open Innovation: Technology, Market, and Complexity*. 4(21)**,** 2-24. https://www.mdpi.com/2199-8531/4/3/21/htm, 2018.
[4]. National Education Association (NEA). Preparing 21st century students for a global society: An educator's guide to the "Four Cs". Retrieved from http://www.nea.org/assets/docs/A-Guide-to-Four-Cs.pdf, 2018.
[5]. Ministry of Education and Culture. Regulation of the Minister of Education and Culture number 59 of 2014: The 2013 Senior High School Curriculum. Jakarta: Ministry of Education and Culture, 2016.
[6]. Chaffee, J. *The Philosopher's way: thinking critically about profound ideas* (4th Edition). Upper Saddle River, NJ: Pearson Education, Inc, 2013.
[7]. Ministry of Education. *Focus on food: thinking critically about food and nutrition.* Wellington, New Zealand: Learning Media Ltd, 2008.
[8]. Ministry of Education and Culture. Regulation of the Minister of Education and Culture number 24 of 2016: The Core Competence and Basic Competence of Curriculum 2013 in Basic and Middle School. Jakarta: Ministry of Education and Culture, 2014.
[9]. Cottrell, S. Critical thinking skills: developing effective analysis and argument. New York: Palgrave Macmillan, 2005.
[10]. Nieto, A.M., & Saiz, C. Skills and dispositions of critical thinking: are they sufficient. *Anales de Psicología*, 27(1) 202-209, 2011.

[11]. Halpern, D. F. *Thought and knowledge an introduction to critical thinking* (5th Edition). New York: Psychology Press, 2014.
[12]. Kusmaryono, I., Suyitno., H., Dwijanto, D., & Dwidayanti., N. The effect of mathematical disposition on mathematical power formation: review of dispositional mental function. *International Journal of Instruction*, 12(1), 343-356. https://doi.org/10.29333/iji.2019.12123a, 2019.
[13]. Arsal, Z. The effects of microteaching on the critical thinking dispositions of pre-service teachers. *Australian Journal of Teacher Education*, 40(3), 140-153. http://dx.doi.org/10.14221/ajte.2014v40n3.9, 2015.
[14]. Facione, P. A. *Critical thinking: what it is and why it counts*, Insight Assessment. Retrieved from https://www.insightassessment.com/About-Us/Measured-Reasons/pdf-file/Critical-Thinking-What-It-Is-and-Why-It-Counts-PDF, 2015.
[15]. Chadwick, C. *Teaching kids to think critically*. Lanham, Maryland: The Rowman & Littlefield Publishing Group, Inc, 2014.
[16]. Facione, P.A., Giancarlo, C.A., Facione, N.C., & Gainen, J. The disposition toward critical thinking. *Journal of General Education*, 44(1), 1-25, 1995.
[17]. El-Demerdash, D.A., El Hawashy, Z.I., Donia, S.A.A., & Taha, E.E. Preferred educational strategies and critical thinking dispositions among nursing students. *Journal of American Science*, 7 (5) 406-416, 2011.
[18]. Du, X.Y., Emmersen, J., Toft, E., & Sun, B. PBL and critical thinking disposition in Chinese medical students – A randomized cross-sectional study. *Journal of Problem-Based Learning in Higher Education*, 1(1), 72-83. https://doi.org/10.5278/ojs.jpblhe.v1i1.275, 2013.
[19]. Pai, Hs-C., & Cheng-Joo, E. The relationships among critical thinking disposition, caring behavior, and learning styles in student nurses. *Open Journal of Nursing*, 3(2), 249-256. 10.4236/ojn.2013.32034, 2013.
[20]. Ojewole, F., & Thompson, C. Assessment of critical thinking dispositions of nursing students in southwestern Nigeria. *International Journal of Research in Applied: Natural and Social Sciences*, 2 (8) 7-16, 2014.
[21]. Hossein, H. Z., Nasrin, K., Khalkhali, H., & Mohammadpour, Y. Effect of evidence-based nursing on critical thinking disposition among nursing students. *Life Science Journal*, 11 (9), 487-491, 2014.
[22]. El-Shaer, A. & Gaber, H. Impact of problem-based learning on students` critical thinking dispositions, knowledge acquisition and retention. *Journal of Education and Practice*, 5(14), 74-85, (2014).
[23]. Arends, R. I. *Learning to teach* (9th Ed). New York: McGraw-Hill, 2012.
[24]. Joyce, B., Weil, M., & Calhoun, E. *Models of teaching* (3th Ed). Boston, MA: Pearson Education, Inc, 2009.
[25]. Nieveen, N. & Folmer, *E.* "Formative evaluation in educational design research". In Plomp, T. J. & Nieveen, N. (eds). *Educational design research, part A: An introduction* (10-51). Retrieved 04/05/2016, from http://downloads.slo.nl/ Document/educational-design-research-part-a.pdf, 2013.
[26]. Savin-Baden, M., & Major, C.H. *Foundations of problem-based learning.* Berkshire: Open University Press, 2004.
[27]. Lickona, T. Educating for character: how our school can teach respect and responsibility, New York: Bantam Books, 1991.
[28]. Branch, R.B. *Instructional design: The ADDIE approach*, New York: Springer Science + Business Media LLC, 2009.
[29]. Ansori, A.Z., Ibrahim, M., & Widodo, W. Theoretical study of the truth-seeking learning model: The learning model to improve students' critical thinking disposition. *Advances in Social Science, Education and Humanities Research*, 218, 125-129. https://doi.org/10.2991/icomse-17.2018.22, 2018.
[30]. Onwuegbuzie, J., Dickinson, W.B., Leech, N.L., & Zoran, A.G. A qualitative framework for collecting and analyzing data in focus group research. *International Journal of Qualitative Methods*, 8 (3), 1-21. https://doi.org/10.1177/160940690900800301, 2009.
[31]. Malhotra, N.K. *Review of marketing research: special issue-marketing legends.* New York: Emerald Group Publishing Limited, 2011.
[32]. Fraenkel, J., Wallen. N., & Hyun, H. *How to design and evaluate research in education*, New York: McGraw-Hill Companies, 2012.
[33]. Ratumanan, T. G., & Laurens, T. *Penilaian hasil belajar pada tingkat satuan pendidikan* (Edisi ke-2). Surabaya: Unesa University Press. (in Indonesia), 2011.
[34]. Slavin, R. E., *Educational psychology: theory and practice* (8th ed.), Boston: Pearson Education, Inc, 2006.
[35]. Schunk, D. H. *Learning theories: an educational perspective.* Boston, MA: Allyn & Bacon, 2012.
[36]. Moreno, R. *Educational psychology*. River Street, Hoboken, NJ: John Wiley & Sons, Inc, 2010).