



MODEL TECHNOLOGY LEARNING CYCLE (TLC): SUCCESS IN LEARNING

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ABSTRACT

The current 21st century development has had a major effect on educational reforms that must adapt to technological developments. There have been many developments in the learning process by integrating technology in order to realize educational reform, one of which is the technology-integrated learning model, TLC. The TLC model was developed to enable future educators to use technology for learning. The TLC model has shown its effectiveness in integrating technology into learning. This has been seen from several studies that show a positive impact on the use of TCL on student learning outcomes. Therefore, the purpose of this article is to explain what an integrated model of technology, TLC, and its application in the learning process is based on the findings of several researchers. Literature study was used in writing this article. The study of journals and books was carried out to enrich the study of the model of integrating TLC technology in learning as well as the study of research results according to several researchers. This article shows that TLC has five phases, namely awareness, exploration and filtration, learning, application, and sharing and reflection which are built to support the use of technology by educators. Educators will have the ability to use new technology and use technology applications in the learning process

Keywords: *Technology Learning Cycle (TLC), Learning, Education.*

1. INTRODUCTION

As the process of development and globalization taking place in the 21st century affects the emergence of various problems and competition in life, each person needs to strive to become an effective and attentive person to the various types of problems in the real world (Rahmasiwi, Susilo, & Suwono, 2018). The current development in the 21st century, more specifically, has a major effect on educational reform that must adapt to technological developments. The education reform in question is not only a curriculum change, but also a change in the orientation of education at a macro level, namely a change in acting from simple action to comprehensive action, a change from loop knowledge to cycle learning, a change from stand-alone learning to e-learning and community learning, and the shift in the dominance of teaching that emphasizes lower-order thinking skills (LOTs) to learning that emphasizes higher-order thinking skills (HOTs) (Miri, Ben-Chaim, & Zoller, 2007).

There have been many developments in the learning process by integrating technology in order to realize educational reform, including learning using The Concerns Based Adoption Model (CBAM) (Fuller, 1969); Technological Pedagogical Content Knowledge (TPACK) (Koehler & Mishra, 2005; Koehler, Mishra, & Cain, 2013); Substitution Augmentation Modification Redefinition (SAMR) (Puentedura, 2012); Technology Acceptance Model (TAM) (Davis, Bagozzi, & Warshaw, 1989); Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh, Morris, Davis, & Davis, 2003); Will Skill Tool Pedagogy (WSTP) (Knezek & Christensen, 2015) and Technology Learning Cycle (TLC) (Marra, Howland, Jonassen, & Wedman 2003). A key factor in integrating technology into education is the availability of teachers directly involved in the delivery of materials as well as complex teaching practices. (Niederhauser & Lindstrom, 2018; Wang, 2017; Webb & Cox, 2004).

Of the several models of technology integration, one model that focuses on the use of technology in the learning process is the Technology Learning Cycle (TLC) model. The development of technology-driven teaching and learning processes is at the heart of the TLC model, as well as the development of one or more technology tools (Wedman & Diggs, 2001). At the TLC stage, an educator must consciously think about what technology is appropriate to use in learning in accordance with learning outcomes and the context of the school environment.



Educators must also understand how to use technology in learning. As far as possible educators should convince students of the benefits of using technology and teach students how to use the technology (Howland & Wedman, 2004; Marra et al., 2004, 2003).

The TLC model was developed to prepare future educators to use technology in their learning (Marra, et al, 2004). The results of initial trials implementing the TLC model show that it is quite effective in integrating technology in learning (Marra, et al, 2003). Furthermore, the development of technology integrated into learning through TLC has gone through a lot of research which has had a positive impact on student learning outcomes (Niederhauser & Lindstrom, 2018). This can be seen from the research results of Marra, et al, (2003), the results of experiments using the TLC model show that the application of TLC is quite effective in science learning. TLC grew out of dissatisfaction with the "techno-centric" perspective of teachers that was too dominant in using applied science and was instead based on the idea that people must become lifelong learners in developing educational technology (Marra, et al, 2003).

The results of subsequent research Howland and Wedman (2004) show The technology learning cycle provides a comprehensive metacognitive tool for individuals to evaluate and track their own progress in learning technology. This designed learning technology can not only be used during research, but can be used for continuous growth and renewal throughout his professional life. The latest research by Patonah, Sajidan, Cari, & Raharjo (2021) which combines the TLC model with the inquiry model to produce the Science Technology Learning Cycle (STLC) model shows that this model is practically applied and effective to empower students' critical thinking skills. Students feel the benefits of learning to develop simple technologies that help solve environmental problems (Patonah, et al, 2021).

Another recent study, namely the research of Utama, Sajidan, Nurkamto, & Wiranto (2019) which combines the TLC model with TPACK for e-learning called ELCoS shows that each stage of The school's electronic learning cycle has the advantage of having communication capabilities (Squillante, Wise, & Hartey, 2014). The communication forum provided by Schoology can be done either as a group or individually. Communication can be made instantly to discuss or ask questions on topics related to study materials, homework, assignments, exams and self-observation reports. The technology has a positive impact in helping students and teachers self-development.

Despite the fact that the TLC model has been widely used to integrate technology in learning, it is necessary to further investigate the findings that have been previously reported regarding the application of TLC in learning. Therefore, this article seeks to explain what an integrated technology model, TLC, and its application in the learning process is based on the findings of several researchers.

2. METHODS

Literature study was used in writing this article. The study of journals and books was carried out to enrich the study of the model of integrating TLC technology in learning as well as the study of research results according to several researchers. In addition, empirical research results from several researchers are used as secondary data to strengthen arguments which are then synthesized into a single unit to provide meaningful information.

This study was conducted as a systematic literature review according to the Kitchenham Guidelines (2004) which consists of 3 phases namely; Plan Review, Conduct Review, Document Review. This method is then described by (Brereton, Kitchenham, Budgen, Turner, Khalil, 2007) as follows:

Phase 1, in this phase an overall assessment plan is carried out from the reviewed articles. The key question to explore the study of this review literature is, what is the TLC learning model and how is it applied in learning? The validation protocol development is rigorous and iterative. This includes an overall plan for systematic research and validation of the literature.

Phase 2, an empirical study of article searches using the Google Scholar and Scopus data bases for the last 10 years. These studies were analyzed and filtered in searches using the words "TLC," "Technology Learning Cycle". The next step is to search for articles that are suitable for learning and meet the rules of writing scientific articles. Several articles were removed from this study because the author was the same and he required rewriting.



From the search on the search engine mentioned above, 6 articles were obtained, but only 5 were taken. The articles are taken that have clear objectives, methodology and results.

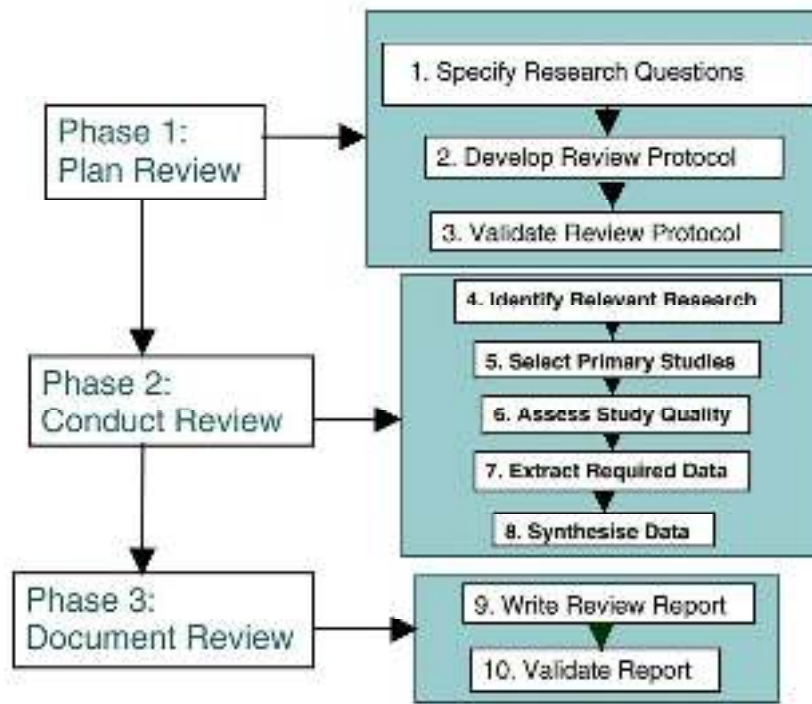


Figure 1. Literature Review Procedures

In addition, the article was rejected because it was written by someone in the same study. The results are presented in Table 1 below.

Table 1. List of articles that fit in the review

No.	Authors	Structure of scientific articles	Same study
1	Rose M. Marra, Jane Howland, Judy Wedman, Laura Diggs (2003)	√	
2	Rose M. Mara, Jane Howland, David H. Jonnasen, John Wedman (2004)	√	
3	Siti Patonah, Sajidan, Cari, Sentot Budi Rahardjo, (2021)	√	
4	Howland, J., & Wedman, J. (2004)	√	
5	C Utama, Sajidan, J. Nurkamto, Wiranto (2019)	√	√
6	C Utama, Sajidan, J. Nurkamto, Wiranto (2020)	√	√

The article in number 6 was deleted because it was already represented by article number 5. The data was extracted very carefully, avoiding overlapping factors in the study of the TLC learning method.



3. RESULTS & DISCUSSION

Learning with TLC Model

The need for effective use of technology in the 21st century makes technology integration an important part of the curriculum, Marra, et al (2014). Then continued by Howland and Wedman (2004) to develop a learning model for faculty development, specifically individual technology learning titled TLC. This model encourages the concordance of learning outcomes, learning activities, and assessment/feedback integrated into technology. (Nicolle, 2005). In this suggestion model is a view on the process. As for the development that involves effective technology: 1. Awareness, awareness of what technology can offer; 2. Opportunity, opportunity to study convergence technology; 3. Time, Time to learn skills; 4. Application, Applying Skills for Learning; 5. Reflection, reflected in training.

Access to all these components and hardware and software provides a foundation for professional development that enables educators to model skills through a teaching and learning tool called the TLC Concept Model. (Sprague, Kopfman, Dorsey, 1998; Wedman & Diggs, 2001). TLC encourages independent self-development that can change over time as new technologies and technology applications emerge. Therefore, TLC is based on the ability of educators to apply technology: the ability to learn and use new technologies and use technology applications (Wedman & Diggs, 2001). TLC has five phases, namely:

1. Awareness, Know the importance of technology through the media, family, students, friends and colleagues. 2. Exploration and filtration, choose the types of technology and techniques or tools that will be used alone or in the classroom. 3. Learning, Development and use of vocational training skills. This stage includes: Engineering studies advanced technology. Pedagogical - preparation, improving learning planning using tools and practices. 4. Application, apply strategies designed with technology for the intended learning outcomes. 5. Sharing and reflection, learn to discuss, criticize, apply it yourself and start the cycle over.

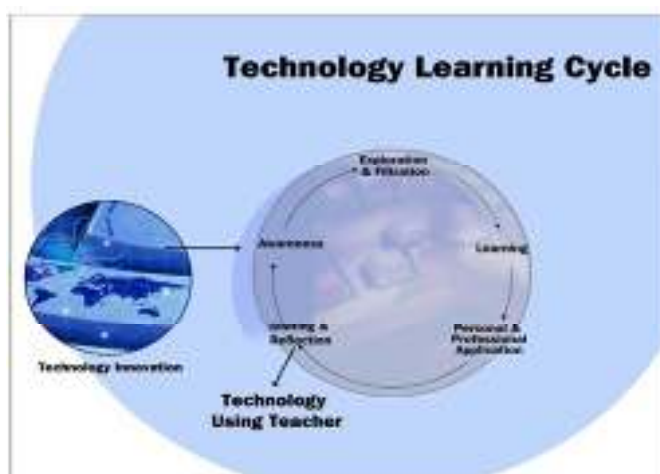


Figure 2. Five phases of the (TLC) Technology Learning Cycle

The results of the validation of the TLC integrated model in learning conducted by Marra, et al (2014) on 11 teachers in the faculty of education showed that 80% of the teachers indicated that web management-based learning was well integrated in their learning. Around 40% of all teachers reported that website creation and maintenance was well integrated with TLC and there was an increase of around 10% of teachers reporting that communication indicators in learning were well integrated. Two-thirds of teachers reported that the use of e-mail for students to connect with their peers, with indicators in the areas of collaboration, and social learning, was well integrated into targeted learning for one year of learning. on the other hand, there was an increase of 15% towards group learning and group problem solving. The biggest increase in technology integration after one year of participation was the use of technology tools to communicate between teachers and students increased from 25%



to 80%. One is used to make the syllabus and other educational information more accessible to students. Students use it to communicate with other students, as well as to obtain assignments and produce various documents for use in field experiences. Other teachers develop specialized applications such as web-based lesson plan formats and web-based literature systems. Students use this application to get feedback on lesson plans and to select literature used in learning (Merra, et al, 2004).

STLC Model in Empowering Critical Thinking Skills

The application of TLC in learning is also carried out by Patonah, et al, (2021) using the TLC model and the inquiry model to produce a Science Technology Learning Cycle (STLC) model. The concept of this model stems from science and inquiry which are an integral part of scientific inquiry (Kazempour, 2018). Student activities start from observing, students ask questions about conjectures or hypotheses, then test these hypotheses, after they are interesting and the final stage is reporting the results. This research process is a systematic and interdependent reflection process. (Thompson, 2017). The expected benefits of science students from scientific learning research are that students are able to think critically, do things systematically, and are factual. However, the activities carried out in the laboratory do not fully guarantee the benefits of these students. (Marchut & Gormally, 2019). Students engaged in research activities have little opportunity to tackle real problems. As a result, the resulting products do not match the problems they face. To deal with these problems, the right solution that can be used is with technology-integrated learning. Students show concepts learned with proper technology or simple technical products. These types of activities are a way to motivate students and engage them in real science and engineering practice (Applebaum, Vitale, Gerard, & Linn, 2017).

Learning that integrates technology with the claim of creating an STLC based on constructivist, meaningful, and discovery-based learning concepts. The term used in the learning syntax refers to the survey component (Wenning 2011) and the TLC by Marra, et al (2004). Model specificity is developed outside and inside the classroom to emphasize teachers' critical thinking skills. The STLC learning model has six different syntaxes, from observing, designing applied technologies, sharing, sharing, writing, and applying (Patonah, et al, 2019). Six cycles are performed sequentially, described as follows.

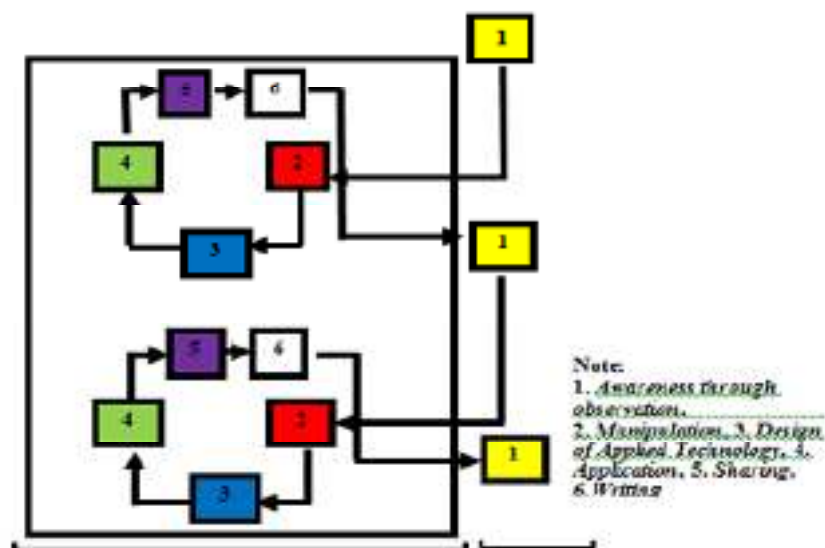


Figure 3. STLC Syntax

STLC syntax starts from observing which aims to manipulate. students have to observe really according to difficult situation. Then design simple technology from basic information and observations. Next, students design simple technology as a product. The process of student activities can be shared through the application or in groups in class. It can be said that the activities carried out in the STLC model prioritize groups to support each



other. Each group provides comments and questions about the product being developed. The STLC model in the last syntax is to write reports. In the end, students can write information reports from the Beginning Steps to the Final Steps. (Patonah, 2018).

This study provides suggestions that the STLC model is able to develop critical thinking skills practically and effectively. Practicality is shown in the activities of teachers and students in the “Good” and “Very Good” categories. The effectiveness of the STLC model on the development of critical thinking skills is evident in the high Ngain category, p-value in each cycle/theme <0.5 , and the responses of students who agree with the STLC model to empower critical thinking skills. Students experience the benefits of learning STLC to create simple skills that help them solve problems around them. This study suggests that the STLC learning model is an alternative learning model that can improve critical thinking skills at various educational levels, especially when preparing future teachers. (Patonah, 2021).

TLC Individualized Technology Learning

Research on the TLC learning model was also conducted by Howland & Wedman (2004) on 98 prospective teachers in the Faculty of Education. The basis of learning development designed in Howland & Wedman's (2004) research is process-oriented learning (Sprague, Kopfman, & Dorsey, 1998). The principle of process-based learning is that an effective skills-related teacher development model should include: (a) Awareness of what technology has to offer, (b) Opportunities to study technology integration, (c) time to learn skills, (d) Applying technology to education, and (e) reflection on teaching. Professional development processes that incorporate these elements are combined with access to technical simulation hardware and software as teaching and learning tools.

The development of the TLC model in the research of Howland & Wedman (2004) We view the ability to learn and use new technologies as a core competency for educators using technology. The TLC model demonstrates the belief that major changes need to be made to teacher education and provides learners with a viable, personalized approach at the level of knowledge of different technologies and their applications. The TCL phase in the research of Howland & Wedman (2004) is explained starting from awareness, at this stage, individuals want to use new technologies and are embracing new innovations. In the exploration and filtering phase, individuals consider and select technologies to explore and explore the capabilities, availability, and usefulness of the various innovations discovered in their consciousness. The learning phase includes mastering technical skills as well as acquiring pedagogical skills that enable effective integration of technology for learning. In the Application phase, people combine educational generation into the coaching methodology, the usage of their newly received understanding to aid coaching and learning. Finally, in the phase of exchange and reflection, people reflect and evaluate the skills integrated into the curriculum. At this stage, students develop their professional technical skills to support the teaching and learning process.

Electronic Learning Cycle on Schoology (ELCoS)

Another application of TLC in learning was carried out by Candra, et al (2019) who developed the concept of a new learning model adopted from the technology-based learning cycle or called TLC which in its application uses LMS Schoology. Schoology as an LMS is electronic learning that supports educational and learning activities using the Internet, extranets, intranets, or other networks as a means of communicating knowledge (Beran, Drefs, Kaba, Al Baz, Al Harbi, 2015). Schoology's electronic learning cycle learning model uses TLC syntax. It begins with recognition, exploration and filtering, learning, personal and professional applications, sharing and reflection.

The application of Schoology starts from the awareness stage where Schoology is an LMS tool. Then in the exploration and filtration stage, Schoology as (a) learning resources such as web, links, URLs, and others; (b) discussion forums and assistance interactions; (c) monitor readiness before class starts. At the learning stage as well as the personal and professional application stage, Schoology as (a) Quiz questions about pre-test and post-test, and other formative assessments; (b) Learning Resources: Content that can be linked to the web, classroom activities and link URLs; (c) Work as a product and work; (d) Group work/product sharing forum; (e) Forums used for asynchronous communication; (f) Master class for expert evaluation; (g) Shorter time / questionnaire for



reflection reporting in 3 minutes. The final stage is exchange and reflection, which schools can apply for. (a) a three-minute questionnaire as a reflection report; (b) Quiz for self-assessment; (c) Assignments for reflection reports; and (d) Forum for sharing medium-term reflection reports (Utama, 2019).

Derived from TLC, the concept of ELCoS has several syntactic steps to more specifically adapt the use of technology by both teachers and students. The difference is that the steps in the ELCoS concept can change their order and start with different syntax depending on the material and the material passing context (Howland & Wedman, 2004). Because e-learning-in-school (ELCoS) constructs are learning cycles, the learning phase can begin in different scenes that adapt to the learning outcomes. (Main, 2019). The results showed This communication may be conducted immediately through the school to discuss or ask questions about topics related to textbooks, exercises, assignments, exams, and self-observation reports. The technology has a positive impact in helping students' self-development towards students and students towards teachers.

4. CONCLUSION

TLC is a model for understanding how individuals apply the use of technology as well as a framework to support the development of learning. TLC takes a more process-oriented perspective, suggesting that an effective technology-related development model must include awareness (perception of what technology can offer), opportunity (opportunity to integrated technology discovery society), time (time to understand technology, application). technology application in teaching) and reflection (reflecting in teaching). TLC has five phases: awareness, exploration and filtration, learning, application, sharing and reflection designed to support educators' use of technology, where educators will have opportunities to use new technologies and use technology applications. The TLC model has been applied in various lessons starting from the learning of Marra et al. (2014), Howland & Wedman (2004), Patonah et al. (2021), and Candra et al. (2019), where all the evolution of this learning model shows the results of research that effectively integrates technology into learning and has a positive impact on student learning outcomes. However, it is necessary to develop this model with a combination of theory and more real applications in learning. By carrying out further research development, it is believed that it can make a significant contribution to the development of technology-based learning models that are more effective and relevant to the educational context in Indonesia, as well as increasing understanding of the importance of technology integration in improving student learning outcomes.

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