# Educational Transformation Through Virtual Learning Environment (VLE) as an Effort to Improve Students' Critical Thinking Competence

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**Abstract:** Industrial revolution 4.0 in the 21st century, many countries have made their country's roadmaps to be able to survive in the midst of dynamic changes. The 21st century is marked by information that can be accessed by anyone, anytime and anywhere, computing or the use of robots, automation or work that can be done routinely and communication that becomes unlimited in every aspect of people's lives. The purpose of this research is to, 1) find out the feasibility of the developed Virtual Learning Environment (VLE) media for use in learning, 2) find out the perceptions of teachers and students towards the developed Virtual Learning Environment (VLE). This research and development (R&D) research adapt the 4-D development model (define, design, develop and desiminate). The results of this research, namely the validity of the learning media developed was obtained from the assessment results with an average percentage of 93% in the 'Very Good' category, the quality of the learning media developed obtains assessment results with an average percentage of 92% in the category "Very Good" and received a positive response from students with a percentage ≥ 90%. Learning uses integrated Android-based VLE media STEM approaches are able to improve 4C competencies and beyond provide a positive response to significant student learning outcomes.

**Keywords:** E-assesment; 4C Competence; Virtual Learning Environment; Web Based Learning

## Introduction

Improving the quality of education in Indonesia can be developed through the implementation of educational reforms. Changes that occur in traditional learning towards learning that further enhances critical thinking is called educational reform (Redhana, 2010; Sugiyarto et al., 2018 and Sumiati et al., 2018). In the world of education, many branches of knowledge must be studied to achieve educational goals. Learning is a teaching and learning process in education and is also said to be a complex process involving several interrelated aspects including psychological, pedagogical and didactic (Surayya et al., 2014; Setiawaty et al., 2018).

On the psychological aspect of learning activities students have different levels of development and various learning processes. As in learning to memorize, how to understand concepts, attitudes and motor skills. Therefore, a teacher does not only have theoretical abilities but also has practical skills so that he can design learning to be better and more interesting, easy for students to understand and fun, (Mahasneh & Alwan, 2018; Malele & Ramaboka, 2020).

Increasing these competencies can be implemented with educational transformation through the use of educational media in learning activities (Anshari et al., 2015; Ester van Laar et al., 2020). One of the learning media that is considered to be a balance point and respond to the dynamics of technological

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development is known as the concept of electronic learning (e-learning). The learning model through e-learning is actually a learning concept that has undergone a transformation from conventional forms into a digital form (Suharyanto & Mailangkay, 2016). This is in accordance with the President's directives (2019-2024) to create superior human resources, where character education (priority to character education and Pancasila practice); Deregulation and de-bureaucratization (elimination of regulations that hinder investment breakthroughs and increases); Increasing investment and innovation (government policies must be conducive to mobilizing the private sector to increase investment in the education sector); Job creation All government activities are oriented towards job creation; Prioritizing new and innovative vocational education and training approaches and technology empowerment (by strengthening technology as an equity tool, both remote areas and big cities get the same opportunities and support for learning) (Imanda et al.,2021; Imanda et al., 2017)

Facing the industrial revolution 4.0 in the 21st century, many countries have made roadmaps for their countries to be able to survive in the midst of dynamic changes. The 21st century is also marked by the abundance of (1) information that is available anywhere and can be accessed at any time; (2) faster computing; (3) automation that replaces routine jobs; and (4) communication that can be done from anywhere and anywhere. Entering the 21st century the use of technology, information and communication transcends borders, so that the state transforms education by adjusting to the times (digitalization). This also has a significant effect on increasing teacher digital competence, (Laar et al., 2020); Daryanto and Karim, 2017); Ministry of Education and Culture Research and Development, 2013; Setiawaty et al., 2022; Pane et al., 2018).

The 21st century is also known as the knowledge age, in this era, all alternative means of fulfilling life's needs in various contexts are more knowledge-based. Efforts to meet the needs of knowledge-based education, knowledge-based economic development, knowledge-based social empowering and development, and knowledge-based industry development (Kijima, dkk. 2021 dan Wang et al., 2022). In the 21st century, education is becoming increasingly important to ensure students have learning and innovation skills, skills in using information technology and media, and can work and survive by using life skills (Chen et al., 2011; Goodsett, 2020; Gu et al., 2022).

Based on the results of observations and interviews conducted at SMK schools in North Aceh District and Lhokseumawe City, it was found that the lack of varied media use in the chemistry learning process resulted in students having difficulty understanding the material. Because of this, teachers should be able to carry out interesting teaching and learning activities by selecting and applying appropriate, effective and varied teaching media in order to facilitate the delivery of chemistry material and to increase student interest and interest in learning. In addition, a monotonous or teacher-centered method without interesting teaching variations will certainly make students bored and bored. Teachers need to develop more creative methods and use learning media to support the delivery of lessons. By developing learning methods using interactive learning media, it will attract students' interest and motivation to learn. Students will be more enthusiastic in participating in learning and the material conveyed through learning media can be absorbed properly.

Learning outcomes obtained optimally are also expected to be supported by one of the factors, namely interest and motivation to learn, because it can provide stimulation in learning for someone. Interest can affect the quality of achievement of student learning outcomes in certain fields of study, while motivation encourages and directs interest in learning to achieve a goal. Based on the description above, the teacher must carry out learning innovations so that student learning outcomes are further improved by implementing Virtual Learning, students can study learning materials independently and are interactive, which are presented in the form of Web Based Learning (WBL) and e-assessment through Learning Management Systems (LMS). From the description above, the researcher is interested in conducting research with the title "Educational Transformation Through a Virtual Learning Environment (VLE) as an Effort to Increase Competence in the 21st Century".

## Method

This research is a type of research and development (R&D) research with the aim of developing VLE media. The resulting product is in the form of a website that functions as a high school learning media. This study adapted the 4-D (*Define, Design, Development,* and *Disseminate)* procedures (Thiagarajan, et al., 1974), and will be implemented in junior high schools in North Aceh Regency and Lhokseumawe City.

The research procedures to be carried out are described: 1) Definition (Define): (a). Front and analysis, (b) learner analysis, (c) task analysis, (d) concept analysis, and (e) specifying instructional objectives; 2) Design: (a) constructing criterion–referenced test, (b) media selection, (c) format selection and (d) initial design; 3) Development: (a) expert appraisal, and (b) developmental testing; 4) Dissemination: (a) validation testing, (b) packaging and (c) diffusion and adoption

(Thiagarajan & Semmel, 1974). The subjects of this research were 10 chemistry teachers and 50 high school/vocational school/equivalent students in the district North Aceh.

## Result and Discussion

### Defining Stage

This defining activity is done to see initial analysis. such as student and school needs, as for the needs of students and adjust to the need's students and school conditions. analysis of student characteristics such as learning style, motivation, and activity.

### Designing Stage

Design is carried out for design before development by planning the outline before developing the product, through constructing criterion–referenced test, media selection, format selection, and initial design.

### Development Stage

Development is a technique for validating and assessing the feasibility of product designs or drafts to see validity and feasibility. This stage focuses on validating and assessing the feasibility of the VLE media product design, validation was carried out by 3 expert lecturers. This stage is testing the VLE media product design to reviewers, namely 3 peer reviewer lecturers to validate VLE media.



**Figure 1.** Diagram of material expert media validation result



**Figure 2.** Diagram of material expert media validation result

While the results of the assessment of the media expert validator I on the linguistic aspect (90%), software engineering (92.5%), and visual and audio display (92%), as well as the score results of the media expert II validation test questionnaire on the linguistic aspect (90 %), software engineering (92.5) and visual and audio display (88%). obtained an overall percentage of 93.4% with a very good category

### Dessemination Stage

This stage includes validation testing, packaging, diffusion and adoption. The product that has been revised at the development stage is then implemented for students to be asked for their responses and a feasibility test by teachers who teach science.
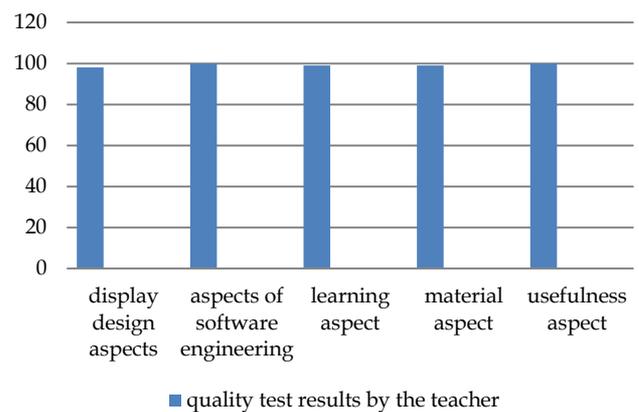


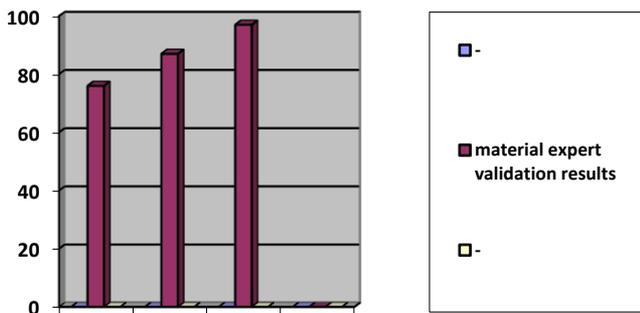**Figure 3.** Diagram quality tesr results by the teacher
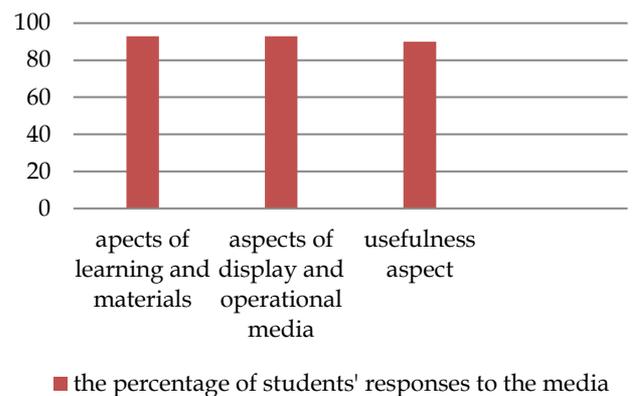


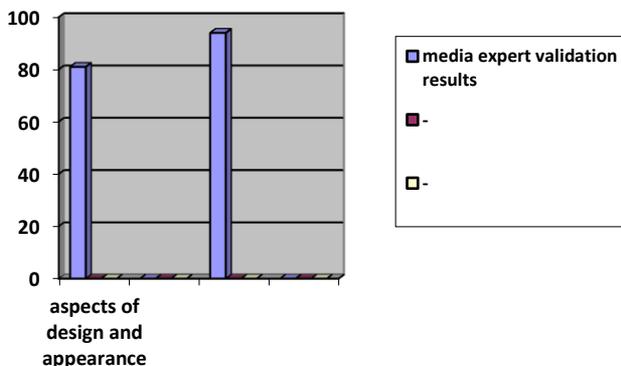**Figure 4.** Diagram of media quality results by students

This trial stage was carried out with the aim of knowing the effectiveness of the media. The learning developed is seen from the increase in students' 4C competencies in turn, has a positive impact on student learning outcomes. Instruments used in the test Try this in the form of test questions that have been validated first. Application of the developed media can improve

student skills so that they can have a significant influence on student learning outcomes with 71% completeness. This is in line with the results of research by Setiawaty et al., 2022; Harvey & Kamvounias, 2008; Imanda et al.,2021 that the application of good and interesting media and the effectiveness of the product can provide positive impact on students' competencies and cognitive learning outcomes.

## Conclusion

Media quality based on the assessment of material experts obtained a percentage of 87%, based on the assessment of media experts obtained a percentage of 88%, assessment teachers get a percentage of 99% in the "very good" category. This category shows that learning media is based on Android on hydrocarbons and petroleum materials can already be used as a learning medium. There is a significant change in students' cognitive ability on hydrocarbon and petroleum materials based on the results of the average value the pretest is 34.5 and the average posttest score is 85.4.

**Author Contributions**
The authors are involved in overall contributing of this article.

**Conflicts of Interest**
The authors declare that there is no conflict of interest regarding the publication of this article.

## References

Anshari, M., Alas, Y., & Guan, L. S. (2015). Pervasive Knowledge, Social Networks, and Cloud Computing: E-learning 2.0. *Eurasia Journal of Mathematics Science and Technology Education*, 11(5), 909–921. https://doi.org/10.12973/eurasia.2015.1360a

Arsyad, A. (2011). *Learning Media.* Jakarta: Raja Grafindo Persada.

Chen, Y.T., Chen, T.J., & Tsai, L.Y. (2011). Development and Evaluation of Multimedia Reciprocal Representation Instructional Materials. *International Journal of Physical Sciences*, 6(6):1431-1439. https://doi.org/10.5897/IJPS11.066

Goodsett, M. (2020). Best practices for teaching and assessing critical thinking in information online learning objects. *The Journal of Academic Librarianship*, 46(5). https://doi.org/10.1016/j.acalib.2020.102163

Gu, C., Jiangjie, C., Jiacheng, L., Shuyuan, L., Weilong, W., Qianling, J., Chun, Y., & Wei, W. (2022). The impact of eye-tracking games asa training case on students' learning interest and continuous learning intention in game design courses: Taking Flappy Bird as an example. *Learning & Motivation,* 78. https://doi.org/10.1016/j.lmot.2022.101808.

Harvey, A., & Kamvounias, P. (2008). Bridging the implementation gap: a teacher-as-learner approach to teaching and learning policy. *Higher Education Research and Development,* 27(1), 31–41. https://doi.org/10.1080/07294360701658716.

Kijima, R., Mariko, Y. Y. & Marcos, S. M. (2021). Using design thinking to cultivate the nextgeneration of female STEAM thinkers. International Journal of STEM Education, 8(1), 1-15. DOI: 10.1186/s40594-021-00271-6

Ester van Laar, E. V., Alexander J. A. M. van Deursen., Jan A. G. M. van Dijk & Jos de Haan. (2020). Determinants of 21st-Century Skills and 21st-Century Digital Skills for Workers: A Systematic Literature Review. *journals.sagepub.com*, 1 –14. https://doi.org/10.1177/2158244019900176.

Imanda, R., Alvina, S., Setiawaty, S., Hartati, R., 2021. Penggunaan Handout Terhadap Hasil Belajar Siswa Pada Konsep Kelarutan dan Hasil Kali Kelarutan di SMA 6 Banda Aceh. *KATALIS: Jurnal Penelitian Kimia dan Pendidikan Kimia* 4 (1), 9-13. https://doi.org/10.33059/katalis.v4i1.3138

Imanda, R., Khaldun, I., & Azhar. (2017). Pengembangan Modul Pembelajaran Kimia SMA Kelas XI Pada Materi Konsep dan Reaksi-Reaksi dalam Larutan Asam Basa. *Jurnal Pendidikan Sains Indonesia*, 5(2):42-49. https://doi.org/10.24815/jpsi.v5i2.9816

Mahasneh, A., & Alwan, A. (2018). The Effect of Project Based Learning on Student Teacher Self Efficacy and Achievement. *International Journal of Instruction*, 11 (3): 511-524. Retrieved from https://eric.ed.gov/?id=EJ1183424

Malele, V., & Ramaboka, M. (2020). The Design Thinking

Approach to Students STEAM projects. *Procedia CIRP*. 91: 230-236. https://doi.org/10.1016/j.procir.2020.03.100

Pane, N., Syahputra, E., & Mulyono. (2018). Improving the ability of creative thinking mathematically and self-confidence student through Application Model Eliciting Activities (MEAs) Review from Student Gender. *American Journal of Educational Research*, 6(4), 319-323.

Redhana, I W. (2010). Pengaruh Model Pembelajaran Berbasis Peta Argumen Terhadap Keterampilan Berpikir Kritis Siswa pada Topik Laju Reaksi. *Jurnal Pendidikan dan Pengajaran*, 43 (17): 141-148. https://doi.org/10.23887/jppundiksha.v43i2.1721

Setiawaty, S., Nuraini, F., Ayu, R., Ratna, U., Izkar, H., Iryana, M., & Ratih, P. S., (2018). Science, Technology, Engineering, and Mathematics (STEM) Learning on Student's Science Process Skills and Science Attitudes. Proceedings of MICoMS 2017. *Emerald Publishing Limited*, 1 (1): pp. 575-581. https://doi.org/10.1108/978-1-78756-793-1-00036

Setiawaty, S., Lukman, I.R., Imanda, R., Sari, R.P., and Mursyida. (2022). Development of Chemistry Puzzles Book for High Scholl Student. *AIP Conference Proceedings*, 2468 (1). https://doi.org/10.1063/5.0102468

Setiawaty, S., Imanda, R., Lukman, I.R., and Pasaribu, Al. 2022. Development of STEM Learning based Android to Improving Students' Logical Thinking Skills. *Jurnal Penelitian Pendidikan IPA*, 8 (6), 2933-2936. DOI: https://doi.org/10.29303/jppipa.v8i6.2179.

Sugiyarto, K. H., J. Ikhsan, & I. R. Lukman. (2018). The use of an android–based-game in the team assisted individualization to improve students' creativity and cognitive achievement in chemistry.ICoSMEE, Journal of Physics: ConferenceSeries, 1022(1). https://doi.org/10.1088/1742-6596/1022/1/012037

Sumiati, E., Damar, S., F, Faizah. (2018). Pengembangan Modul Fisika Berbasis Scientific Approach untuk Meningkatkan Keterampilan Proses Sains Siswa. *Jurnal Pendidikan Fisika dan keilmuwan (JPFK)*. 4(2): 75-88. Retrieved from http://ejournal.unipma.ac.id/index.php/JPFK/article/view/2535.

Suharyanto, & Mailangkay, A. B. L. (2016). Penerapan E-Learning Sebagai Alat Bantu Mengajar Dalam Dunia Pendidikan. *Jurnal Ilmiah Widya*, 3: 17– 21.

Surayya, L., Subagia, I. W., & Tika, I. N. (2014). Pengaruh Model Pembelajaran Think Pair Share terhadap Hasil Belajar IPA Ditinjau dari Keterampilan Berpikir Kritis Siswa. *e-Journal Program Pascarjana Universitas Pendidikan Ganesha*, 4 (1): 1-11. Retrieved from https://ejournal-pasca.undiksha.ac.id/index.php/jurnal_ipa/article/view/1105

Thiagarajan, Sammel, D. S., & Semmel, M. I. (1974). *Instructional Development for Training Teacher of Exceptional Children.* Bloomington: Indiana University.

Wang, L. H., Bing, C., Gwo-Jen, H., Jue-Qi, G., & Yun-Qing, W. (2022). Efects ofdigital game-based STEMeducation onstudents' learning achievement: ameta-analysis. International Journal of STEM Education, 9(26): 1-13. https://doi.org/10.1186/s40594-022-00344-0