

## Investigating Students' Creativity in Teaching Mechanics Concept with Learning Management System

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### Abstract

*Learning management systems (LMS) has been widely recognized as an effective platform for modern learning. LMS allows teachers to manage and monitor student activities. This article discusses the use of LMS in teaching mechanics and its effect on student creativity. This research includes development research with three stages, namely preliminary studies, design development, and model testing. The model testing stage used a quasi-experimental method with one group post-test design. The sample of this study were 21 students in a university in Mataram, Indonesia. The measured creativity includes verbal creativity, figural creativity, numerical creativity, and procedural creativity. The results showed that there were differences in students' creativity scores in each aspect. The creativity test consists of 10 essay questions that are spread on each aspect. The results showed that there were differences in students' creativity scores in each aspect. The highest average creativity score is in the verbal aspect, then followed by figural and numerical creativity. The lowest creativity score is on procedural aspects. Based on students' responses, the LMS was able to meet their learning needs because it contains learning resources, learning media, worksheets, and practice questions.*

**Keywords:** Learning management system, online learning, creativity, mechanics.

### 1. Introduction

The development of technology in this era is very important in all aspects of life. Technological developments that continue to lead to wider access to information. At present, retrieving and transferring information can be easily done anytime and anywhere through the internet network. Various technologies have been created at this time to help humans to solve problems in everyday life. The world of education is currently undergoing a massive transition as a result of the digital revolution [1]. Technology can be used to improve the quality of education in both its processes and products. Changes in technology in the field of education not only in the concept but also in the context of education itself [2].

The use of technology in education can motivate students to be superior and more advanced in learning. Technology can also be used as a means of communication, learning, media, data processing and so on [3]. Along with the times, learning technology has developed very rapidly. Technology can assist students in obtaining information without limits [4]. In the implementation of the learning process, we can know by the use of technological developments in the world of education, as is done by teachers by combining technological tools in the learning process.

One effective technology for learning today is Learning Management System (LMS). LMS is commonly used in schools or colleges to facilitate learning. LMS can provide learning content and information media to facilitate interaction between

lecturers and students. Many students revealed that accessing various sources through LMS on blended learning was very useful in understanding the material [5].

Changes in technology in the field of education are driven by human creativity, and in turn, provide creative and innovative new results. A relationship between creativity and technology will create better educational outcomes [6]. Creativity is very important for the success of the 21st century. Creativity plays an important role in gaining global competition, where creativity is knowledge from the human brain, which can change things to be more valuable and offer competitive advantages [7]. The creativity possessed by a person can provide good handling of problem situations and analyze them appropriately [2]. Education needs to facilitate students to develop the creativity that covers various disciplines and use technological tools for creative solutions and outcomes [6].

The learning process needs to develop learning experiences through approach and innovation. In learning mechanics requires a more detailed and broad understanding and explanation. Mechanics learning must also specifically be directed at developing students' soft skills through active learning, whether physical, mental-intellectual, or social, to understand the concepts of Mechanics and implement them creatively in their lives [9]. This certainly requires practice and development of creativity in learning mechanics. Based on the description above, the purpose of this study is to determine student creativity in learning mechanics using learning management systems.

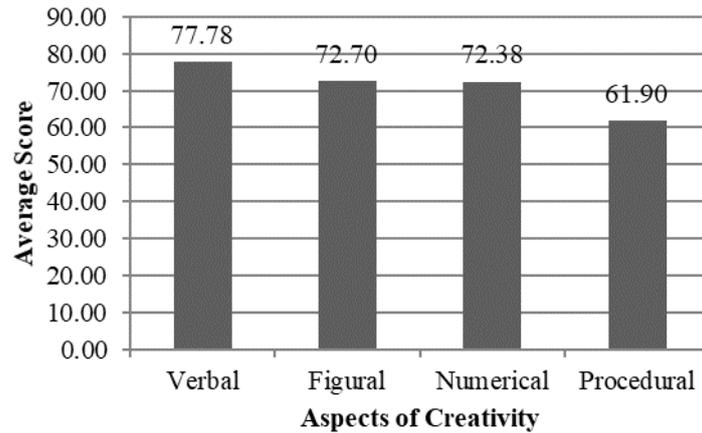
## 2. Method

This research includes development research with three stages, namely preliminary studies, design development, and model testing. The LMS learning tool developed has gone through a series of expert validation tests. On model testing stage, the quasi-experimental method is used with one group post-test design. The sample of this study were 21 students at one of the tertiary institutions in the city of Mataram, Indonesia. The measured creativity includes verbal creativity, physical creativity, numerical creativity, and procedural creativity. 10 essay-shaped creativity test questions are spread evenly on each aspect. Student creativity data on each aspect was obtained from the average results of post-test scores on each aspect of creativity.

## 3. Results and Discussion

Creativity is the ability to discover new things by using ideas that are unusual but still rational. Creativity can help in doing things better. For this reason, everyone needs to be creative. In his perspective, creativity can be developed through learning and the results reflect something new and valuable [9]. Creativity is oriented towards the reality which involves knowledge and skills, that is, functional creativity, which can be trained [10]. Characteristics of people who have creativity are people who can form appropriate judgments in pouring facts into ideas and then filtering and elaborating ideas [11]. According to Kaufman & Sternberg [12], creative ideas must represent something different, new, or innovative, of high quality, and must be following the tasks that have been defined. Thus, the creative response will be something new, good, and relevant.

In this study, LMS is used to investigate student creativity in learning mechanics. Learning using LMS is effectively used in developing student creativity. Next in Figure 1 is the average score of creativity in each aspect.



**Figure 1. Average Score of Creativity in Each Aspect**

Based on Figure 1, there are differences in student creativity scores in each aspect. The highest average creativity score is in the verbal aspect. Then followed by figural and numerical creativity. The lowest creativity score is on procedural aspects. In general, these results indicate that LMS can develop student creativity in the learning process of mechanics. LMS which is used as e-learning is one approach that can increase student creativity in learning [13]. Online learning with LMS is significantly able to increase teacher creativity to design creative learning as well.

LMS is used to make it easier to provide feedback on tasks, support active user involvement and offer easier communication [14]. In the learning process, LMS is used as an e-learning tool to facilitate students in learning. E-learning mechanics contains mechanics teaching material, namely the sub-subject of Newton's Law Language about Motion, Work and Energy, and Simple Harmonic Motion. E-learning is equipped with virtual media such as video and virtual laboratories. The media is used to foster student creativity. The average score of verbal creativity is highest compared to other creativity because in the learning process the use of LMS in the blended learning model facilitates students to submit ideas verbally and discuss topics being studied. Besides, the chat feature on e-learning provided is used by students to exchange information and discuss it with other lecturers or students. This is certainly very supportive of the development of the students' verbal creativity.

The average score of students' figural creativity is also quite good, which is 72.70. Learning mechanics with LMS supports the development of figural creativity. Many mechanical materials are visualized in the form of images, such as drawing graphics and the forces acting on the motion system. This is what supports the development of students' figural creativity. The LMS presents virtual laboratories and learning videos that facilitate students to learn. The images and animations presented can increase student activity so that students become accustomed to drawing patterns. This also causes students' figural creativity to develop properly. Gunawan et al., [15] also mentioned that the use of virtual laboratories can increase student creativity in both male and female students. Verbal, figural and numerical creativity can be increased with the support of virtual laboratories as a learning media. Gunawan et al., [16] also revealed that in addition to increasing creativity, virtual laboratories were also able to improve science process skills, especially in skills hypothesizing, practicing, and communicating.

Some concepts of mechanics are also studied in the form of exercises of mathematical problems and their solution through several procedures, so as to support student numerical creativity. Mahmudi & Sumarmo [17] revealed that learning that is oriented towards mathematical structured and logical thinking such

as problem-based mathematical habits of mind strategies influences the achievement of mathematical creativity. Procedural creativity has the lowest average score this is because students are not familiar with the form of the assessment instrument. In the learning process, the development of procedural creativity is only in some learning syntax. The development of procedural creativity is when students complete worksheets and conduct virtual experiments. The same research conducted by Gunawan et al [18] the use of Moodle LMS can improve the creativity of students in second semester, fourth semester, and sixth semester on verbal, figural, numerical and procedural aspects. Numerical and procedural creativity increases with semester level increases. Whereas verbal and figural creativity experienced an insignificant increase.

Student responses related to LMS learning as a whole can meet the needs of students in learning because the LMS is equipped with learning resources, worksheets and practice questions. Some students also think that they have not been accustomed to evaluating patterns and models of creativity, especially when they are asked to pour out their ideas in making new equations based on existing equations and making new problem-solving procedures. This shows the magnitude of the factors of practice, habits, and learning environment to develop students' creativity. According to Byrge & Tang [19] creativity can be developed through a training process. Creativity training will be able to increase creative self-efficacy as well as in creative production.

The development of creativity can be done by utilizing the development of information and communication technology, including its use in learning physics. LMS with Moodle can improve the quality of learning that is oriented to creativity [18]. E-learning mechanics acts as a bridge between teachers and students. The teacher will manage the LMS system by filling in the learning material, so students can easily access the material, learning media and even practice questions anywhere and anytime. LMS can manage features in the learning process in the form of classes, material or content, attendance, discussion forums to assessments [20]. In addition to increasing creativity, LMS has also been proven to be able to improve other learning outcomes. The use of LMS with Moodle enhances students' critical thinking skills [21] and understanding the concept of waves [22].

Research on creativity in other fields shows the same trend of results. Verbal and figural creativity have a positive correlation. The relationship depends on the treatment and assessment instruments used to measure creativity [23]. The use of virtual media can also increase students' higher ability to think divergently to combine ideas verbally compared to associating ideas through forms or images [24]. Research in secondary schools about creativity shows that figural creativity is higher than verbal creativity. Students prefer to learn by drawing sketches or graphs rather than verbal delivery [25]. In contrast to the results of the study Gunawan et al [26] found that learning with computer simulation can improve procedural creativity very well. The verbal and figural creativity of students has increased but not significant enough. Several other studies on the use of computer systems show a positive impact on some learning outcomes. Learning with interactive multimedia can improve students' ability to think critically [27], problem-solving abilities [28] and conceptual understanding [29].

## 4. Conclusion

The use of LMS in learning mechanics can support student creativity in aspects of verbal, figural, numerical and procedural creativity. Verbal creativity get the highest score compared to other creativity. While the procedural creativity test has the lowest average score. Figural creativity scores were higher than numerical creativity. E-learning mechanics can facilitate students in learning well. Students can easily access information from teaching materials and learning videos. E-learning is also equipped with a virtual laboratory, worksheets, and questions that can be used as exercises. Overall students gave a positive response to the learning because it indirectly created a creative and innovative learning environment. Recommendations that can be given for further research are the use of offline and online stages in learning must be adjusted to the material needs and variables to be measured.

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## References

- [1] Collins, A., & Halverson, R. *“Rethinking education in the age of technology: The digital revolution and schooling in America.”* Teachers College Press, (2018).
- [2] Gunawan, G., Harjono, A., Sahidu, H., Taufik, M., & Herayanti, L, “Project-based learning on media Development Course to Improve Creativity of Prospective Physics Teacher,” In AIP Conference Proceedings., vol 2194, (2019), pp. 020032.
- [3] Finkelstein, N. D., Adams, W. K., Keller, C. J., Kohl, P. B., Perkins, K. K., Podolefsky, N. S., ... & LeMaster, R, “When Learning about The Real World is Better Done Virtually: A Study of Substituting Computer Simulations for Laboratory Equipment”, *Physical review special topics-physics education research.*, vol. 1, (2015), pp. 010103.
- [4] Gunawan, G., Harjono, A., Sahidu, H., Herayanti, L., Suranti, N. M. Y., & Yahya, F, “Using Virtual Laboratory to Improve Pre-service Physics Teachers’ Creativity and Problem-Solving Skills on Thermodynamics Concept”, In *Journal of Physics: Conference Series.*, vol. 1280, (2019), pp. 052038.
- [5] Pektas, S. T., & Gurel, M. O, “Blended Learning in Design Education: An Analysis ff Students' Experiences within The Disciplinary Differences Framework,” *Australasian Journal of Educational Technology.*, vol 30, no.1, (2019), pp. 31-44..
- [6] Henriksen, D., Mishra, P., & Fisser, P, “Infusing Creativity and Technology in 21st Century Education: A Systemic View for Change,” *Educational Technology & Society.*, vol. 19, no. 3, (2016), pp. 27-37.
- [7] Wu, H. Y., Wu, H. S., Chen, I. S., & Chen, H. C, “Exploring the Critical Influential Factors of Creativity for College Students: A Multiple Criteria Decision-Making Approach,” *Thinking Skills and Creativity.*, vol. 11, (2014), pp. 1-21.
- [8] Rosana, D., Jumadi, J., & Pujianto, P, “Pengembangan Soft Skills Mahasiswa Program Kelas Internasional Melalui Pembelajaran Berbasis Konteks Untuk Meningkatkan Kualitas Proses dan Hasil Belajar Mekanika,” *Jurnal Pendidikan IPA Indonesia.*, vol. 3, no.1, (2014), pp 12-21.
- [9] Wyse, D., & Ferrari, A, “Creativity and Education: Comparing The National Curricula of The States of The European Union and The United Kingdom”. *British Educational Research Journal.*, vol. 41, no.1, (2015), pp. 30-47.
- [10] Cropley, D., & Cropley, A, “Functional Creativity,” *Camb. Handb. Creat*, (2010), pp. 301-318.
- [11] Rawat, K. J., Qazi, W., & Hamid, S, “Creativity and Education,” *Academic Research International.*, vol. 2, no. 2, (2012), pp. 264-275.
- [12] Kaufman, J. C., & Sternberg, R. J. (Eds.), *“The Cambridge Handbook of Creativity”*, Cambridge University Press, (2010).
- [13] Yeh, Y. C., & Lin, C. F, “Aptitude-Treatment Interactions During Creativity Training in E-Learning: How Meaning-Making, Self-Regulation, and Knowledge Management Influence Creativity,” *Journal of Educational Technology & Society.*, vol 18, no. 1, (2015), pp. 119-131.
- [14] Rubin, B., Fernandes, R., Avgerinou, M. D., & Moore, J, “The Effect of Learning Management Systems on Student and Faculty Outcomes,” *The Internet and Higher Education.*, vol. 13, no. 1, (2010), pp. 82-83.

- [15] Gunawan, G., Suranti, N. M. Y., Nisrina, N., Herayanti, L., & Rahmatiah, R, "The Effect of Virtual Lab and Gender Toward Students' Creativity of Physics in Senior High School." In *Journal of Physics: Conference Series.*, vol.1108, (2018), pp. 012043.
- [16] Gunawan, G., Harjono, A., Hermansyah, H., & Herayanti, L, "Guided Inquiry Model Through Virtual Laboratory to Enhance Students' Science Process Skills on Heat Concept," *Jurnal Cakrawala Pendidikan.*, vol. 38, no. 2, (2019), pp. 259-268.
- [17] Mahmudi, A., & Sumarmo, U, "Pengaruh Strategi Mathematical Habits Of Mind (MHM) Berbasis Masalah terhadap Kreativitas Siswa," *Jurnal Cakrawala Pendidikan.*, vol. 30, no. 2, (2011), pp. 216-229.
- [18] Gunawan, G., Sahidu, H., Susilawati, S., Harjono, A., & Herayanti, L, "Learning Management System with Moodle to Enhance Creativity of Candidate Physics Teacher," In *Journal of Physics: Conference Series.*, vol. 1417, (2019), pp. 012078.
- [19] Byrge, C., & Tang, C, "Embodied Creativity Training: Effects on Creative Self-Efficacy and Creative Production," *Thinking Skills and Creativity*, vol. 16, (2015), pp. 51-61.
- [20] Sahidu, H., Gunawan, G., Herayanti, L., Indriaturrahmi, I, Astutik, F., & Bon, A. T, "The Development of E-Assessment with Learning Management System," *Proceedings of the International Conference on Industrial Engineering and Operations Management Pilsen, Czech Republic*, (2019).
- [21] Herayanti, L., Gummah, S., Sukroyanti, B. A., Gunawan, G., & Makhrus, M, "Pengembangan Perangkat Pembelajaran Berbasis Masalah Menggunakan Media Moodle Untuk Meningkatkan Keterampilan Berpikir Kritis Mahasiswa Pada Materi Gelombang," *Jurnal Pendidikan Fisika dan Teknologi.*, vol. 4, no. 2, (2018), pp. 158-167.
- [22] Herayanti, L., Gummah, S., Sukroyanti, B. A., Ahzan, S., & Gunawan, G, "Developing Moodle in Problem-Based Learning to Improve Student Comprehension on the Concepts of Wave," *Advances in Intelligent Systems Research (AISR).*, vol. 157, (2018), pp. 158-167.
- [23] Wechsler, S, "Validity of The Torrance Tests of Creative Thinking to The Brazilian Culture," *Creativity Research Journal.*, vol. 18, no. 1, (2006), pp. 15-25.
- [24] Gunawan, G., Sahidu, H., Harjono, A., & Suranti, N. M. Y, "The Effect Of Project Based Learning With Virtual Media Assistance on Student's Creativity In Physics,". *Cakrawala Pendidikan.*, vol. 36, no. 2, (2017), pp. 167-179.
- [25] Dău-Gaşpar, O., & Marinca, A, "Verbal and Figural Creativity in Contemporary Secondary-School Students," *Theoretical and Applied in Psychology SICAP23.*, vol. 45, (2016).
- [26] Gunawan G, Harjono A, Susilawati and Dewi, S. M, "Generative Learning Models Assisted by Virtual Laboratories to Improve Students' Creativity in Physics," *Journal of Advance Research in Dynamical & Control Systems.*, vol. 11, (2019), pp. 403-411.
- [27] Gunawan, G., Harjono, A., Herayanti, L., & Husein, S, "Problem-Based Learning Approach with Supported Interactive Multimedia in Physics Course: Its Effects on Critical Thinking Disposition," *Journal for the Education of Gifted Young Scientists.*, vol. 7, no. 4, (2019), pp. 1075-1089.
- [28] Gunawan, G., Suranti, N. M. Y., Nisrina, N., & Herayanti, L, "Students' Problem-Solving Skill in Physics Teaching with Virtual Labs," *International Journal of Pedagogy and Teacher Education.*, vol. 2, (2018), pp. 10-87.
- [29] Harjono,A., Gunawan, G., Adawiyah, R., & Herayanti, L, "An Interactive e-Book for Physics to Improve Students' Conceptual Mastery," *International Journal of Emerging Technologies in Learning.*, vol. 15, no. 5, (2020), pp. 40-49.