Innovative Journal of Curriculum and Educational Technology
10 (1) (2021) : 123–131

https://journal.unnes.ac.id/sju/index.php/ujet/article/view/

The Effectiveness of Multimedia Assisted Project-Based Learning and Self-Regulation on Learning Outcomes of Light Vehicle Engineering Skills

RR. Rina Probowati[1]✉, Samsudi Samsudi[2], Farid Ahmadi[2]

[1] Light Vehicle Engineering Skills, Public Vocational School 3 Semarang, Indonesia
[2] Pascasarjana, Universitas Negeri Semarang, Indonesia

Article Info

History Articles
Received:
June 2020
Accepted:
July 2021
Published:
November 2021

Keywords:
project-based learning, multimedia, self-regulation

Abstract

Project-based learning is used as a reference for developing the ability to create and update because it is seen as having characteristics that effectively direct students to investigate essential ideas and questions, framed through the discovery process, able to accommodate the different needs and interests of students, directing freedom in making products or services and presentations that exceed what the teacher hopes, requires the ability to think creatively, critical thinking, the ability of information to find and write conclusions and present material, and relate to real and authentic problems and the latest issues. Multimedia is a medium for delivering information that contains complete material because it presents the material in writing and is equipped with videos and evaluation tools. The next difference is self-regulation as the variable studied in addition to learning outcomes. The results showed that project-based learning improved student learning outcomes, as evidenced by the Wilcoxon test results with a significance value = < 0.05. Learning outcomes shown from knowledge tests and performance tests are influenced not only by the students' ability to practice based on the theory being learned but also by their ability to self-regulate (self-regulation). The correlation between self-regulation and knowledge learning outcomes is 0.465, and the correlation between self-regulation and practical learning outcomes is 0.890, with the significance of each test of 0.000 < 0.05. It shows that the learning outcomes of cooling system knowledge and practices are influenced by self-regulation. Project-based learning tools assisted with multimedia are effective as a learning model for class XI students of light vehicle engineering at Public Vocational High Schools in Semarang City are classified as valid. Multimedia-assisted project-based learning is effective as a learning model for class XI students of light vehicle engineering at Public Vocational High Schools in Semarang City. This multimedia-assisted project-based learning can improve learning outcomes, achieve completeness and be better than project-based learning. Self-regulation affects class XI students' learning outcomes of light vehicle engineering at Public Vocational High Schools in Semarang City.

✉ Correspondence address:
Pascasarjana, Universitas Negeri Semarang, Indonesia
Jalan Kelud Utara III Semarang, Jawa Tengah Indonesia
E-mail: semangat201454@gmail.com

p-ISSN 2252-6404
e-ISSN 2502-4515

INTRODUCTION

The Facing globalization in the 21st-century education should prepare students so that they can collaborate, solve problems, think critically, and think creatively (Mukminan, 2014; Afandi, 2016). Responding to these challenges, according to Trilling and Fadel (2009) in Afandi et al. (2016), learning should undergo a paradigm shift into student-centered learning, applied skills, from material-based to project-based, collaborative, and learning for life.

Project-based learning is used as a reference for developing the ability to create and update because it is seen as having characteristics that effectively direct students to investigate important ideas and questions, framed through a process of discovery, able to accommodate the different needs and interests of students (NYC Department of Education, 2009).

This paradigm shift and the use of project-based learning are very relevant to vocational high school learning, with the ability to renew and create being the main elements. Cooling system maintenance is part of the basic engine maintenance competencies that must be mastered. But the fact is that there are still many students when faced with real problems in light vehicle engines experiencing errors in carrying out the procedure.

There are indications that there is a lack of application of project-based learning because so far, learning has been dominated by teachers through direct learning. Less considering the use of appropriate media. As a result, the memory obtained is instantaneous. Therefore it is necessary to carry out multimedia-assisted project-based learning.

Through project-based learning assisted with multimedia, it can be predicted that multimedia will have a more active influence on the cooling system maintenance ability of class XI students of Public Vocational High Schools in Semarang City.

The cooling system's learning result is a cognitive and practical ability in the basic competence of checking the cooling system in class XI students of light vehicle engineering needs to be improved. Thus, multimedia-assisted project-based learning is predicted to affect self-regulation, and subsequently, self-regulation will affect learning outcomes.

Various previous researchers, namely Rios (2010), Movahedzadeh (2012), Tamim (2013), Du and Han (2016), Thivivesa (2014), Doppelt (2003), Lasauskiene (2015), Borhan and Ismail (2011), conducted research on project-based learning that has a positive impact on learning outcomes. Research conducted by the author has the same method use, but different in the media's help. This study combines the use of project-based learning methods and the use of multimedia.

The next difference is self-regulation as the variable studied in addition to learning outcomes. Self-regulation refers to the process by which students systematically direct their thoughts, feelings, and actions towards achieving their goals (Zimmerman and Schunk, 2001).

This study analyzes the validity of multimedia-assisted project-based learning designs in class XI students of light vehicle engineering at Public Vocational High Schools in Semarang City. Analyzing the effectiveness of multimedia-assisted project-based learning in class XI students of light vehicle engineering at Public Vocational High Schools in Semarang City.

METHODS

This study used a quasi-experimental research design using Pre-test and Post-test, Non-Equivalent Control Group Design. Before the multimedia-assisted project-based learning was carried out in the experimental group (XE) and project-based learning (X_K), initial data collection was carried out on the cooling system maintenance capability (Y_1), and after the study, the final data was collected for the cooling system maintenance capability (Y_2). This study population was students of class XI competency in light vehicle engineering skills at Public Vocational High Schools in Semarang City,

including Public Vocational High Schools 1 Semarang, Public Vocational High Schools 3 Semarang, Public Vocational High Schools 4 Semarang, and Public Vocational High Schools 5 Semarang as many as 361 students. Samples were taken by random cluster sampling from each school, taken by two classes as the experimental and control groups.

The variables studied were the learning outcomes of basic competency in cooling system examination and self-regulation as the dependent variable. In contrast, the implementation of multimedia-assisted project-based learning was the independent variableThe learning outcomes of the cooling system examination in question are the results achieved by students after participating in project-based learning, which is seen from two aspects: learning outcomes from knowledge and skills. Data collection methods include knowledge testing techniques, performance tests, questionnaires, observations, interviews, and documentation. Data were analyzed descriptively, t-test and regression analysis.

RESULTS AND DISCUSSION

The Validity of Project-Based Multimedia Assisted Learning Design

The design stage is the stage of conducting learning preparation, which consists of preparing learning tools and testing their validation. Some things designed as learning preparation are syllabus, lesson plan, job sheet, multimedia learning, test instruments, and multimedia-assisted project-based learning stages.

Sinta et al. (2013) stated that the learning device was validated and revised according to the validator's input, then the device was tested in the trial group.

The validation of the validator's syllabus validation obtained an average value of 4.5 in the very good category. The average result of lesson plan validation is 4.37, which is included in the very good category. The average result of the validator's assessment on the job sheet is 4.29 in the very good category. The average validation result of learning multimedia by the validator is 4.38, which is included in the very good category.

The Effectiveness of Multimedia Assisted Project-Based Learning

According to Tiurma and Retnawati (2014) in Buchori (2016) states that the results of the effectiveness test of Learning using Multimedia (PMM) are more significant than Learning without using Multimedia (PTMM).

Multimedia Assisted Project Based Learning is carried out in steps: (1) Determining the basic question (essential question), (2) Compiling project planning (designing project plan), (3) Compiling a schedule (creating schedule), (4) Monitoring, (5) Test the results (assess the outcome), (6) Evaluate the experiment.

The validator's assessment of Multimedia Assisted Project-Based Learning steps is 4.33 in the very valid category.

This research is in line with that conducted by Wahyuni and Djukri (2016), which states that the development product of computer-assisted biology learning media developed is suitable for use in the learning process. Other research by Hasjiandito and Djuniadi (2014) shows that project-based blended learning is valid, practical, and effective in learning. Chasanah, Rohman, and Zubaidah (2019) state that the PjBL-based biodiversity module is feasible and practical to use for learning. Raibowo, Adi, and Hariadi (2020), in their research, concluded that interactive multimedia-based teaching materials were effective and efficient in learning.

The initial ability of the students' cooling system before learning was still below the KKM (<70), with an average of 56.8 in the group planned for learning using the PjBL method (experiment) and 55.8 in the conventional group (control). The skills assessment results in the experimental group were 82.28, and the control group was 73.74. From the data, it can be seen that students' skills in implementing cooling

system practices in the experimental group are more than in the control group.

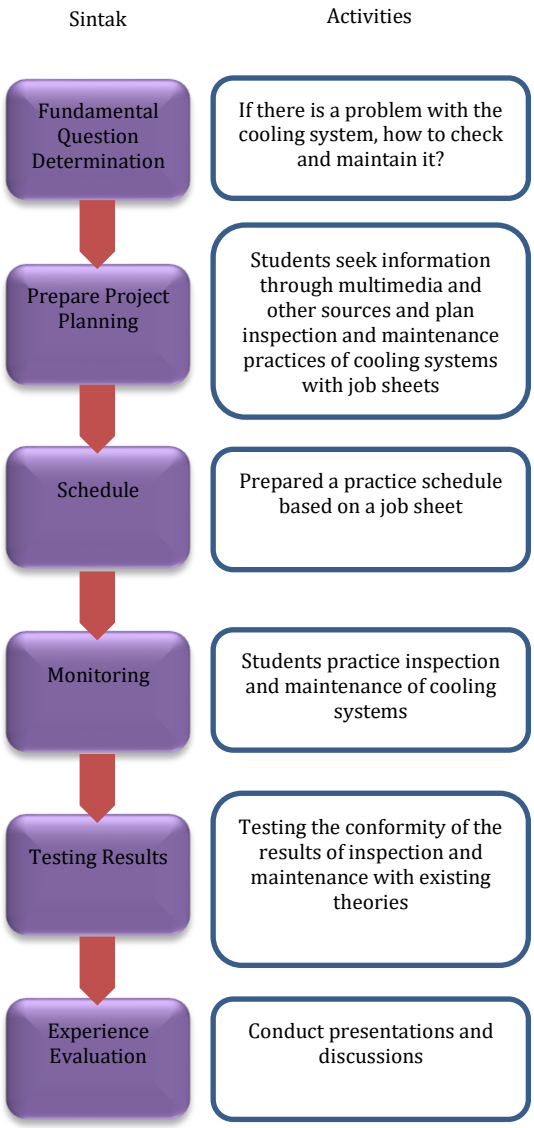

Figure 1. Learning steps

The average result of the assessment of knowledge about the cooling system in the experimental group was 81.50, while the control group was 74.90. From the data, it can be seen that the students' knowledge of the cooling system in the experimental group is more than the control group. Student self-regulation in the experimental group was 80, and the control group was 72.4. These data indicate that self-regulation of PjBL learning with multimedia is more than the control group.

Hypothesis I, which states that there is an increase in learning outcomes in multimedia-assisted project-based learning in class XI students of light vehicle engineering at Public Vocational High Schools in Semarang City, can be seen from the results of the Wilcoxon test, which shows that all students get post-test scores more than pretest scores, with a Z value = -9.98 with a sign value = 0.000 < 0.05, which means that hypothesis I is accepted. Thus, learning outcomes in multimedia-assisted project-based learning positively impact improving learning outcomes for cooling systems.

Hypothesis II states that learning outcomes in multimedia-assisted project-based learning in class XI students of light vehicle engineering in Semarang City achieve minimum completeness tested using Wilcoxon by comparing post-tests with KKM = 70. The test results showed that out of 132 students, 120 students whose post-test results exceeded the KKM = 70, as many as six students with post-test results equal to the KKM = 70, and there were still six students whose post-test results were still below the KKM. The Wilcoxon test results obtained a Z value = -9.67 with a significance of 0.000 < 0.05, which means that the learning outcomes in multimedia-assisted project-based learning in class XI students of light vehicle engineering in Semarang City achieve minimal completeness.

Hypothesis III, which states that learning outcomes in multimedia-assisted project-based learning are more than project-based learning, is tested using U Mann Whitney by comparing post-test data and skill scores between the experimental and control groups. The U Mann Whitney test results for post-test data are 0.000 with a Z value = 1.5474, and a significance value for the practice value data is 0.000 with a Z value = -7.607. The two significance values are still below 0.05, which means that knowledge and skills in multimedia-assisted project-based learning are more than project-based learning.

Hypothesis IV, which states that there is an effect of self-regulation on the learning outcomes of class XI students in light vehicle engineering in Semarang City can be seen from the spearman rank correlation with the

correlation reaching 0.465 with a significance value of 0.000 < 0.05, which means that there is a significant influence between self-regulation and knowledge learning outcomes. The correlation between self-regulation and skills learning outcomes is 0.890 with a signed value = 0.000 < 0.05, which means a significant effect between self-regulation on practical learning outcomes.

Hypothesis IV, which states that there is an effect of self-regulation on the learning outcomes of class XI students in light vehicle engineering in Semarang City can be seen from the spearman rank correlation with the correlation reaching 0.465 with a significance value of 0.000 <0.05, which means that there is a significant influence between self-regulation and knowledge learning outcomes. The correlation between self-regulation and skills learning outcomes is 0.890 with a signed value = 0.000 < 0.05, which means a significant effect between self-regulation on practical learning outcomes.

Solving problems is an essential part to master when working or opening your own business. This is following the objectives of project-based learning to improve students' science process skills such as observation, classification, interpretation, prediction, communication, planning experiments, applying concepts, hypothesizing, and asking questions (Adinugraha, 2018).

The results showed that project-based learning improved student learning outcomes, as evidenced by the Wilcoxon test results with a significance value < 0.05. Student learning outcomes also achieved learning completeness, as evidenced by the Wilcoxon test results with a significance value < 0.05. There are only six students out of 132 in the experimental group who are under KKM = 70. The learning outcomes of both knowledge and practice in the experimental group with multimedia-assisted project-based learning were significantly better than learning in the control group. This is evident from the significance value of the Mann Whitney U test below 0.05.

According to Bell (2010), project-based learning is an innovative approach to learning that teaches many essential strategies for achieving success in the 21st century. Research by Wekesa and Ongunya (2016) provides empirical evidence that the use of project-based learning facilitates higher quality learning and has an effect on learning achievement.

Through project-based learning, students are no longer passive recipients of knowledge because they gain deep experience, integrate the knowledge they have acquired with the new knowledge they have acquired, collaborate, and are closer to real-world problems (Riosa et al., 2010; Grant, 2002).

Students engage in intellectually challenging assignments that encourage the investigation of a problem through knowledge and skills to solve complex problems. (Movahedzadeh, et.al, 2012; Tamim, 2013), Furthermore, have an impact on student academic achievement (Du and Han, 2016). Project-based learning emphasizes communication more, and students focus more on paying attention to delivering their messages. At the same time, students apply the knowledge they have acquired (Thitivesa, 2014).

Research by Doppelt (2003) shows that motivation and self-image from all levels have increased. In this lesson, the teacher changes their role in the classroom to become creative mentors who foster student competence. Research by Lasauskiene and Rauduvaite (2015) concludes that teachers' positive feelings in implementing project-based learning and creating continuous improvement in student abilities. Borhan's research (2011) shows the influence of project-based learning on students' attitudes and concerns about the environment.

According to (NYC Department of Education, 2009), the steps that need to be taken in project-based learning include setting goals, developing the final product format, planning the project scope, designing learning activities, and assessing the project design. This technique is intended to assess students' overall ability in

organizing and implementing a competency (Depdiknas, 2008).

Cooling system maintenance is part of the basic engine maintenance competencies that must be mastered. However, the fact is there are still many students when faced with real problems in light vehicle engines, experience errors in carrying out the procedure. There are indications that there is a lack of application of project-based learning because teachers have dominated learning through direct learning.

Multimedia is a medium for delivering information that comprehensively contains material. It not only presents written material but is also equipped with videos and evaluation tools. Psychologically, according to Megrabian (1981) in Cai and Abbott (2013), 93% of a person's communication is done non-verbally because the human brain is more comfortable accepting image objects simultaneously through language, which tends to be linear.

Learning outcomes are changes in student behavior due to teaching and learning activities, in the form of cognitive, affective, and psychomotor aspects (Purwanto, 2010) and Sudjana, (2010).

Meanwhile, Bloom, Benjamin S.,etc. (1956) divides and hierarchically arranges the level of cognitive learning outcomes starting from the lowest and simplest, namely memorization, to the highest and most complex, namely evaluation. The level of cognitive learning outcomes was further revised by Anderson and Krathwohl (2001), namely: remembering, understanding, applying, analyzing, evaluating, and creating.

According to Krathwohl, D.R., Bloom, B.S., & Masia, B.B. (1964; 1973), the affective domain includes feelings, values, appreciation, enthusiasm, motivation, and attitudes. Affective abilities, especially attitudes, from students can be seen from their tendencies, changes, and developments based on affective domain categories.

Simpson (1972) presents seven main categories for psychomotor abilities from the simplest to the most complex, namely perception, readiness, imitation, habitual, proficient, natural, and original. The level of the psychomotor ability category from Simpson (1966; 1972) and Dave (1970) is proven to be used to measure the level of achievement of students' abilities as a result of learning in the psychomotor domain, especially for fields that are full of physical, motor and kinesthetic use, such as sport, music, fine arts, dance, drama, experiments in science.

Concerning learning, self-regulation is an active, constructive process where students set their learning goals and then monitor, regulate, and control their cognition, motivation, and behavior, guided and focused on goals and contextual in their environment (Pintrich 2000a). According to Bandura, self-regulation is an ability possessed by humans in the form of the ability to think and manipulate the environment, resulting in changes in the environment due to these activities.

Beek (2014) states the importance of self-regulation as a daily life skill and during school learning. Students who can adjust and adjust learning behavior, so they can learn efficiently (Cazan, 2013) and achieve better academic results (Järvelä, Järvenoja, and Malmberg, 2012; Jossberger, BrandGruwel, Boshuizen, and van de Wiel, 2010; Kuo, 2010; Pintrich, Nice, and De Groot, 1994; Winne, 1995, 2005; Zimmerman, 2008). Self-regulation is considered the key to successful learning at school and outside of school (Kuo, 2010; Pintrich, 2002; Winne, 1995; Zimmerman, 2002). As a component of the learning environment, the teacher can play an essential role in stimulating and developing student self-regulation (Kuo, 2010; Reeve, 2009).

Ekici (2014) states that students who have self-regulation skills can manage anxiety and behavior to facilitate learning and maintain academic success (Brynes et al., 1999). Patterns of thought, emotion, and action work together to achieve learning goals in the self-regulation process (Boekaerts, 2002). Kruglanski et al. (2010) focus on two basic self-regulation functions: assessment and activation by

considering self-regulation of setting goals and trying to achieve these goals. Carver and Schier (2011) define self-regulation as self-correcting adjustments, such as suppressing internal impulses or anxiety from individuals to stay connected in the process of achieving goals. According to Pintrich (2004), students can be active in defining, setting goals, and establishing strategies regarding specific goals.

The cooling system's learning result is a cognitive and practical ability in the basic competence of checking the cooling system in class XI students of light vehicle engineering needs to be improved. Learning is still centered; there are teachers, meaning that the teacher provides material theoretically followed by practical activities.

The teacher has not used multimedia as a demonstration medium, so students 'practical ability only relies on students' attention to the teacher's initial explanation. Psychologically, according to Megrabian (1981) in Cai dan Abbott (2013), 93% of a person's communication is done non-verbally because the human brain is more comfortable accepting image objects simultaneously than through language, which tends to be linear.

Learning outcomes shown from knowledge tests and performance tests are influenced not only by the students' ability to practice based on the theory being learned but also by their ability to self-regulate (self-regulation). This is also evidenced by the correlation between self-regulation and knowledge learning outcomes of 0.465 and the correlation between self-regulation and practical learning outcomes of 0.890. The significance of each test of 0.000 < 0.05. This shows that the learning outcomes of cooling system knowledge and practices are influenced by self-regulation.

CONCLUSION

Based on the results above, it can be concluded that project-based learning tools assisted with multimedia are effective as a learning model for class XI students of light vehicle engineering at Public Vocational High Schools in Semarang City are classified as valid. Project-based learning assisted with multimedia is effective as a learning model for class XI students of light vehicle engineering at Public Vocational High Schools in Semarang City. This multimedia-assisted project-based learning can improve learning outcomes, achieve completeness and be better than project-based learning. Self-regulation affects class XI light vehicle engineering's learning outcomes at Public Vocational High Schools in Semarang City.

REFERENCES

Achmad Buchori, Muhtarom, Maharani Anisa. (2016). “Keefektifan model pembelajaran LC5E dan CRH berbantuan multimedia interaktif terhadap hasil belajar siswa”. Jurnal Pendidikan dan Pembelajaran (JPP) Vol 23 No.2.

Afandi, Junanto, & Afriani. (2016). Implementasi digital-age literacy dalam pendidikan abad 21 di Indonesia. Prosiding Seminar Nasional Pendidikan Sains (SNPS). 113-119.

Anderson, L.W. & Krathwohl, D.R. (Eds.) (2001). A taxonomy for learning, teaching, and assessing: a revision of bloom's taxonomy of educational bjectives. New York: Longman.

Andri & Istyawati. (2013). "Pengaruh model pembelajaran berbasis proyek terhadap tingkat kerjasama siswa dan hasil belajar siswa kelas X TPM pada mata pelajaran menggambar di SMKN 1 Jetis Mojokerto". Jurnal Pendidikan Teknik Mesin. Volume 01 Nomor 02: 28-37.

Arifin, Z. (2013). " Evaluasi pembelajaran ". Bandung: Rosdakarya.

Aufa Ashfahani, Haryono Haryono, Kustiono Kustiono.(2020). The Effectiveness of Project Based Learning and Discovery Learning with Modul to Improve Learning Outcome for AutoCAD Subject.Innovative Journal of Curriculum and Educational Technology. 72-77.
https://doi.org/10.15294/ijcet.v9i2.39460

Beek, J.A. V, De Jong, F.P.C.M., Minnaert, A.E.M.G. & Wubbels, Th. (2014). "Teacher practice in secondary vocational education: between teacher-regulated activities of student learning

and student self-regulation". Teaching and Teacher Education. 40. 1-9.
https://doi.org/10.1016/j.tate.2014.01.005

Bell, S. (2010). "Project-based learning for the 21st century: skills for the future". The Clearing House, 83: 39-43.
https://doi.org/10.1080/00098650903505415

Bloom, Benjamin S.,etc. (1956). "Taxonomy of educational objectives: the classification of educational goals". Handbook I: Cognitive Domain. New York: Longmans, Green and Co.

Borhan, M.T. (2011). "Promoting environmental stewardship through project-based learning (PBL)". International Journal of Humanities and Social Science Vol. 1 No. 4. 180-186.

Cai, T. & Abbott, E. (2013). " Using video as a replacement or complement for the traditional lecture/demonstration method in agricultural training in Rural Uganda". Journal of Applied Communications. Vol. 97: 4. Page 1-15.
https://doi.org/10.4148/1051-0834.1127

Cazan, A.M. (2013). "Teaching self regulated learning strategies for psychology students". Procedia - Social and Behavioral Sciences78 :743 - 747.
https://doi.org/10.1016/j.sbspro.2013.04.387

Chasanah, Y., Rohman, F., Zubaidah, S. (2019). "Efektivitas modul keanekaragaman hayati berbasis project based learning dalam upaya peningkatkan hasil belajar kognitif siswa SMA". Teori, Penelitian, dan Pengembangan. Volume: 4 Nomor: 4. 531-536.

Chiang, C. L. & Lee, H. (2016). "The effect of project-based learning on learning motivation and problem-solving ability of vocational high school students". International Journal of Information and Education Technology: Vol. 6, No. 9. 709-712.
https://doi.org/10.7763/IJIET.2016.V6.779

Dave, R. (1967). Psychomotor domain. Berlin: International Conference of Educational Testing.

Depdiknas. (2008). Penilaian hasil belajar Sekolah Menengah Kejuruan. Jakarta: Direktorat Jenderal Manajemen Pendidikan Dasar Dan Menengah Direktorat Pembinaan Sekolah Menengah Kejuruan.

Doppelt, Y. (2003). "Implementation and assessment of project-based learning in a flexible environment". International journal of technology and design education 13, 255-272.
https://doi.org/10.1023/A:1026125427344

Du, Xiaomei & Han, Jie. (2016). "A literature review on the definition and process of project-based learning and other relative studies". Creative Education, 7, 1079-1083.
https://doi.org/10.4236/ce.2016.77112

Ekici, M. , Coskun, H. I, Yurdugul. H. (2014). "Investigation of the relationship between learning approaches and online self-regulation behaviour". Procedia - Social and Behavioral Sciences 141, 285 - 289.
https://doi.org/10.1016/j.sbspro.2014.05.050

Hasjiandito, A, Haryono, Djunaidi (2014). "Pengembangan model pembelajaran blended learning berbasis proyek pada mata kuliah media pembelajaran di jurusan PGPAUD UNNES". Innovative Journal Of Curriculum And Educational Technology. Vol 3 No 2. 38-43.

Ilter, I. (2014). A study on the efficacy of project-based learning approach on social studies education: Conceptual achievement and academic motivation. Educ. Res. Rev. 487-497.
https://doi.org/10.5897/ERR2014.1777

Järvelä, Järvenoja & Malmberg, (2015). "How do types of interaction and phases of self-regulated learning set astage for collaborative engagement?". Learning and Instruction xxx13.
https://doi.org/10.1016/j.learninstruc.2016.01.005

Krathwohl, B.S. Bloom, B.B Masia. (1964). Taxonomy of educational objectives. The Classification of Educational Goals, Handbook II: Affective Domain. David McKay Company, Inc.

Lasauskiene, J & Rauduvaite, A. (2015). "Project-based learning at university: teaching experiences of lecturers". Procedia - Social and Behavioral Sciences 197. 788 - 792.
https://doi.org/10.1016/j.sbspro.2015.07.182

Movahedzadeh, F., Patwell, R., Rieker, J.E., & Gonzalez, T. (2012). "Project-based learning to promote effective learning in biotechnology courses". Education Research International. Volume 2012, Article ID 536024, 1-8.
https://doi.org/10.1155/2012/536024

Mukminan. (2014). "Tantangan pendidikan di Abad 21". Seminar Nasional Teknologi Pendidikan 2014. Diselenggarakan oleh Program Studi Teknologi Pendidikan Program Pascasarjana - Universitas Negeri Surabaya, 29 November 2014.

NYD Department of Education. (2000). Project based learning: inspiring middle school students to engage in deep and active learning. 52 Chambers Street. New York, New York 10007.

Pintrich, P.R & Wolters, C.A. &Baxter, G.P. (2000). "Assessing metacognition and self-regulated learning". Digital Commons@University of Nebraska - Lincoln.1-1.

Purwanto. (2010). Evaluasi hasil belajar. Yogyakarta: Pusat Belajar.

Raibowo, S.,Adi, S., Hariadi, I. (2020). "Efektivitas dan uji kelayakan bahan ajar tenis lapangan berbasis multimedia interaktif". Teori, Penelitian, dan Pengembangan. Volume: 5 Nomor: 7. 944-952.

Ríosa, I Cazorlaa, A., José M. Puentea, D., José L. Yagüea. (2010). "Project-based learning in engineering higher education: two decades of teaching competences in real environments"Procedia Social and Behavioral Sciences 2 1368-1378.
https://doi.org/10.1016/j.sbspro.2010.03.202

Simpson, E.J. (1972). The Classification of educational objectives in the psychomotor domain. The Psychomotor Domain. 3:43-56. Gryphon House.

Sinta, I., Haryono, H. and Wibawanto, H. 1. "Pengembangan model pembelajaran inkuiri berbantuan media pembelajaran interaktif (MPI) untuk mengembangkan minat berwirausaha pada warga SOS Desa Taruna Semarang". Innovative Journal of Curriculum and Educational Technology. 2, 2 (1).
https://doi.org/10.15294/ijcet.v2i2.2680

Sudjana, N. (2010). Penilaian hasil proses belajar mengajar. Bandung: PT Remaja Rosdakarya.

Suherman, E., dkk. (2004). Strategi pembelajaran matematika kontemporer. Bandung: UPI.

Tamim, S.R.(2013). "Definitions and uses: case study of teachers implementing project-based learning". Interdisciplinary Journal of Problem-Based Learning. volume 7, no. 2. 72-99.
https://doi.org/10.7771/1541-5015.1323

Thitivesa, D. (2014)."The Academic Achievement of writing via project-based learning". World Academy of Science, Engineering and Technology International Journal of Economics and Management Engineering. Vol:8, No:9. 2994-2997.

Wahyuni, Sri & Djukri (2016). "Pengembangan media pembelajaran berbantuan komputer dan keefektifannya terhadap kemandirian belajar dan penguasaan konsep bryophyte". Jurnal Inovasi Teknologi Pendidikan. Volume 3, No 1. 79-91.
https://doi.org/10.21831/tp.v3i1.8262

Wekesa, W & Ongunya, R.O. (2016). "Project based learning on students' performance in the concept of classification of organisms among secondary schools in Kenya". Journal of Education and Practice. Vol.7, No.16. 25-31.

Zimmerman, B.J.& Kitsantas, A. "Comparing students' self-discipline and self-regulation measures and their prediction of academic achievement". Contemporary Educational Psychology 39 : 145-155.
https://doi.org/10.1016/j.cedpsych.2014.03.004