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Improving Student Abilities in Plant Anatomy Courses Using a Collaboration of Research-Based Learning Models and Gamification Techniques

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ABSTRACT

The quality of education in NTT is still low and needs to be improved. One of them is by improving the quality of learning through the collaboration of innovative learning models. The focus of this study was to determine the increase in students' abilities in plant anatomy courses using collaborative research-based learning models and gamification-based assessment techniques. This pre-experiment research used a qualitative research approach. The research sample was determined using purposive sampling technique with one group pretest-postest design. The test data were analyzed descriptively. The results showed that there was a difference in the average pretest of 40.5 and posttest of 80.5. The results of the n-gain calculation obtained a score of 0.6 with the gain category being moderate. Classically, the class was complete with a percentage of 100%. The conclusion of the results of this study is that there is an effect of blended learning strategies through the collaboration of research-based learning models and gamification-based assessment techniques on student learning outcomes in the Unwira Biology Education Study Program.

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INTRODUCTION

In recent times, the world has entered an era that is characterised by the advent of the fourth industrial revolution, which is commonly referred to as Industry 4.0. This is an era in which a multitude of industrial sectors, including manufacturing, trade, and social industries, are underpinned by technological advancement.(Haqqi & Wijayati, 2019). In other words, this era may be defined as one in which technological products have come to exert a significant influence over human life in all its aspects(Atiah, 2020). he third industrial revolution is characterised by the

development of tall buildings and direct production promotion. The fourth industrial revolution, however, is distinguished by three key areas of literacy: data literacy, technological literacy, and human literacy. (Pambayun & Permassanty, 2021). In light of the aforementioned, it can be argued that these three literacies are essential for the development of all forms of work in today's revolutionary era. Consequently, it can be posited that education must follow this trend. (Darise, 2019).

It is crucial for those involved in higher education especially Institute of Teachers' Education, particularly those providing human resource services, to recognise this phenomenon as a challenge. (Syafaruddin et al., 2016). This is to prevent a discrepancy between the standards of higher education and those required by industry. Two significant challenges impede the world of education's ability to align with the tenets of the Industrial Revolution 4.0. The first is the limited technological proficiency of lecturers and teachers, and the second is the vast and evolving landscape of data literacy and technology.(Arti, 2020). Consequently, Institute of Teachers' Education must identify an optimal approach to ensure that its graduates are adequately prepared to navigate the complexities of the Industrial Revolution 4.0. (Arifian, 2019).

The Faculty of Teacher Training and Education at Unwira, one of the Institute of Teachers' Education in Kupang-NTT, must prepare its graduates to compete globally in this era. This preparation must take the form of familiarising students with the process of learning activities. The most suitable learning model is blended learning.. (Hussin et al., 2017). Blended learning is a term that is comprised of two words: "blended" and "learning." According to the Collins Dictionary, the former means "mixed together to improve quality," while the latter means "learning." Therefore, blended learning can be defined as a method of improving the quality of learning. (Widiara, 2018).

The term "blended learning" is employed by some scholars to denote an educational methodology that incorporates both traditional, face-to-face instruction and digital, computer-based learning, delivered via online or offline platforms, and facilitated through the utilisation of e-learning tools.. (Usman, 2019). The design of this strategy requires the lecturer or teacher to adopt a creative approach in order to blend the various elements successfully. There is no standardised approach to practising this strategy, as lecturers are permitted to design lectures and teaching methods that align with the style and content of the material in question.. (Sudarman, 2015).

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An additional learning model that can be deployed alongside blended learning is the research-based learning (PBR) model. Aligned with the scientific approach, the PBR model is consistent with the current curriculum.. (Sariada, 2019). The programme integrates research into learning and encompasses a variety of learning approaches. PBR provides students with opportunities to search for data, develop hypotheses, collect information, analyse information, and make conclusions based on the data they collect. This is achieved through a 'learning by doing' approach, whereby students can build new knowledge through research procedures. It is therefore anticipated that the programme will enhance the quality of learning. (Slameto, 2015). However, in order for the learning process to be of high quality, lecturers need to motivate students to participate actively and provide ample space for students to develop creativity, initiative, and abilities that match their attention and physical and psychological growth. Therefore, education should be tried with methods that are interactive, inspiring, fun, and challenging.

The most effective method for motivating students is through the integration of gamification principles into the evaluation of their learning processes. (Yaniaja et al., 2020). Gamification is an approach to incorporating game elements into the learning process with the objective of motivating students and maximising satisfaction and engagement. Gamification, like games, can be implemented in both online and offline contexts. It places particular emphasis on the accumulation of points at each level of the game. These points can be employed to facilitate the assessment process, thereby enhancing students' motivation to learn. Furthermore, the distinctive feature of gamification is its capacity to assist players in restarting or replaying, rectifying errors, and reducing concerns about failure, thereby fostering their interest in the game. Games have the potential to enhance an individual's cognitive, emotional, and social abilities, thereby increasing their inclination to learn. (Nataliya, 2015).

It is typical for students to be reluctant to engage in lengthy daily chores. Instead, they tend to prefer allocating their time to leisure activities, such as gaming. (Fakhrunnisaa et al., 2023). The blended learning model, gamification concept and research-based learning model have yet to be applied in the context of the Biology Education Study Programme. Students enrolled in the Biology Education Study Programme have not yet had the opportunity to engage with a variety of innovative learning programmes. The persistence of long-established patterns of thought and behaviour among students represents a significant challenge for lecturers at Unwira, with implications for the quality of learning. Furthermore, a range of additional factors, including

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student background, infrastructure, parents' economic status, learning environment and psychological factors, also contribute to the quality of learning. (Nurhuda, 2022). In light of the actual circumstances and the difficulties inherent to the learning environment during the industrial revolution 4.0, it is imperative for Unwira, a higher education institution in NTT, to engage with the prevailing shift in the educational landscape. To this end, it is crucial to assess the efficacy of blended learning strategies that integrate PBR models and gamification techniques into online learning for students enrolled in the Biology Education Study Programme at Unwira Kupang..

RESEARCH METHODS

This research is a pre-experimental study with a one-group pretest-posttest design. The design comprises a single group, whereby the dependent variable is initially measured prior to the administration of the experimental treatment (pre-test), and then again following the conclusion of the treatment (post-test). The design is illustrated in the following figure..

Group	Pre-test	Treatment	Post-test
Experiment	O1	X	O2

Keterangan:
O1 : Pre-test
O2 : Post-test
X : Treatment (given learning by using PBR and Gamification collaboration)

The subjects of this study were students of the Biology Education Study Programme in semester IV of the 2022/2023 academic year who were enrolled in the plant anatomy course. There were 21 students in total, comprising 6 males and 15 females. The sample was selected via purposive sampling, whereby a specific set of criteria was employed to identify the subjects for participation.

The research instrument is a student learning outcomes test sheet that contains a series of test questions. These are divided into two categories: pretests or initial tests and final tests or posttests. The test questions are in the form of short description questions, with a total of 15 numbers. In addition to the aforementioned questions, there are also 120 quiz questions in the form of essay questions with short answers.

The research procedure comprises three principal stages: the initial stage of preparation, the subsequent activities, and the final stage, which is the data analysis. The preparation stage comprises the preparation of research instruments and the determination of the experimental class.

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Furthermore, the implementation stage comprises a preliminary assessment (prestest/initial test) prior to the learning phase, which is conducted within the experimental class over 16 sessions. The learning phase employs a research-based learning model and assessment method that incorporates gamification techniques. The implementation of gamification techniques involved the administration of quiz questions for seven meetings (after learning both in the classroom and using Google Forms outside the classroom) and the presentation of research goals at three meetings prior to the final examination.

The quiz questions were in the form of 10 numbers with short answers, which proved challenging for students to answer correctly and thus collect points. A score of 10 is awarded to students who provide the correct answer. In the event of an incorrect response, a penalty of -5 points is applied. Students who successfully collect 50 points are entitled to take the UTS. Meanwhile, research goals are assessed in the form of proposals, data collection and reports. These three goals are a requirement for students to take the final exam. Furthermore, a final test or post-test is carried out to determine student understanding during the learning process. The final stage is the data analysis stage, during which the data from the pre-test and post-test results were analysed descriptively.

The data collected in the form of pre-test and post-test results were subjected to descriptive analysis, whereby the average pre-test and post-test scores and the N-gain value were determined. The average score was determined by the formula:

$$\text{Learning outcome score} = \frac{Students' Score}{Maximum Score} x100$$

Meanwhile, to calculate n-gain, the formula:

$$\text{N-gain Score} = \frac{Posttest\ Score - Pretest\ Score}{Ideal\ Score - Pretest\ Score}$$

The criteria for determining the n-gain score can be seen in the following table:

Table 1. N-gain Criteria

Nilai N-gain	Category
g > 0,7	High
0,3 < g < 0,7	Medium
g < 0,3	Low

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RESEARCH RESULTS

The results of the calculation of the average value of students in plant anatomy courses before learning (pretest) and after learning (posttest) using the PBR model in conjunction with gamification assessment techniques are presented in Figure 1.

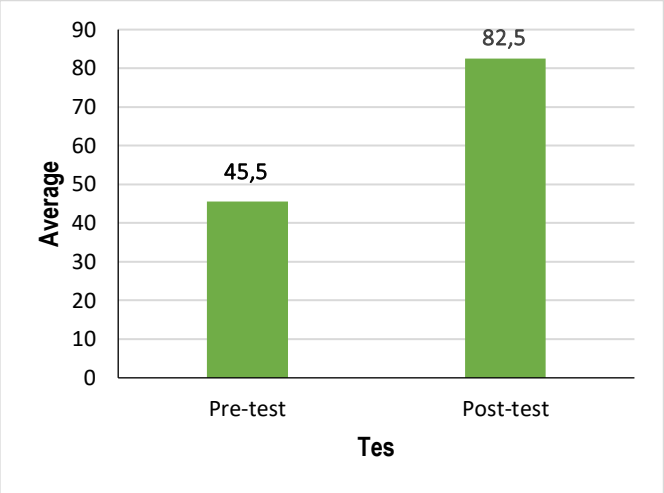

Figure 1: Average student test scores

The results of the calculation of the average test, as illustrated in the figure, demonstrate a comparison of scores between the pre- and post-learning periods. The average test score prior to learning is 45.5, while the post-learning score is 80.5. The increase in scores can be calculated using the n-gain formula, as shown in the following table.

Table 2. n-gain values

Pretest	Postest	N-gain	Kategori
45,5	80,5	0,6	Sedang

The table above illustrates the n-gain value, which serves as an indicator to assess the extent of improvement in student learning outcomes subsequent to the learning process. The value of 0.6, when classified, falls within the moderate improvement category.

The findings of this study indicate that students who participated in the learning process using the PBR model in conjunction with gamified assessment techniques demonstrated a notable advancement in their knowledge base. The learning process itself provided students with valuable learning experiences and enhanced their cognitive abilities..(Trianggono et al., 2022).

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DISCUSSIONS

The efficacy of a learning process is typically demonstrated by an observable enhancement in students' capacity to master specific material, to the extent that they are able to attain the anticipated competencies. (Lince, 2022). It can be reasonably deduced from the evidence presented that the integration of the PBR model and gamification assessment techniques into a blended learning environment has a beneficial impact on the efficacy of the learning process. This is evidenced by the observed improvement in students' scores on pretest to posttest assessments.

In light of the findings of this study, it can be posited that the integration of the PBR model and gamification within a blended learning strategy has served to enhance students' motivation to learn. This is due to the fact that the very nature of gamification entails a competitive element, whereby students are driven to excel and emerge victorious. In alignment with this assertion, the research outcomes (Rahmawati, 2023)This study, which employs a collaborative approach integrating problem-based learning (PBL) and gamification models, demonstrates that learners exhibit heightened enthusiasm for learning as a result of the incorporation of game elements. The implementation of gamification strategies has been shown to enhance learners' motivation and engagement in learning, as games possess intrinsic characteristics that are inherently engaging. (Naatonis et al., 2023).

In addition to the proven effectiveness of gamification in enhancing learning motivation, the PBR model offers a distinctive learning experience for students. This is because, in contrast to the conventional approach, students are afforded the chance to unearth new insights through the process of research. The act of seeking and discovering their own knowledge enables students to develop a comprehensive range of competencies. In addition to grasping the fundamental concepts and knowledge associated with the subject matter, students also acquire a multitude of scientific process skills, including the formulation of hypotheses, the collection and analysis of information, the evaluation of information, and the drawing of conclusions. Furthermore, the cultivation of an honest attitude, the development of effective collaboration abilities, and the nurturing of other positive personal attributes are also encouraged.

The learning process with PBR is based on the concept of learning by doing, which is consistent with the scientific approach, which is the educational approach that has been most widely adopted in this century. This is because the scientific approach, as defined by the Human Resources Development and Education Quality Assurance Agency, is characterised by the

following key features: 1) It encourages learners to think critically and analytically, recognising, mastering and dismantling problems with precision, and utilising learning modules correctly. 2) It ensures that learning materials are based on evidence and are not mere fantasy or fairy tales. 4) Teachers and students interact in a manner that is free from prejudice, subjective thinking, and distorted reasoning; 5) Students are encouraged to develop and enhance their capacity for rational and objective thinking in response to the material presented in the lesson; and 6) The objectives of the lesson are straightforward yet engaging, as they are based on theories, concepts, and empirical reality that can be accounted for. (Suparsawan & SD, 2020).

The scientific approach, which is in accordance with the PBR model, provides students on the Biology Education Study Programme with a rich learning experience, as evidenced by the high level of completion observed in the entire class, with a percentage of classical completeness of 100%. Furthermore, all students achieved a score of > 60.

CONCLUSIONS

The conclusion that can be drawn from the results of this study is that there is an effect of blended learning strategies, which combine research-based learning models with gamification-based assessment techniques, on the learning outcomes of students on the Unwira Biology Education Study Programme.

REFERENCES

Arifian, F. D. (2019). Peran lembaga pencetak tenaga kependidikan (LPTK) dalam mempersiapkan generasi emas bangsa. *Jurnal Pendidikan Dan Kebudayaan Missio*, *11*(1), 26–38.

Arti, M. (2020). Tantangan sekolah dan peran guru dalam mewujudkan pembelajaran bahasa yang efektif di era 4.0 menuju masyarakat 5.0. *Prosiding Seminar Nasional Program Pascasarjana Universitas PGRI Palembang.*

Atiah, N. (2020). Pembelajaran Era Disruptif Menuju Masyarakat 5.0. *Prosiding Seminar Nasional Program Pascasarjana Universitas PGRI Palembang.*

Darise, G. N. (2019). Implementasi Kurikulum 2013 Revisi sebagai solusi alternatif pendidikan di Indonesia dalam menghadapi Revolusi Industri 4.0. *Jurnal Ilmiah Iqra'*, *13*(2), 41–53.

Fakhrunnisaa, N., Putri, R. H., Edy, M. R., Armiana, A., Zainab, Z., & Juharman, M. (2023). Gamification Sebagai Strategi Peningkatan Kualitas Belajar Mahasiswa Jurusan Teknik Informatika Dan Komputer Universitas Negeri Makassar. *Jurnal Pendidikan Terapan*, 63–68.

Haqqi, H., & Wijayati, H. (2019). *Revolusi industri 4.0 di tengah society 5.0: sebuah integrasi ruang, terobosan teknologi, dan transformasi kehidupan di era disruptif*. Anak Hebat Indonesia.

Hussin, Z., Siraj, S., Darusalam, G., & Salleh, N. H. M. (2017). Kajian model blended learning dalam jurnal terpilih: satu analisa kandungan. *JuKu: Jurnal Kurikulum & Pengajaran Asia Pasifik*, *3*(1), 1–6.

Lince, L. (2022). Implementasi kurikulum merdeka untuk meningkatkan motivasi belajar pada sekolah menengah kejuruan pusat keunggulan. *Prosiding Seminar Nasional Fakultas Tarbiyah Dan Ilmu Keguruan IAIM Sinjai*, *1*, 38–49.

Naatonis, R. N., Umam, M. C., Rohid, N., & Asy'ari, D. N. (2023). Media Gamifikasi Dan Self Regulated Learning Sebagai Solusi Peningkatan Kemampuan Profil Pelajar Pancasila. *SIPTEK: Seminar Nasional Inovasi Dan Pengembangan Teknologi Pendidikan*, *1*(1).

Nataliya, P. (2015). Efektivitas penggunaan media pembelajaran permainan tradisional congklak untuk meningkatkan kemampuan berhitung pada siswa sekolah dasar. *Jurnal Ilmiah Psikologi Terapan*, *3*(2), 343–358.

Nurhuda, H. (2022). Masalah-masalah pendidikan nasional; faktor-faktor dan solusi yang ditawarkan. *Dirasah: Jurnal Pemikiran Dan Pendidikan Dasar Islam*, *5*(2), 127–137.

Pambayun, E. L., & Permassanty, T. D. (2021). *An Integrated Marketing Communication Circle in 4.0 Era: Filosofi, Konsep, dan Implementasi*. Penerbit Adab.

Rahmawati, N. (2023). *Pengaruh penerapan model problem based learning berbasis gamifikasi terhadap hasil belajar siswa kelas III Sekolah Dasar*.

Sariada, I. K. (2019). Pembelajaran berbasis riset di perguruan tinggi: Peluang, tantangan memasuki era revolusi industri 4.0. *Seminar Nasional Fakultas Seni Pertunjukan*, 23–34.

Slameto, S. (2015). Pembelajaran berbasis riset mewujudkan pembelajaran yang inspiratif. *Satya Widya*, *31*(2), 102–112.

Sudarman, S. (2015). Pengaruh strategi pembelajaran blended learning terhadap perolehan belajar konsep dan prosedur pada mahasiswa yang memiliki self-regulated learning berbeda. *Jurnal Pendidikan Dan Pembelajaran (JPP)*, *21*(1), 107–117.

Suparsawan, I. K., & SD, S. P. (2020). *Kolaborasi Pendekatan Saintifik dengan Model Pembelajaran STAD Geliatkan Peserta Didik*. Tata Akbar.

Syafaruddin, S., Asrul, A., Mesiono, M., Wijaya, C., & Usiono, U. (2016). *Inovasi Pendidikan: Suatu Analisis Terhadap Kebijakan Baru Pendidikan*. Medan: Perdana Publishing

Trianggono, M. M., Panglipur, I. R., Kurniawan, M. U., & Ashadi, F. (2022). analisis penerapan metode flipped classroom dalam menstimulasi kemampuan berpikir kreatif mahasiswa di masa pandemi covid-19. *Jurnal Dimensi Pendidikan Dan Pembelajaran*, *10*(1), 16–23.

Usman, U. (2019). komunikasi pendidikan berbasis blended learning dalam membentuk kemandirian belajar. *Jurnal Jurnalisa*, *4*(1).

Widiara, I. K. (2018). Blended learning sebagai alternatif pembelajaran di era digital. *Purwadita: Jurnal Agama Dan Budaya*, *2*(2), 50–56.

Al-Jahiz: Journal of Biology Education Research
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http://e-journal.metrouniv.ac.id/index.php/Al-Jahiz

Yaniaja, A. K., Wahyudrajat, H., & Devana, V. T. (2020). Pengenalan Model Gamifikasi ke dalam E-Learning Pada Perguruan Tinggi. *ADI Pengabdian Kepada Masyarakat*, *1*(1), 22–30.