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Drone-based development of SIPEJAR statistical for education course content packages

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Abstract
Learning Management System (LMS) is an innovation in the learning process that allows online learning to be more effective and efficient. Like many other higher education institutions, Universitas Negeri Malang provides opportunities for innovation and easy access to knowledge by utilizing an LMS called the Sistem Pengelolaan Pembelajaran (SIPEJAR). SIPEJAR is an open-source system that can be modified according to the user's needs and desires. The aim of this research is to develop SIPEJAR content packages by using the ADDIE model for statistics for education courses with drone-based learning. SIPEJAR development products include lesson plans, textbooks, and SIPEJAR content packages for 16 meetings. Drone-based development is focused on developing explanatory videos, presentation slides, and student interaction with learning materials. The finding results indicated that the drone-based development of SIPEJAR content packages is valid with an average score of 3.77 out of 4, practical with an average score of 4.19 out of 5, and quite effective with classical completeness percentage obtained was 60% with an average score of 74.63. This means that drone-based SIPEJAR content packages have been well developed, even though they can be improved further. Our research findings indicated that the E-LKPD is valid with a percentage of 91.00%, practical with a percentage of 89.05%, and effective with a classical learning completeness percentage of 82.76%.

Keywords: *ADDIE model, drone-based, SIPEJAR, Higher Education*

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INTRODUCTION

Education is an essential aspect of the development of modern society, and technological developments have significantly influenced how we learn and teach. One of the main innovations in the educational learning process is using Learning Management Systems (LMS), which enable more effective and efficient online teaching and learning. In practice, there are quite a lot of LMS providers to choose from (Kasim & Khalid, 2016). One of them is Moodle, which is one of the open-source LMS providers that is widely used in Indonesia.

Furthermore, using LMS can increase the effectiveness of online learning (Rohmawati, 2022). Increasing effectiveness can take the form of easy access to learning materials and various communicative interactive features between teachers, students, materials, and information communication technology (Masdar Limbong et al., 2022). Apart from that, using LMS can also overcome several limitations, especially in large classes (Huong et al., 2023), such as lack of interaction between teachers and students, class management, time constraints, large number of students, and difficulty in providing individual feedback.

One other advantage is that LMS can be combined with face-to-face learning using the flipped classroom or hybrid/blended learning model, as done by (Kirani & Azhar, 2023). Thus, using LMS in flipped classrooms or hybrid/integrated learning can open up various exciting opportunities in the learning process (Black et al., 2007). However, these various attractive opportunities may require different preparations and needs, which can include many things, starting from the readiness of supporting facilities and infrastructure, suitability of the curriculum, learning media, teacher readiness, student readiness, and various other challenges (Azari, 2021) (Négyesi et al., 2021).

One of the other obstacles faced in using LMS in learning is monitoring students in following or participating in all activities that have been arranged in the LMS (Utami et al., 2023). Apart from that, the need for interactive media and control over students is one of the challenges in online learning, primarily asynchronous online learning that uses LMS (Prasetyo & Wulandari, 2020). So, the need for a control system and monitoring of students in activities in the LMS is something that needs to be considered.

Like many other higher education institutions, Universitas Negeri Malang also provides the opportunity for innovation and easy access to knowledge by utilizing an LMS called the Sistem Pengelolaan Pembelajaran (SIPEJAR). The learning management system at Universitas Negeri Malang is managed in one system called SIPEJAR (Universitas, 2020). Learning planning and implementation are recorded in SIPEJAR in the form of learning activities and teaching activities (Universitas, 2020).

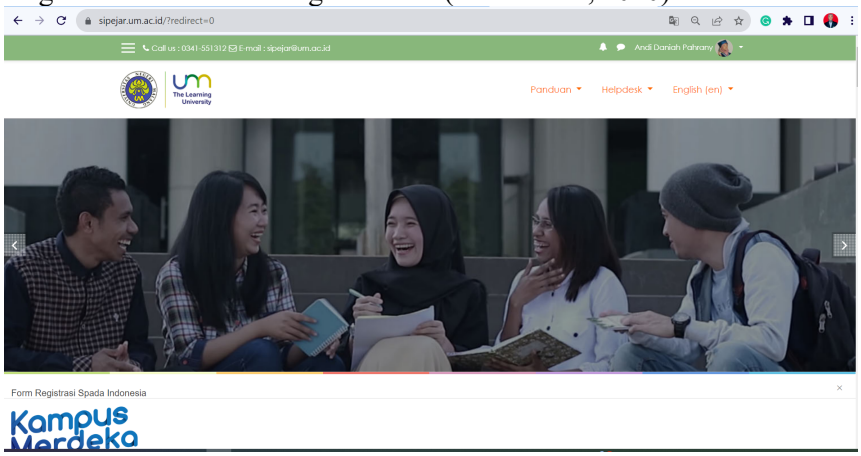


Figure 1 SIPEJAR Dashboard Display

SIPEJAR is open source, so it can be modified according to user needs and desires (Surjono, 2010). SIPEJAR development supports lectures and learning by containing various interactive and innovative features such as discussions, communication, assignments, collaboration, assessments, explanatory videos, and many others. This open-source nature is both a challenge and an opportunity. It is a challenge because developing SIPEJAR requires a relatively not short amount of time, special skills related to ICT that may not have been mastered, and an understanding of cybergogy that can align learning objectives and the media used to convey the information needed to achieve them (Rafi et al., 2020).

Dronagogy, or a drone-based learning approach, is one of the promising innovations in the world of education. Drone-based learning has been applied in several studies, such as in (Shadiev & Yi, 2022) (Voštinár, 2023). That research uses real drones that fly and are controlled by humans to help the learning process. However, what is meant by dronagogy in this research is a learning approach that uses the "concept" of drones as a system for controlling and monitoring learning stages. The specific drone concept is a remote system that allows for the creation of a more interactive and exciting learning experience with systematic real-time monitoring of all student activities in the SIPEJAR. So, it can be further ensured that students follow the entire series of learning activities that have been determined without neglecting or simply meeting the standards requested by the SIPEJAR. This is in accordance with the opinion of Dr. Muhammad Helmi Norman, who stated that "dronagogy does not always have to use drones" (Norman et al., 2018). The development of a dronagogy-based SIPEJAR is focused on ensuring that students access all the material that will lead to learning objectives with an interesting and memorable learning experience and ensuring that each student receives objective feedback and assessments that are prepared in a systematic and real-time. In this study, the research will focus on developing learning content for statistics for education in SIPEJAR which is adjusted to the curriculum in the Department of Mathematics, Universitas Negeri Malang.

Figure 2 One of The Basic Features of Monitoring Students Activities at SIPEJAR

The aim of this research is to develop SIPEJAR content packages by using the ADDIE model for statistics for education courses with drone-based learning. SIPEJAR development products include lesson plans, textbooks, and SIPEJAR content packages for 16 meetings. The reason for selecting the ADDIE model was because it is widely recognized as a crucial model for creating education and training programs (Cahyadi, 2019). Additionally, the ADDIE model consists of well-organized stages and is easily comprehensible for researchers

This research is aimed to develop SIPEJAR content packages by using the ADDIE model for statistics for education courses with drone-based learning (dronagogy). The development model will use the well-known ADDIE model (Muruganantham, 2005). The concept of implementing Dronagogy in developing SIPEJAR will be carried out by utilizing various features available in SIPEJAR or utilizing third-party applications that will be embedded in SIPEJAR. The use of dronagogy concepts in statistics education can provide a unique and engaging learning experience, as well as facilitate a deeper understanding of statistical concepts that are often considered challenging. Statistics courses for education are essential courses for education students to study. This course provides a basic understanding of statistics that can be used to analyse educational data and is expected to increase students' statistical literacy.

METHOD

The SIPEJAR development design will be carried out using a research and development approach with the ADDIE model. The ADDIE model is a popular model that was first developed in 1975. The ADDIE model is categorized as an essential model in developing education and training programs (Cahyadi, 2019). The development will be carried out in the SIPEJAR Statistics for Education course for undergraduate mathematics education students at the Faculty of Mathematics and Natural Sciences, Universitas Negeri Malang. The Statistics for Education course is offered in even semesters starting from the sixth semester. All SIPEJAR content in the Statistics for Education course will be developed based on dronagogy.

As is the ADDIE model used in the SIPEJAR development design in this research. The content that will be developed starts from lesson plans, textbooks, presentation slides, audio, explanatory videos, multiple choice and essay assessments, infographics, and motion graphics. Content packages including all material in statistics for education courses starting from 1) Introduction and Sampling Techniques; 2) Data Measurement and Presentation; 3) Probability Distribution and Estimates; 4) Hypothesis and Significance Test; 5) Compare two groups; 6) Association Analysis; 7) Simple Linear Regression and Correlation; 8) Multiple Regression and Correlation; and 9) Analysis of Variance (ANOVA).

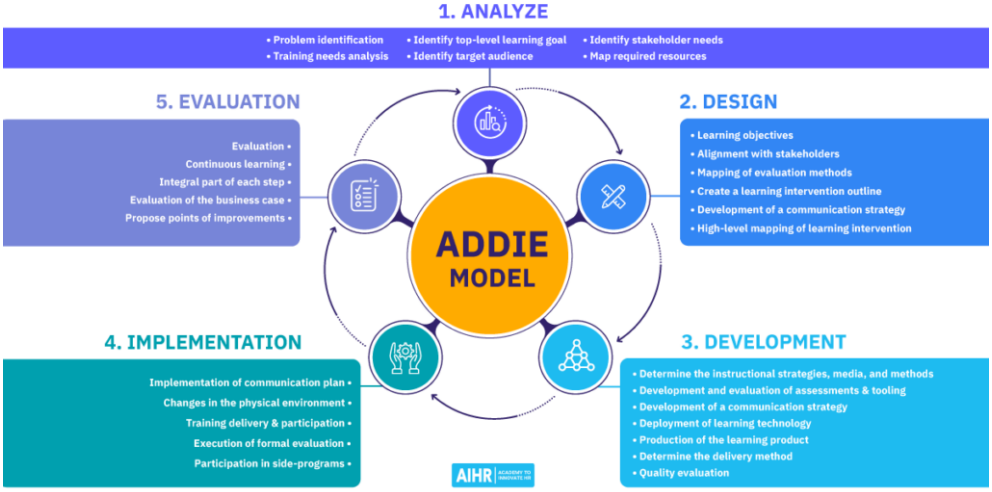


Figure 3 ADDIE Model Stages (source: https://www.aihr.com/blog/addie-model/)

In more detail, first at the analysis stage, the researcher carried out an analysis of the description of the statistics for education course, which is already in the 2020 Mathematics Department curriculum document. The researcher carried out an examination to determine the direction of development and the steps that need to be taken to support the achievement of appropriate learning objectives. With course achievements and graduate achievements. An analysis is supported by a discussion with the head of the Statistics Expertise Group of the Department of Mathematics.

The second design stage process is reflected in the lesson plans for the statistics for education course prepared by the researcher. The lesson plans contain all aspects that need to be developed, starting from course

identity, course descriptions, learning objectives, activity descriptions, assessments, and evaluations to the references used. At this stage, the media that will need to be developed will also be designed.

The third stage is development, lesson plan content is developed based on dronagogy at SIPEJAR, starting from preparing book courses, presentation slides, explanatory videos, infographics, motion graphics, assessments, and audio. This content will explain all the material in statistics for education courses.

In the fourth stage of implementation, the SIPEJAR content that has been developed will be provided on a limited basis to validators consisting of media experts, linguists, fellow lecturers, and users.

Dronagogy-based SIPEJAR content was developed based on input from statistics lecturers (material), media experts, linguists, and users at the implementation stage. Evaluation data is in the form of a 1 to 7 Likert scale questionnaire regarding using SIPEJAR.

Finally, the last stage, the evaluation stage, was carried out to perfect the dronagogy-based SIPEJAR content, which had been developed based on input from statistics lecturers (material), media experts, linguists, and users at the implementation stage.

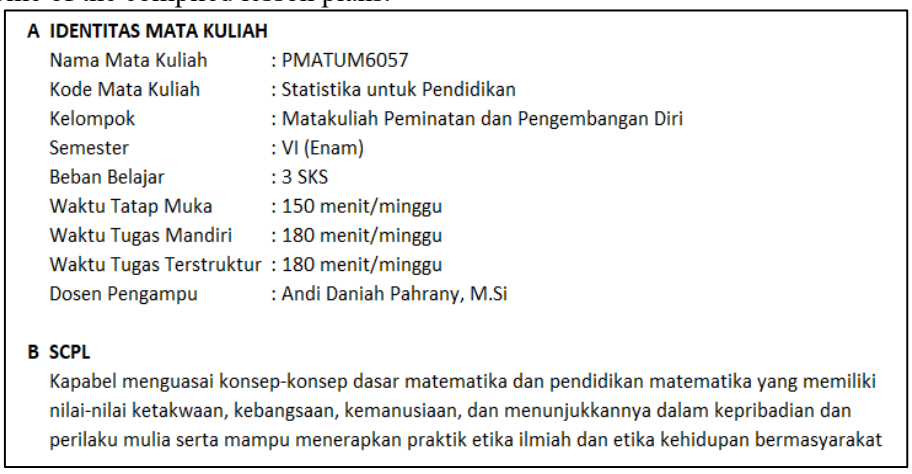
The data was analysed using quantitative descriptive techniques. The data included validation sheet results for validity tests, student response questionnaire results for practicality tests, and the results of working on test questions for effectiveness tests. These techniques helped to process the data in a more systematic and detailed manner, allowing for a more comprehensive understanding of the research findings. This study collected data from September 4th to 15th, 2023. The study subjects were 2nd-semester Department of Mathematics, State University of Malang students.

RESULTS AND DISCUSSION

This research is a SIPEJAR content development design in statistics for education courses using the dronagogy-based ADDIE model. The results of the study will be an explanation of the design process for developing dronagogy-based SIPEJAR content using the ADDIE model. The description will focus more on how the dronagogy design is implemented in the development of SIPEJAR content for statistics for education courses.

At the analysis stage, the researcher first conducted a study of the 2020 Mathematics Department curriculum documents, especially regarding statistics for education courses. The curriculum document shows a fairly clear picture of course identity, Graduate Profile Achievement Standards (GPAS), and Course Learning Outcomes (CLO). These things will be used to determine the direction and design needs for SIPEJAR content development. Apart from that, the researcher also held discussions with the chairman of the group expertise statistics, who is the one responsible for the statistics for education course, to get the latest input and ideas regarding the content that needs to be presented in the statistics for education course. This initial analysis is fundamental to carry out, especially as a guide in the future design development process (Cahyadi, 2019).

At the design stage, guidelines and a learning program framework are created, which consist of lesson plan, textbooks, and material content. The lesson plan contains course identity, GPAS, CLO, Sub-CLO, course description, references, details of learning activities, assignment plans, assessments, and evaluations. Figure 4 are display of some of the compiled lesson plans.



A IDENTITAS MATA KULIAH

Nama Mata Kuliah	: PMATUM6057
Kode Mata Kuliah	: Statistika untuk Pendidikan
Kelompok	: Matakuliah Peminatan dan Pengembangan Diri
Semester	: VI (Enam)
Beban Belajar	: 3 SKS
Waktu Tatap Muka	: 150 menit/minggu
Waktu Tugas Mandiri	: 180 menit/minggu
Waktu Tugas Terstruktur	: 180 menit/minggu
Dosen Pengampu	: Andi Daniah Pahrany, M.Si

B SCPL

Kapabel menguasai konsep-konsep dasar matematika dan pendidikan matematika yang memiliki nilai-nilai ketakwaan, kebangsaan, kemanusiaan, dan menunjukkannya dalam kepribadian dan perilaku mulia serta mampu menerapkan praktik etika ilmiah dan etika kehidupan bermasyarakat

Figure 4 Lesson Plan of Statistics for Education Course

Next, the textbook design will be prepared based on the learning material that will be presented in the lesson plan. Of course, textbook design is material that contains statistical concepts and data processing with a direction toward the realm of educational data. In detail, Table 1 is the textbook layout in this study.

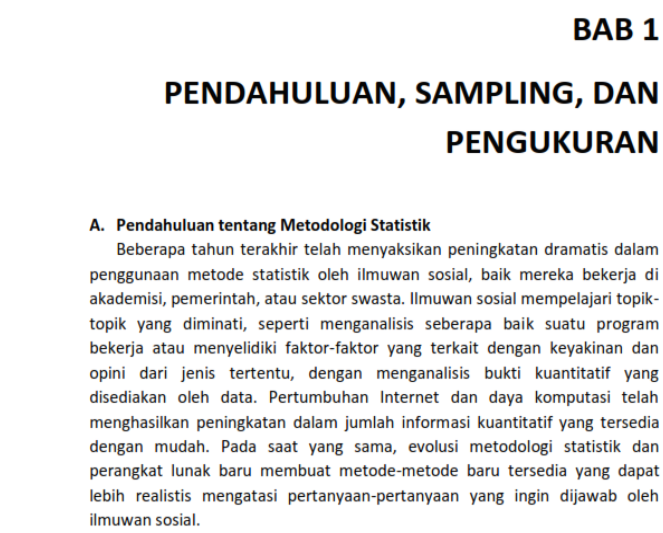
As a complement to the textbook, for each chapter, supporting media will be designed in the form of video explanations, audio explanations, motion graphics, infographics, presentation slides, and assessment tools. Apart from that, articles are also presented as case studies from accredited national journals or international journals. In total, there are 14 presentation slides, 5 video explanations, 4 audio explanations, 5 infographics, 2 motion graphics, 90 assessment questions, and 5 articles.

Table 1 Contents of Statistics for Education Textbooks

BAB 1 Pendahuluan dan Teknik Sampling	BAB 6 Analisis Asosiasi
1.1. Pendahuluan tentang Metodologi Statistik 1.2. Statistika Deskriptif dan Inferensia 1.3. Peran Komputer dan Perangkat Lunak 1.4. Variabel dan Pengukuran 1.5. Sampling 1.6. Variabel dan Potensi Bias 1.7. Metode Sampling lainnya	6.1. Tabel Kontingensi 6.2. Uji Independensi Chi-Kuadrat 6.3. Mendeteksi pola asosiasi dengan residu 6.4. Mengukur asosiasi pada tabel kontingensi
BAB 2 Pengukuran dan Penyajian Data	BAB 7 Regresi Linear Sederhana dan Korelasi
2.1. Tabel dan Grafik 2.2. Ukuran Pemusatan Data 2.3. Variabilitas Data 2.4. Statistik Deskriptif Bivariat 2.5. Statistik Sample dan Parameter Populasi	7.1. Hubungan Linear 7.2. Persamaan prediksi kuadrat terkecil 7.3. Model regresi linear 7.4. Korelasi 7.5. Inferensi Slope dan Korelasi 7.6. Model Asumsi dan pelanggaran
BAB 3 Distribusi Peluang dan Estimasi	BAB 8 Regresi Berganda dan Korelasi
3.1. Pendahuluan probabilitas 3.2. Distribusi probabilitas 3.3. Beberapa distribusi peluang khusus 3.4. Estimasi Titik dan Selang 3.5. Interval kepercayaan 3.6. Pemilihan ukuran sample	8.1 Model Regresi Berganda 8.2 Korelasi berganda dan R^2 8.3 Inferensi untuk Parameter Regresi Berganda
BAB 4 Hipotesis dan Uji Signifikansi	BAB 9 Analysis of Variance (ANOVA)
4.1. Uji signifikansi untuk mean 4.2. Uji signifikansi proporsi 4.3. Keputusan dan Jenis Kesalahan dalam Uji 4.4. Keterbatasan Uji signifikansi 4.5. Menentukan peluang kesalahan tipe 2	9.1. Pemodelan Regresi dengan Variabel 9.2. Dummy untuk Kategori 9.3. Perbandingan Berganda Rata-rata 9.4. Membandingkan beberapa rerata 9.5. ANOVA dua-jalur dan Pemodelan regresi
BAB 5 Compare two group	
5.1. Data Kategorik: Membandingkan dua proporsi 5.2. Data Kuantitatif: Membandingkan dua mean 5.3. Membandingkan mean pada sample dependen	

The next development stage was carried out at SIPEJAR based on the analysis and design stages. Development is carried out based on dronagogy, so development will be directed as possible so that it is as if we have drones in SIPEJAR. The drone can function as a supervisor who ensures all learning material is accessed and listened to by students or as a director who guides students towards the learning goals of taking statistics courses for education. The development framework is based on (Norman et al., 2018).

In order to facilitate learning, the Mathematics Department is in the process of developing textbooks for their lecturers to use. These textbooks will serve as the primary reference source for students. To prepare the textbooks, a variety of literary sources have been adapted to fit the curriculum. An example of a textbook page can be seen in Figure 5.



BAB 1

PENDAHULUAN, SAMPLING, DAN PENGUKURAN

A. Pendahuluan tentang Metodologi Statistik

Beberapa tahun terakhir telah menyaksikan peningkatan dramatis dalam penggunaan metode statistik oleh ilmuwan sosial, baik mereka bekerja di akademisi, pemerintah, atau sektor swasta. Ilmuwan sosial mempelajari topik-topik yang diminati, seperti menganalisis seberapa baik suatu program bekerja atau menyelidiki faktor-faktor yang terkait dengan keyakinan dan opini dari jenis tertentu, dengan menganalisis bukti kuantitatif yang disediakan oleh data. Pertumbuhan Internet dan daya komputasi telah menghasilkan peningkatan dalam jumlah informasi kuantitatif yang tersedia dengan mudah. Pada saat yang sama, evolusi metodologi statistik dan perangkat lunak baru membuat metode-metode baru tersedia yang dapat lebih realistis mengatasi pertanyaan-pertanyaan yang ingin dijawab oleh ilmuwan sosial.

Figure 5 One of The Pages in The Statistics for Education Textbook

Dronagogy-based development is carried out by utilizing the features in SIPEJAR, for example, the part of displaying a page in SIPEJAR as displayed on Figure 6. Dronagogy is tried to be implemented by setting the page only to be displayed and not to be downloaded. Then, it is arranged that the quiz or practice questions are spread out on all pages so that students will be forced to open and read all the pages on that page.

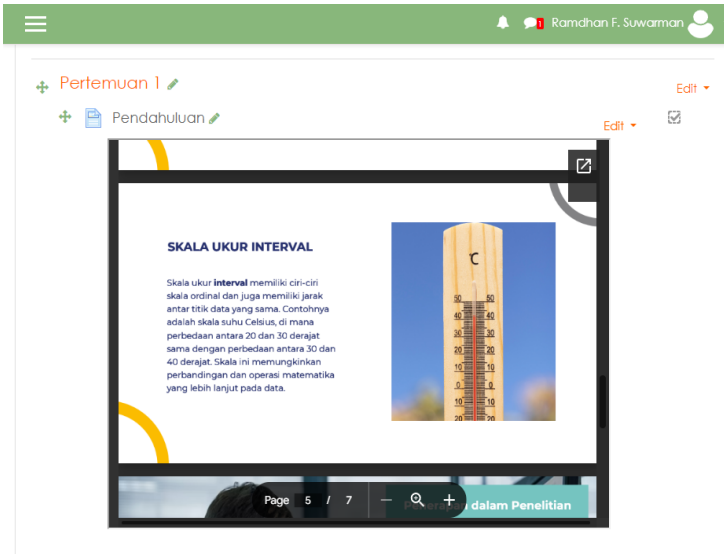


Figure 6 Example of A Presentation Slide Display on SIPEJAR

Dronagogy-based development is also carried out by utilizing third-party features embedded in SIPEJAR, for example, the mind map feature from MindUP. In this mind map, all students are asked to collaborate and contribute to the same mind map page as displayed on Figure 7.

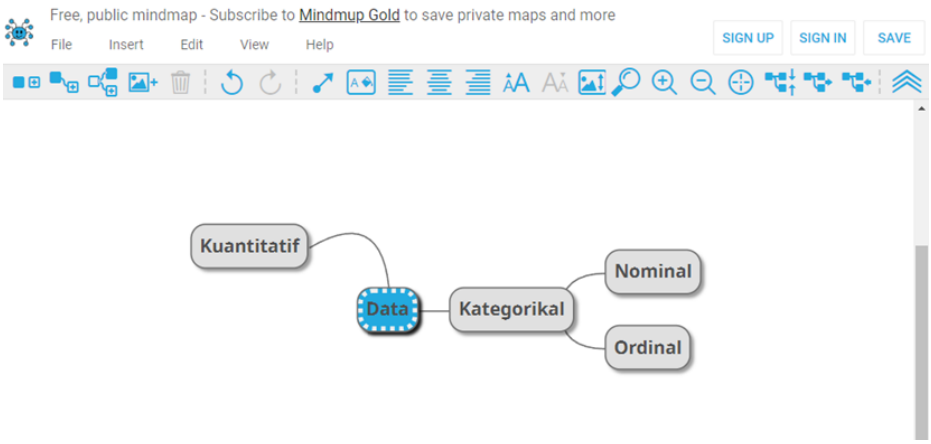


Figure 7 Mind map display on www.mindup.com

in general, the development of SIPEJAR based on dronagogy was carried out in the development of presentation slides, explanatory videos, and interactions between students with learning materials.

After development is complete, the product resulting from the development will be implemented at the implementation stage. In this case, SIPEJAR will be tried by limited people because SIPEJAR was prepared at the beginning of the odd semester and will be used generally in the even semester. SIPEJAR was tried by validators consisting of statistics lecturers (materials), media experts, linguists, and users. First, the researcher presented the results of developments related to SIPEJAR based on dronagogy in statistics for education courses and invited them to using SIPEJAR.

Finally, at the evaluation stage, after SIPEJAR has been tried by the validators and assessor. The analysis of the validity data of teaching materials was conducted and the results were presented in Table 2. The findings show that the teaching materials have an average score of 3.77, which falls under the category of being valid. This means that the interactive teaching materials developed are reliable and can be used confidently in a classroom setting. Additionally, the materials can be tested using the flipped-classroom or hybrid learning model to ensure that they are effective and can facilitate the learning process.

Based on the data presented in Table 3, it can be concluded that the teaching materials were evaluated for their practicality and received an average score of 4.19, placing them in the practical category. This suggests that the interactive teaching materials are highly effective in supporting the learning process and have the potential to be utilized in real-life learning situations. As such, they are a valuable resource for educators and learners alike. Overall, the data analysis confirms that the interactive teaching materials are not only useful but also practical, making them a dependable and effective tool for enhancing the learning experience.

Table 2 Results of the validity of teaching materials

Assessed Aspects	Average Score	Criteria
Material Aspects	3.76	Valid
Aspects of Learning	3.67	Valid
Aspects of Teaching Material	3.88	Valid
Average	3.77	

Table 3 Results of the practically of teaching materials

Assessed Aspects	Average Score	Criteria
Material Aspects	4.22	Practical
Aspects of Learning	4.26	Practical
Aspects of Teaching Material	4.11	Practical
Average	4.19	

To assess the effectiveness of student learning outcomes, an evaluation test was administered after each session. This test consisted of assessment questions to gauge the completeness of each student's evaluation. The results of this evaluation are presented in Table 4.

Table 4 Students Learning Outcome Evaluation Scores

No	Average Score	Results
1.	76.87	Completed
2.	80.24	Completed
3.	70.14	Not Completed
4.	62.56	Not Completed
5.	83.33	Completed
Average	74.63	

Based on the information provided in Table 4, it was discovered that out of the 5 students involved in the study, 2 students did not complete the evaluation test. This means that only 3 students completed the evaluation of learning outcomes after engaging in SIPEJAR.

The classical completeness percentage obtained was 60% with an average score of 74.63 in evaluating learning outcomes. These findings suggest that the developed drone-based development of SIPEJAR Statistical for Education course content packages by using ADDIE model is quite effective in improving student learning outcomes. Therefore, it cannot yet be concluded that SIPEJAR is a effective tool for enhancing student learning outcomes, and it can assist educators in developing more effective teaching techniques. This result could be caused by the fact that only 5 students were involved in the evaluation. More reliable results can be obtained once the developed content is provided to a larger number of students.

This study's findings are consistent with previously conducted research by (Maharani & Hidayah, 2024) and (Asmianto et al., 2024). These studies have demonstrated the effectiveness of the ADDIE model as a learning aid, highlighting the benefits of utilizing this model in the instructional process. Moreover, this study's results support the conclusions of (Shadiev & Yi, 2022) (Voštinár, 2023), which showed that the drone-based learning model is highly effective in online learning environments. Although the classical learning completion rates of the participants were quite effective in this study. However, this does not detract from the notion that the drone-based development of SIPEJAR statistical for education course content packages using the ADDIE model is a robust and reliable tool for enhancing the learning experience in online settings.

CONCLUSION

The development of the SIPEJAR statistics for education course for the Bachelor of Mathematics Education Program, Faculty of Mathematics and Natural Sciences, Universitas Negeri Malang was carried out using the ADDIE model based on dronagogy. As with the ADDIE model, development is carried out starting from the analysis, design, development, implementation, and evaluation stages. SIPEJAR development products include lesson plan, textbooks, and SIPEJAR content in the form of 14 presentation slides, 5 video explanations, 2 motion graphics, 5 infographics, 4 audio explanations, and 90 assessment questions. Dronagogy-based development is focused on developing explanatory videos, presentation slides, and student interaction with teaching materials. Dronagogy-based is carried out by utilizing various features in SIPEJAR and third-party applications that can be embedded into SIPEJAR. The finding results indicated that the drone-based development of SIPEJAR content packages is valid with a average score 3.77, practical with average score 4.19, and quite effective in improving student learning outcomes with classical completeness percentage obtained was 60% with an average score of 74.63. It means that SIPEJAR content packages that develop with drone-based have been well developed even though it has room to be improved even further.

In order to elevate the caliber of this content, there are various enhancements that can be made. These include refining the animation, augmenting the number of practice questions, standardizing the writing format, and furnishing feedback. Although the drone-based development of SIPEJAR holds promise as an alternative for SIPEJAR development, it necessitates substantial resources for its implementation.

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REFERENCES

Asmianto, Wahyuningsih, S., Azizah, Qohar, A., & Atan, N. A. (2024). *Design of geometry e-module for junior high school students based on gamification using the ADDIE model*. In *AIP Conference Proceedings* (Vol. 3049, No. 1, p.030004). AIP Publishing. https://doi.org/10.1063/5.0195629

Azari, R. (2021). Farhangian University E-learning System (LMS): Examining pros and cons Based on Professor-user personal experiences. *Journal of Pouyesh in Education and Consultation (JPEC)*, *1399*(13), 68–90.

Black, E. W., Dawson, K., Beck, D., & Dipietro, M. (2007). The other side of the LMS: Considering implementation and use in the adoption of an LMS in online and blended learning environments. *TechTrends*, *51*(2), 35–39. https://doi.org/10.1007/s11528-007-0024-x

Cahyadi, R. A. H. (2019). Pengembangan Bahan Ajar Berbasis Addie Model. *Halaqa: Islamic Education Journal*, *3*(1), 35–42. https://doi.org/10.21070/halaqa.v3i1.2124

Huong, V. T. M., Tung, N. T. T., Hong, T. T. M., & Hanoi National University of Education, Vietnam, tieumyhong@hnue.edu.vn. (2023). Teaching and Learning in Large Classes at Universities during the Covid-19 Pandemic: A view of Vietnamese Students. *International Journal of Instruction*, *16*(3), 307–324. https://doi.org/10.29333/iji.2023.16317a

Kasim, M., & Khalid, F. (2016). Choosing the Right Learning Management System (LMS) for the Higher Education Institution Context: A Systematic Review. *International Journal of Emerging Technologies in Learning (iJET)*, *11*(06), 55. https://doi.org/10.3991/ijet.v11i06.5644

Kirani, P., & Azhar, M. (2023). *Pengembangan Sistem Pembelajaran Flipped Classroom Berbasis Inkuiri Terstruktur Menggunakan Lms Moodle Pada Materi Laju Reaksi Kelas XI SMA/MA*. *7*.

Maharani, S. D., & Hidayah, I. N. (2024). *Development of E-LKPD based on the team-assisted individualization learning model using Wizer-me on social arithmetics*. 030013. https://doi.org/10.1063/5.0195460

Masdar Limbong, Firmansyah, Fauzi Fahmi, & Rabiatul Khairiah. (2022). Sumber Belajar Berbasis Media Pembelajaran Interaktif di Sekolah: Learning Resources Based on Interactive Learning Media in School. *Decode: Jurnal Pendidikan Teknologi Informasi*, *2*(1), 27–35. https://doi.org/10.51454/decode.v2i1.27

Muruganantham, G. (2005). *Developing of E-content package by using ADDIE model*.

Négyesi, P., Téglási, I. O., & Racsko, R. (2021). *Pros & cons of e-learning environments from an adaptivity perspective*. *7*.

Norman, H., Nordin, N., Embi, M. A., Zaini, H., & Ally, M. (2018). A Framework of Drone-based Learning (Dronagogy) for Higher Education in the Fourth Industrial Revolution. *International Journal of Engineering*.

Prasetyo, A., & Wulandari, A. (2020). Pembelajaran Daring: Tantangan dan Solusi. *Seminar Nasional Pendidikan Dan Pembelajaran*. Seminar Nasional Pendidikan dan Pembelajaran.

Rafi, I., Nurjannah, F. F., Fabella, I. R., & Andayani, S. (2020). Peluang dan Tantangan Pengintegrasian Learning Management System (LMS) dalam Pembelajaran Matematika di Indonesia. *Jurnal Tadris Matematika*, *3*(2), 229–248. https://doi.org/10.21274/jtm.2020.3.2.229-248

Rohmawati, L.. (2022). Efektivitas Penggunaan Media Pembelajaran Learning Management System (LMS) Sebagai Media Pembelajaran Daring Mahasiswa saat Pandemi Covid-19. *SINAU : Jurnal Ilmu Pendidikan Dan Humaniora*, *8*(1), 29–35. https://doi.org/10.37842/sinau.v8i1.77

Shadiev, R., & Yi, S. (2022). A systematic review of UAV applications to education. *Interactive Learning Environments*, 1–30. https://doi.org/10.1080/10494820.2022.2028858

Surjono, H. D. (2010). *Membangun Course E-Learning Berbasis Moodle*. Universitas Negeri Yogyakarta.

Universitas, N. M. (2020). *Peraturan Rektor Universitas Negeri Malang Nomor 24 Tahun 2020 tentang Pedoman Pendidikan Universitas Negeri Malang*. Universitas Negeri Malang

Utami, A. D., Rofiki, I., Listiawan, T., Darmawan, P., & Suwarman, R. F. (2023). *Pembelajaran Matematika di Era Digital: Tantangan, Strategi, dan Inovasinya* (1st ed.). Perkumpulan Rumah Cemerlang Indonesia.

Voštinár, P. (2023). Using Drones in Teaching Computer Science. *2023 46th MIPRO ICT and Electronics Convention (MIPRO)*, 899–904. https://doi.org/10.23919/MIPRO57284.2023.10159850