



## **Cisco Packet Tracer as a Learning Medium to Improve Student Motivation in Basic Computer Networking**

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### **ABSTRACT**

This study aims to analyze the effect of using Cisco Packet Tracer learning media on the learning motivation of 10th grade students at SMK Negeri 2 Gowa. The study uses a quantitative approach with a quasi-experimental design. Data collection was conducted through the distribution of questionnaires to measure students' learning motivation levels before and after the use of learning media, as well as observations to support the quantitative results obtained. The results of the study indicate that there was an increase in student learning motivation after the implementation of Cisco Packet Tracer learning media. This media allows students to perform interactive computer network simulations, making learning more interesting and easier to understand. The use of Cisco Packet Tracer provides a more contextual learning experience, particularly in computer and network engineering skills. Thus, this technology-based simulation media can be used as an effective learning alternative to increase student learning motivation in vocational high schools.

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## **INTRODUCTION**

Vocational education is a vital component of the national education system that plays a strategic role in preparing competent graduates who are ready to enter the workforce. Vocational education, particularly at the vocational high school (SMK) level, is aimed at producing human resources who not only have theoretical knowledge but also strong technical skills in line with the needs of Industry 4.0 (Turnip, 2023). Efforts to improve the quality of learning in SMK do not only rely on the curriculum but also on the effective implementation of Information and Communication Technology (ICT), which has been proven to increase the efficiency and relevance of learning in line with the demands of the times (Repi et al., 2021). However, the main challenge often faced is how to integrate relevant learning media so that material can be delivered optimally. This urgency is particularly evident in the Computer Network and Telecommunications Engineering (TJKT) program, a leading major that focuses on equipping students with the skills to design, configure, and manage computer networks. Since this competency requires a deep understanding of hardware and logical configurations that are often abstract, teaching methods in computer networking require a specific approach so that students can visualize complex concepts (Prvan & OžEGOVIĆ, 2020). Consequently, the need for these skills requires a contextual and applied learning process, where the use of appropriate practicum modules can help students become accustomed to practices that are close to actual industry conditions (Rozi & Rahmawati, 2021).

Learning media plays a crucial role as a tool to deliver material effectively and efficiently, acting as a vital bridge between complex concepts and student understanding. The right media can help educators deliver material clearly and interestingly, as well as facilitate students in internalizing the lesson material (Sumual et al., 2025). In the context of modern pedagogy, the integration of digital media, including interactive games, has been proven to improve problem-solving skills and make learning more enjoyable (Candra & Rahayu, 2021). This is in line with findings that educational game-based learning media can improve students' technical competencies, such as programming or network logic skills (Ulumudin & Sujatmiko, 2023). This active involvement triggered by interactive media is very important to overcome the challenge of learning motivation in complex technical subjects. Understanding this dynamic is essential because learning motivation is a fundamental factor that influences student success. Specifically, high motivation can lead to a psychological state known as 'flow'; in motivation theory, flow occurs when students are fully engaged in tasks that are challenging but within their capabilities (Csikszentmihalyi, 2014). To achieve this optimal learning state practically, the use of project-based learning models supported by simulation media has been proven to create these conditions and significantly improve student learning outcomes (Lubis & Bahri, 2023).

One of the most relevant simulation-based learning media for vocational network education is Cisco Packet Tracer, which serves as a critical solution to the resource constraints often faced by schools. This application was developed by Cisco Systems to aid in understanding network concepts through visual simulations without the need for expensive physical hardware (Systems, 2025). By eliminating the financial burden and risk of hardware damage, this software allows students to experiment freely, creating a safe environment for trial and error. Reflecting this utility, the development of interactive learning media based on Cisco Packet Tracer has been widely carried out and proven to be valid and practical for use in network infrastructure administration courses (Mahendra & Yeni, 2020). The validity of this approach is not just theoretical but is strongly supported by quantitative evidence from the field, where various empirical studies reinforce the effectiveness of this media. Research by Atjo et al., (2023) confirms that the use of Cisco Packet Tracer has a significant effect on student motivation and learning outcomes in basic networking subjects; specifically, students who use this simulator show improved performance compared to the control class. Moreover, the versatility of this tool extends beyond basic configurations, as the use of this software is also effective in simulating more specific material, such as cellular networks and telecommunications terminals (Yunita et al., 2024), proving its adaptability across various technical competencies.

Implementation studies in various schools consistently demonstrate that Cisco Packet Tracer is an effective simulation-based learning medium in vocational education. At SMK Tarbiyatul Banin-Banat Montong, its use provided a realistic representation of network topology and increased student participation by connecting theoretical knowledge with hands-on practice in contexts constrained by limited physical infrastructure (Amran & Syaharani, 2024). Similar outcomes were reported at SMK Muhammadiyah 2 Tangerang, where the application of Packet Tracer strengthened students' technical understanding, procedural accuracy, and readiness for real-world networking tasks, underscoring its relevance to industry-oriented learning in vocational settings (Yulizar, 2025). Furthermore, the integration of Packet Tracer into interactive e-learning environments has been shown to enhance learning effectiveness and student engagement by enabling flexible learning pathways, repeated practice, and immediate feedback (Bunga et al., 2025). These advantages are reinforced by findings from game-based media development studies, which indicate that rich visualization and interactivity facilitate students' comprehension of abstract networking concepts such as IP addressing, reduce cognitive load, and

support sustained learning motivation (Dunggio et al., 2025), thereby positioning simulation-based media as a strategic component in improving the quality of computer network instruction at the vocational level. Implementation studies in various schools consistently demonstrate that Cisco Packet Tracer is an effective simulation-based learning medium in vocational education. At SMK Tarbiyatul Banin-Banat Montong, its use provided a realistic representation of network topology and increased student participation by connecting theoretical knowledge with hands-on practice in contexts constrained by limited physical infrastructure (Amran & Syaharani, 2024). Similar outcomes were reported at SMK Muhammadiyah 2 Tangerang, where the application of Packet Tracer strengthened students' technical understanding, procedural accuracy, and readiness for real-world networking tasks, underscoring its relevance to industry-oriented learning in vocational settings (Yulizar, 2025). Furthermore, the integration of Packet Tracer into interactive e-learning environments has been shown to enhance learning effectiveness and student engagement by enabling flexible learning pathways, repeated practice, and immediate feedback (Bunga et al., 2025). These advantages are reinforced by findings from game-based media development studies, which indicate that rich visualization and interactivity facilitate students' comprehension of abstract networking concepts such as IP addressing, reduce cognitive load, and support sustained learning motivation (Dunggio et al., 2025), thereby positioning simulation-based media as a strategic component in improving the quality of computer network instruction at the vocational level.

Technological advances in vocational education not only have an impact on technical aspects but also strengthen students' digital literacy through simulation activities that transform abstract concepts into concrete ones (Sumual et al., 2025; Turnip, 2023) Although many studies have described the benefits of Cisco Packet Tracer, studies that specifically analyze its impact on the learning motivation of 10th grade students in the TJKT program at SMK Negeri 2 Gowa are still limited. This study aims to fill this gap by empirically measuring the effect of the application of Cisco Packet Tracer on student learning motivation, so that it can be used as a reference for effective technology-based learning strategies.

## METHOD

The research was conducted using a quasi-experimental approach and pretest and posttest with a group design. The subjects of the study were students from class X TJKT SMK Negeri 2 Gowa, who were divided into two groups. Students from class X TJKT SMK Negeri 2 Gowa, who were the subjects of the study, were divided into two groups: the experimental group, which used Cisco Packet Tracer media, and the control group, which used conventional learning media. The groups were divided randomly, taking into account the students' initial abilities based on the results of a pretest of learning motivation administered before the learning began. The researcher then administered a posttest at the end of the learning period. Statistical tests were used to compare the results of changes in learning motivation between the experimental group and the control group. Normality tests were used to ensure data distribution, and hypothesis tests were used to identify the significance of the differences between the two groups. The results of the students' pretest and posttest were then analyzed using the t-test, namely the independent t-test or the paired t-test.

**Table 1.** Pretest and Posttest Research Design

Class	Pretest.	Treatment	Posttest.
Experiment	O <sub>1</sub>	X <sub>1</sub>	O <sub>2</sub>

Control      O<sub>1</sub>      X<sub>2</sub>      O<sub>2</sub>

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Description:

O<sub>1</sub> : Results of the Pretest

O<sub>2</sub> : Post-test results

X<sub>1</sub> : Use of Cisco media

X<sub>2</sub> : Use of conventional media

The following normalized gain equation is used to determine the increase in student learning motivation by comparing students' pretest and posttest scores, thereby measuring the effectiveness of the learning intervention relative to the maximum possible improvement. The normalized gain (N-gain) provides a more accurate description of learning improvement because it accounts for students' initial motivation levels and avoids bias caused by ceiling effects. This approach has been widely used in educational research to evaluate the impact of instructional strategies and learning media on cognitive and affective learning outcomes (Hake, 1998).

$$g = \frac{S_f - S_i}{S_{max} - S_i}$$

Description:

S<sub>f</sub> = Final score (posttest)

S<sub>i</sub> = Initial score (pretest)

S<sub>max</sub> = Maximum value

g = gain

The t-test sample was employed to determine whether there was a significant difference in learning motivation between students in the experimental group and those in the control group after the implementation of the learning media. Prior to hypothesis testing, prerequisite analyses were conducted, including tests of normality and homogeneity, to ensure that the data met the assumptions required for parametric statistical analysis (Sugiono, 2013). All statistical procedures were performed using the SPSS software with a significance level set at 0.05, corresponding to a 95% confidence interval. The hypotheses formulated in this study were designed to examine whether the application of the Cisco Packet Tracer learning media resulted in a statistically significant improvement in students' learning motivation compared to conventional learning methods. The hypotheses used in this study are as follows:

Ho :	There is no evidence that there is a significant difference between students in the experimental group and students in the control group in terms of increased learning motivation among students.
Ha :	There is evidence that the experimental group class and the control group class differ in terms of increasing student learning motivation.

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## RESULTS AND DISCUSSION

This study aims to analyze the effectiveness of Cisco Packet Tracer learning media in increasing the learning motivation of 10th grade students majoring in Computer Network Engineering and Telecommunications (TJKT) at SMK Negeri 2 Gowa. The research design used was a quasi-experiment involving two groups, namely the experimental class and the control class. The experimental class was given treatment in the form of learning using Cisco Packet Tracer simulation media, while the control class followed learning with conventional media commonly used in schools, such as textbooks and PowerPoint presentations. The selection of these two treatments was intended to objectively compare the differences in student learning motivation levels between simulation-based learning and conventional learning.

The learning material used in this study refers to the subject of Basic TJKT Skills, specifically computer networking competencies. This material was chosen because it requires a high level of conceptual understanding and practical skills, making it highly relevant for implementation through simulation media. Before learning began, all students in both classes were asked to fill out a learning motivation questionnaire as a pretest instrument to identify their initial motivation levels. After the learning process was completed, the same questionnaire was given again as a posttest to obtain data on learning motivation after the treatment.

The data analyzed in this study were changes in students' learning motivation scores between the pretest and posttest. These score changes were then used to determine the level of increase in learning motivation in each class. The results of the analysis showed an increase in the average learning motivation in both the experimental and control classes. However, the increase in the experimental class was higher than that in the control class, indicating that the use of Cisco Packet Tracer learning media contributed more significantly to the increase in student learning motivation. These findings formed the basis for comparing the effectiveness of the two learning approaches, as presented in the following research results.

**Table 2.** Results of Learning Motivation Measurement

<b>Class</b>	<b>Number of students</b>	<b>Pretest.</b>	<b>Posttest</b>	<b>Gain</b>
Experiment	30	68,37	91.77	73,73
Control	30	69,70	85.57	52.20

The results of descriptive analysis show that before the treatment was given, the level of learning motivation of students in the experimental class and the control class were relatively comparable. The average pretest score for learning motivation in the experimental class was 68.37, while the control class had a slightly higher average score of 69.70. This small difference indicates that the initial abilities and learning motivation conditions of the two groups were at almost the same level, making the two classes suitable for comparison in this study.

After the learning media implementation stage was carried out, there was an increase in learning motivation in both groups. However, this increase showed a striking difference. In the experimental class that used Cisco Packet Tracer learning media, the average score for student learning motivation increased significantly to 91.77. Meanwhile, in the control class that used

conventional learning media, the increase in learning motivation only reached an average score of 85.57. These findings indicate that simulation-based learning through Cisco Packet Tracer provides a more interesting, challenging, and relevant learning experience for students, thereby encouraging higher learning motivation compared to conventional learning.

To analyze the magnitude of the increase in learning motivation more objectively, the pretest and posttest data were further analyzed using the normalized gain equation. The use of normalized gain aims to determine the level of effectiveness of the increase in learning motivation by considering the students' initial scores. The results show that the gain value in the experimental class is higher than that in the control class, confirming that the increase in learning motivation in the experimental class is not only greater in absolute terms but also more effective in proportional terms.

Furthermore, to determine whether the difference in learning motivation between the experimental and control classes is statistically significant, an independent t-sample test was conducted. Before the t-test was conducted, the data was first tested for prerequisites, namely normality and homogeneity. The normality test results showed that the learning motivation data in both groups was normally distributed, while the homogeneity test showed that the variance of the two groups was homogeneous. With both prerequisites fulfilled, the independent t-sample test was suitable for use.

The results of the independent t-sample test, as shown in the table, indicate a significant difference between the increase in learning motivation of students in the experimental class and the control class. These findings reinforce the conclusion that the use of Cisco Packet Tracer learning media has a significant effect on increasing the learning motivation of grade X TJKT students at SMK Negeri 2 Gowa compared to the use of conventional learning media. Thus, Cisco Packet Tracer simulation media can be considered an effective alternative learning media to increase student learning motivation in basic computer networking subjects.

**Table 3.** Results of the Normality Test for Learning Motivation

<b>Class</b>	<b>N</b>	<b>Mean</b>	<b>Std. Deviation</b>	<b>sig</b>
Experiment	30	91.77	1.501	.274
Control	30	85.57	2.932	.535

The normality test results show that the data on the increase in student learning motivation in the experimental class and control class are normally distributed. This is indicated by the significance value (sig.) in the experimental class of 0.274, which is above the threshold value of 0.05. This value indicates that there is no significant difference between the empirical data distribution and the normal distribution, so the data can be said to meet the normality assumption. This condition is important because parametric statistical tests, such as the independent sample t-test, require normally distributed data for the test results to be valid and interpretable.

The fulfillment of the normality assumption in the experimental class shows that the variation in the increase in student learning motivation after the application of the Cisco Packet Tracer learning media is spread reasonably around the mean value, without any extreme deviations. Thus, the data obtained reflects the population conditions representatively and allows

researchers to make objective comparisons between the experimental class and the control class. Therefore, the results of this normality test provide a strong basis for conducting homogeneity tests and independent sample t-tests to test the significance of differences in learning motivation improvement between the two groups.

**Table 4.** Results of Homogeneity Test and Independent Sample t-test

		<b>Levene's Test for Equality of Variances</b>				
		<b>F</b>	<b>Sig.</b>	<b>t</b>	<b>df</b>	<b>Sig. (2- tailed)</b>
Post Test	Equal variances assumed	11.372	.001	10.308	58	.000
	Equal variances not assumed			10.308	43.226	.000

Based on the table presented, the results of the homogeneity test and the independent sample t-test show a significance value of 0.001, which is smaller than the significance limit of 0.05. According to the concept of learning media use that emphasizes active student involvement in the learning process (Mulyanta, 2009)(Mulyanta, 2009), these findings indicate a statistically significant difference between the learning motivation of students in the experimental class and the control class after the treatment was applied. Thus, the null hypothesis ( $H_0$ ), which states that there is no difference in learning motivation between the two groups, is rejected, while the alternative hypothesis ( $H_a$ ), which states that there is a difference in learning motivation, is accepted.

The results of this study indicate that students in the experimental class experienced a higher increase in learning motivation after participating in learning using Cisco Packet Tracer media. This increase shows that the application of simulation-based learning media can create a more interesting and challenging learning atmosphere for students. Through the use of Cisco Packet Tracer, students not only receive material passively, but are also directly involved in the learning process through activities such as designing, configuring, and testing computer networks virtually. This provides a more concrete and contextual learning experience, so that students feel that learning is more relevant to the world of work they will face.

In line with the view that learning media serves as a means to foster student interest and engagement, the use of simulation media encourages students to be more active in exploring previously abstract concepts of computer networks. Simulation activities allow students to experiment repeatedly without fear of making mistakes, thereby fostering confidence and

curiosity. This active involvement contributes to increased student attention during learning, as they focus on the task at hand and are interested in completing each stage of the simulation.

Furthermore, increased learning motivation is also reflected in students' increased perseverance and enthusiasm in participating in learning. Students become more persistent in completing tasks, more active in asking questions, and show greater interest in understanding the material in depth. This shows that learning media not only serves as a tool for delivering material, but also as a strategic factor that can influence students' learning attitudes and behavior. Therefore, these findings reinforce the role of simulation-based learning media, such as Cisco Packet Tracer, as an important component in increasing student learning motivation, especially in vocational subjects that require direct technical understanding and practical skills.

### **CONCLUSIONS**

Based on the results of this study, it can be concluded that the use of Cisco Packet Tracer learning media has been proven effective in increasing the learning motivation of 10th grade TJKT students at SMK Negeri 2 Gowa through a more interactive and contextual learning experience. This media is able to encourage active student involvement and increase interest and enthusiasm in computer network learning. However, this study still has limitations because it only focuses on the aspect of learning motivation, involves subjects limited to one school, and uses a relatively short implementation period. Therefore, further research is recommended to integrate Cisco Packet Tracer with a project-based learning approach to develop students' competencies holistically, as well as to expand the scope of subjects, variables, and research time in order to obtain more comprehensive results.

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### **REFERENCES**

- Amran, A., & Syaharani, H. (2024). Implementation of Cisco Packet Tracer as Network Simulation in Educational Environment at SMK Tarbiyatul Banin-Banat Montong School. *Jurnal Mandiri IT*. <https://doi.org/10.35335/mandiri.v13i1.312>
- Atjo, M. F., Olii, D., Manggopa, H., & Rompas, P. T. D. (2023). The Effect of Packet Tracer Simulator Media on Motivation and Learning Outcomes of Basic Network TKJ Students of Cokroaminoto Vocational School, Kotamobagu. *International Journal of Information Technology and Education*, 2(2), 26–44. <https://doi.org/10.62711/ijite.v2i2.103>
- Bunga, N. B. I., Ulfa, N., Jufri, & Setiawan, A. (2025). Media E-Learning Interaktif Berbasis Cisco Packet Tracer dalam Pembelajaran Jaringan Komputer di SMK TKJ. *Pendas : Jurnal Ilmiah Pendidikan Dasar*. <https://doi.org/10.23969/jp.v10i2.26320>
- Candra, A. M., & Rahayu, T. S. (2021). Pengembangan Media Pembelajaran Berbasis Game Interaktif untuk Meningkatkan Kemampuan Pemecahan Masalah Tematik di Sekolah Dasar. *Jurnal Basicedu*, 5(4), 2311–2321. <https://doi.org/10.31004/basicedu.v5i4.1212>
- Csikszentmihalyi, M. (2014). *Flow: The Psychology of Optimal Experience*. Harper & Row.

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- Dunggio, M. S., Mulyanto, A., Hermila, A., Rohandi, M., Olii, S., & Dangkoa, E. V. (2025). *Pengembangan Media Pembelajaran Berbasis Game pada Materi Konsep IP Address di SMKN 1 Limboto*. 37–45.
- Hake, R. R. (1998). Interactive-engagement versus traditional methods: A six-thousand-student survey of mechanics test data for introductory physics courses. *American Journal of Physics*, 66(1), 64–74. <https://doi.org/10.1119/1.18809>
- Lubis, A. H. A. S., & Bahri, S. B. (2023). *Meningkatkan Hasil Belajar Siswa SMK Melalui Model Project Based Learning Dengan Media Cisco Packet Tracer*. <https://consensus.app/papers/meningkatkan-hasil-belajar-siswa-smk-melalui-model-lubis-bahri/2e5aafb944585d6b8f5d6801d9b286d8/>
- Mahendra, B., & Yeni, F. (2020). *Pengembangan Media Pembelajaran Interaktif Berbasis Aplikasi Cisco Packet Tracer pada Mata Pelajaran Administrasi Infrastruktur Jaringan di SMK*. <https://consensus.app/papers/pengembangan-media-pembelajaran-iteraktif-berbasis-mahendra1-yeni/172ad1226fac5c51b68e45680e8dec46/>
- Mulyanta. (2009). *Tutorial Membangun Media Interaktif Media Pembelajaran*. Universitas Atma Jaya.
- Prvan, M., & OŽEGOVIĆ, J. (2020). Methods in Teaching Computer Networks: A Literature Review. *ACM Trans. Comput. Educ.*, 20(3). <https://doi.org/10.1145/3394963>
- Repi, Y. M., Wonggo, D., & Liando, O. E. S. (2021). Implementasi Pembelajaran TIK di Sekolah Menengah Kejuruan. *EduTIK: Jurnal Pendidikan Teknologi Informasi Dan Komunikasi*, 2(5), 773.
- Rozi, F., & Rahmawati, N. R. (2021). Penerapan Modul Praktikum Jaringan Komunikasi Data dan Komputer Berbasis Cisco Packet Tracer Version 7.3.1.0362. *Journal of Informatics and Communications Technology (JICT)*, 3(1), 10–19.
- Sugiono, M. (2013). *Metode Penelitian Pendidikan*. Alfabeta.
- Sumual, S. D. M., Liow, S. S. Y., & Jhony, K. (2025). Implementasi Pembelajaran Berbasis TIK dalam Pendidikan: Studi Literatur tentang Manfaat, Hambatan, dan Strategi Pengembangan. *Eduatik : Jurnal Pendidikan Teknologi Informasi Dan Komunikasi*, 239.
- Systems, C. (2025). *Packet Tracer*. [https://en.wikipedia.org/wiki/Packet\\_Tracer](https://en.wikipedia.org/wiki/Packet_Tracer)
- Turnip, R. S. (2023). Peningkatan Literasi Digital di Kalangan Pelajar: Pengenalan dan Praktik Penggunaan Teknologi Pendidikan. *Jurnal Review Pendidikan Dan Pengajaran*, 6(4), 21733. <https://doi.org/10.31004/jrpp.v6i4.21733>
- Ulumudin, F. N., & Sujatmiko, B. (2023). Pengembangan Media Pembelajaran Berbasis Game Edukasi Running Maze untuk Meningkatkan Kompetensi Memprogram Siswa. *IT-Edu: Jurnal Information Technology and Education*, 8(3), 1–8. <https://doi.org/10.26740/it-edu.v8i3.56999>
- Yulizar, V. (2025). Pemanfaatan Cisco Packet Tracer dalam Pembelajaran Jaringan Komputer di SMK Muhammadiyah 2 Tangerang. *Journal of Management and Business (MASS)*, 2(01), 19–39.
- Yunita, Mubarak, M. A. N., Firmansyah, A. F. T., & Aribowo, D. (2024). Penggunaan Software Cisco Packet Tracer dalam Simulasi Jaringan Seluler pada Pembelajaran Materi Terminal Telekomunikasi. *Jupiter: Publikasi Ilmu Keteknikan Industri, Teknik Elektro Dan Informatika*, 2(3), 26–33. <https://doi.org/10.61132/jupiter.v2i3.270>