Assessing the Effects of Packet Tracer on the Performance of Information Technology Students in Advanced Networking

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The study aimed to assess the effects of packet tracers on the performance of information technology students in their advanced networking subject. It utilized a mixed-methods type of research. The study's respondents are the 365 3rd year students enrolled in the 2nd semester of the school year 2022-2023 at the College of Information and Communications Technology, Bulacan State University, Philippines. The results of the study indicate that in terms of (1) software engineering aspects, the weighted mean is 4.27, which means that students agreed that packet tracer has a high score for usability, accessibility, and technical quality, suggesting that the application is easy to use, stable, and accessible to students, (2) learning aspects 4.32, the students had an overall positive view of the application's utilization in terms of material compatibility, learning design, and learning usage, (3) display aspects, 4. 28 indicating that students had an overall positive view of the application's utilization in terms of multimedia document, navigation, and design media. Regarding its advantages, the identified themes were technical quality, accessibility, usability, and learning design. Furthermore, the following are the problems encountered by Information Technology students as regards the utilization of the packet tracer in advanced networking: technical difficulties, user interface, limited features, and lack of support. On the other hand, the regression test results suggest no significant relationship between the student's final grade and the predictors included in the model. Therefore, the predictors may not be helpful in predicting the students' final grades in the survey context. Other variables not included in the model may substantially influence the student's final grade.

Keywords: Packet Tracer, Advanced Networking, Performance, Information Technology.

1. Introduction

Information technology courses must cover advanced networking concepts and technologies, and networking is one of those courses. Studying computer network features, protocols, network architectures, and network security is part of the course. According to Allison (2022), the critical component of a computing undergraduate's education is teaching and

learning computer networks. However, it may be hard for students to understand because it involves abstract theory. In a secure, user-friendly setting, simulation-based learning can be utilized as a teaching tool to improve networking-based lecture topics and assist students in better understanding and visualizing how it works. It is common for students taking networking courses to spend time in labs, and scheduling larger classes can make it challenging to ensure that each student has enough access to the necessary tools (Janitor et al., 2010, as cited in Allison, 2022).

Moreover, it cannot be easy to implement complex networking assignments and projects in educational contexts (Sllame & Jafaray, 2010; Reddy et al., 2020). In practice, real-life scenarios without enough direction may be too much for students to handle (Bryd, 2019). Hence, Advanced Networking is a critical subject in Information Technology that covers advanced concepts and technologies related to Networking. It involves studying the advanced features of computer networks, protocols, network architectures, and network security.

Students presenting basic computer network ideas and technologies in a traditional lecture style tend to perceive the subjects as somewhat abstract, making it challenging to encourage them to study them. One of the primary issues with network devices is that students frequently cannot observe or access the actual network equipment and cannot analyze the data packages arriving from the numerous network devices (Zhang et al., 2012).

Giving them access to network simulation software is one alternative strategy. While simulators can't teach students some practical skills, like wiring or connecting actual equipment, they offer a helpful and affordable way to grasp the principles of computer networks, protocols, and applications more thoroughly than traditional tools do.

Likewise, Shanmugam et al. (2011) created techniques to imitate the void between theoretical lectures and laboratory practice to improve students' learning outcomes. According to the study, students who used the Cisco Packet Tracer had significantly better skills in building network topologies and troubleshooting issues. The routing protocol is chosen as a case study to examine the usefulness of utilizing Cisco Packet Tracer as a learning tool in computer network courses based on related prior works.

Caparkada (2015) stated that Cisco Packet Tracer (P.T.) is teaching and learning virtual networking simulation software developed by Cisco Systems Inc. and widely used by the students participating in CCNA or CCNP courses offered by Cisco Networking Academy Program (CAN). Concerning the network operating system on specific devices, P.T. provides a virtual network environment. Using P.T., you can create realistic simulations of different networking structures, configure network systems, and troubleshoot networks. Although P.T. is an interactive program with a graphical user interface (GUI), it gives students access to a text-based CLI (Command Line Interface) for configuring network devices. Students can type partial Cisco IOS commands using the CLI. Most Cisco routers and modern switches use Cisco IOS as their network infrastructure software.

Students from the College of Information and Communications Technology also experienced hardships in understanding advanced networking subjects as per the interview among selected students. Advanced networking concepts are complex and abstract, making

understanding and applying them in practical scenarios difficult. It likewise involves a lot of technical jargon and acronyms, which can be overwhelming and confusing for beginners. Moreso, students need hands- on experience with networking equipment and software. It can be challenging if you don't have access to the necessary resources. However, the packet tracer helps them simulate actual networking processes and makes it easier to understand the subject.

Thus, the researcher aims to assess the effects of packet tracers on the performance of I.T. students in the advanced networking subject. The result helps students gain more practical experience with Packet Tracer, and they can be better prepared for careers in networking and related fields.

Statement of the Problem

1. How may the Packet Tracer Application be described in terms of:

1.1 Software Engineering Aspects;

1.2 Learning Aspects; and

1.3 Display Aspects?

2. What is the performance of Information Technology Students in the Advanced Networking subject?

3. Are there any significant effects of the utilization of Packet Tracer Applications on the Performance of Information Technology Students in the Advanced Networking Subject?

4. What are the advantages of using the Packet Tracer Application in the Advanced Networking Subject?

5. What problems are encountered using the Packet Tracer Application in the Advanced Networking Subject among Information Technology students?

2. Review of Related Literature

Packet Tracer Application

Cisco Packet Tracer is a powerful network simulation program that allows students to experiment with network behavior. It is free for Cisco Network Academy. Packet tracer provides network simulation, visualization, and collaboration capabilities (Zhang et al., 2012). Cisco created Packet Tracer, a program that simulates virtual networking and helps users learn and comprehend various network principles. Students can interact with numerous networking devices by altering their setups, turning them on and off, and other actions. Networking devices appear in packet tracers as they do in reality. After working in a virtual environment with Packet Tracer, a student will feel more confident working in a real-world setting because it is an easy-to-use instructional tool. When a packet doesn't reach its destination, students can learn how to troubleshoot a network and follow the course of that packet as it travels from source to destination. Using Packet Tracer, you may create several situations to help you understand ideas more clearly (Javid, 2014).

Cisco Networking Academy provides students with a comprehensive 21st-century learning experience that helps them develop basic ICT skills needed to design, build, and manage networks, as well as problem-solving, collaboration, and critical thinking. Students complete practical learning activities and network simulations to develop application skills that will help them meet the growing need for network specialists worldwide (Abdulkareem, 2018). Packet Tracer provides a virtual network environment with substantial details of the network operating system on individual devices. Packet Tracer allows the creation of realistic scenarios of various networking structures, network system configuration, and network troubleshooting. Packet Tracer is a graphically based (GUI) interactive software, but it also provides students with a text-based CLI (Command Line Interface) available for configuring network devices. The CLI allows students to enter partial Cisco IOS commands. Cisco IOS is network infrastructure software used on most Cisco routers and current switches (Cabarkapa, 2015).

Performance in Advanced Networking

Improvement of student performance and the quality of education is of utmost importance for all educational institutions. One way to assist students' success and boost the quality of education is to follow up on student performance and identify factors affecting students' achievements (Sokkhey & Okazaki, 2019). Likewise, Zerbini et al. (2017) posited that success at school determines future career opportunities. Education is The gateway to success since it influences what pupils learn and perform during primary and secondary education, which affects their future career opportunities.

Similalry, learning is a system made up of different parts. One of the components of learning is media. Anything, including hardware (concepts and settings) and software (technologies), is considered learning media. Learning resources' content can be communicated to students (individually or in groups) using media, which can pique their interest and excite their thoughts, feelings, and concerns. This makes learning (inside and outside of the classroom) more efficient. The evolution of technology and changes in numerous domains, such as communication and information technology, have made learning media an integral part of the educational process rather than just a tool. In this situation, professionally designed instructional materials can raise the standard of education by making learning engaging and beneficial (Ambiyar et al., 2019).

Moreover, an evaluation is a further aspect of learning. The entire process of using instructional media includes evaluation. A phase that must be completed or passed is evaluation. The method of assessing the adequacy of learning and learning is called evaluation. To ascertain whether learning is appropriate and whether the efficacy and efficiency of media used in the teaching-learning process may achieve the goal that has been defined, the evaluation of instructional media is a process or activity. Along with effectiveness and efficiency, the examination considers accessibility, impact, relevance, and sustainability.

The evaluation of network performance using a simulation program has attracted much attention recently. However, from a scientific perspective, how performance affects a network's users is far less clear. This study will serve as a practical manual for comprehending how to put together and analyze different metrics in the evaluation of

network performance, as well as what to consider when creating a network to eliminate the factors that lead to decreased performance.

The network configuration that was carried out virtually in simulation software can be carried out in a real-world setting. After completing these courses, participants will be able to control the settings as needed and establish the LAN, WAN, WLAN, and WWAN network designs as well as the setup of active network devices such routers and switches. Every level that makes use of the network service as a result increases the enterprise's profitability. Consequently, the higher profits support ongoing and future expenditures in enhancing the services' performance network (Hashimi & Güneş, 2017).

3. Methodology

In this study, mixed-methods research was employed. Research used quantitative and qualitative methodologies (Halcomb & Hickman, 2015). Mixed techniques leverage the strengths and flaws of qualitative and quantitative approaches to produce an integrated, thorough understanding of the topic under investigation (Scammon et al., 2013).

The subject of the study is third-year students from the Bachelor of Science in Information Technology (BSIT) degree program. The respondents comprised a total of 365 students enrolled in the 2nd semester of S.Y. 2022-2023 at the College of Information and Communications Technology Bulacan State University, Philippines.

A validated instrument was adopted from the study of Ambiyar et al. (2019) and used to measure the effects of a tracer packet on the performance of Information Technology students in advanced networking subject.

4. Results and Discussion

Aspects of the Packet Tracer Application

Packet Tracer, developed by Cisco Systems, is a powerful tool that allows students to design, configure, and troubleshoot networks in a virtual environment. However, it is vital to understand how students perceive the application and its use in the learning process. To this end, a survey was conducted among 365 IT students to assess their perceptions of the various aspects of the Packet Tracer application, including its technical quality, instruction usefulness, accessibility, usability, material compatibility, learning design, multimedia document, navigation, and design media.

In this section, the researcher presented the descriptive results of the survey, including the mean scores for each aspect and their corresponding interpretations. By examining the students' perceptions of the various aspects of the Packet Tracer application, one can gain valuable insights into how it is being used and how it can be improved to better support I.T. students in their learning journey.

Software Engineering. Based on the results of the survey, it appears that the utilization of the Packet Tracer application is highly appreciated among the students. The mean score for the technical quality indicator, "Packet tracer media has provided service to many users (users),"

was 4.52, indicating that the majority of students strongly agree with this statement. Similarly, the mean score for the indicator, "Packet tracer media has good stability moment," was 4.26, which indicates that most students agree with this statement.

Regarding the Instruction Usefulness criterion, students appeared to have positive views about the usability of Packet Tracer. Both indicators, "Packet tracer media is conveniently used in the process" and "Packet tracer media is very user-friendly and not confusing inside," had mean scores of 4.28 and 4.06, respectively. These scores suggest that students found the application to be useful and not too complicated to navigate.

In terms of Accessibility, the mean score for both indicators, "Packet tracer media is easy to run in various software and hardware" and "Application opening speed of Packet tracer media is fast," were 4.27 and 4.29, respectively. This indicates that most students agreed that the application was easy to access and had fast loading times.

The Usability criterion had four indicators, all of which had mean scores above 4. The highest mean score was for "Packet tracer media is easy to be used in the group learning process," which had a mean score of 4.42. The other indicators, "Packet tracer media is easy to be used by students from a background of that different ability," "Packet tracer media is easy to be used in the process of learning independently," and "Packet tracer media is comfortable in operating it," had mean scores of 4.12, 4.14, and 4.30, respectively.

Overall, the mean score for all indicators was 4.27, indicating that students had an overall positive view of the application's utilization.

Furthermore, it can be inferred that Packet Tracer is an effective tool for facilitating learning in the classroom. The high scores for usability, accessibility, and technical quality suggest that the application is easy to use, stable, and accessible to students. Therefore, educators and instructional designers should continue to incorporate Packet Tracer into their lesson plans and training programs to enhance learning outcomes.

Criterion	Indicator	Mean	Interpretation
TECHNICAL QUALITY	Packet tracer media has provided service to many users (users)	4.52	Strongly Agree
	Packet tracer media has good stability moment	4.26	Agree
INSTRUCTION USEFULNESS	Packet tracer media is conveniently used in the process	4.28	Agree
	Packet tracer media is very user-friendly and not confusing inside	4.06	Agree
ACCESSIBILITY	Packet tracer media is easy to run in various software and hardware	4.27	Agree
	Application opening speed of Packet tracer media is fast	4.29	Agree
	Packet tracer media is easy to be used by students from a background of that different ability	4.12	Agree
	Packet tracer media is easy to be used in the process of learning independently	4.14	Agree

	Packet tracer media is easy to be used in the group learning process	4.42	Agree
USABILITY	Packet tracer media is comfortable in operating it	4.30	Agree
	Overall	4.27	Agree

Learning. Based on the results of the survey, it appears that students had a positive view of the compatibility of Packet Tracer with network design material. The mean score for the indicator, "Application of packet tracer media is compatible with network design material," was 4.27, while the mean score for the indicator, "Design materials the network can be practiced with packet tracer applications," was 4.31. These results indicate that most students agreed that Packet Tracer is compatible with network design material.

The mean score for the indicator, "Conformity of material in packet tracer media with the competencies achieved by students," was 4.23, indicating that students agreed that the material in Packet Tracer is consistent with the competencies they have achieved.

Regarding the Learning Design criterion, students appeared to have a positive view of the application's ability to facilitate learning. The mean score for the indicator, "Packet tracer media facilitate students in learning design networking," was 4.42, while the mean score for the indicator, "Packet tracer media can improve students' motivation in network design learning," was 4.44. The mean score for the indicator, "The material in packet tracer media is accompanied by illustrations of images to make it easier for students to understand," was 4.41. These high scores suggest that students found Packet Tracer to be an effective tool for facilitating learning and enhancing motivation in network design.

In terms of Learning Usage, the mean score for all indicators was above 4, indicating that students found the terms used in Packet Tracer to be clear, easy to understand, and consistent with the rules of the language.

Overall, the mean score for all indicators was 4.32, indicating that students had an overall positive view of the application's utilization in terms of material compatibility, learning design, and learning usage.

Moreover, it can be inferred that Packet Tracer is an effective tool for facilitating learning in network design. The high scores for compatibility, learning design, and learning usage suggest that the application is effective in facilitating learning and improving students' motivation. Therefore, educators and instructional designers should continue to incorporate Packet Tracer into their lesson plans and training programs to enhance learning outcomes in network design.

Criterion	Indicator	Mean	Interpretation
MATERIAL COMPATIBILITY	Application of packet tracer media is compatible with network design material	4.27	Agree
	Design materials the network can be practiced with packet tracer applications	4.31	Agree
	Conformity of material in packet tracer media with the competencies achieved by students	4.23	Agree

LEARNING DESIGN	Packet tracer media facilitate students in learning desigr networking	4.42	Agree
	Packet tracer media can improve students' motivation ir network design learning	4.44	Agree
	The material in packet tracer media is accompanied by illustrations of images to make it easier for students tc understand	4.41	Agree
LEARNING USAGE	Packet tracer media use clear terms	4.24	Agree
	Packet tracer media use the terms that are easy to understand	4.29	Agree
	Terms used in packet tracer is by the rules of the language	4.26	Agree
	Overall	4.32	Agree

Display. Based on the results of the survey, it appears that students had a positive view of the multimedia document and navigation features of Packet Tracer. The mean score for the indicator, "It has a menu that helps students," was 4.24, indicating that students agreed that the application's menu was helpful. The mean score for the indicator, "Navigate in packet tracer media makes it easy to operate," was 4.26, while the mean score for the indicator, "Navigation buttons are consistent across packet tracer application," was 4.27. These results suggest that students found the navigation features of the application to be consistent and easy to use.

Regarding the Design Media criterion, students had a positive view of the application's layout design. The mean score for the indicator, "It has a layout design interesting," was 4.26, while the mean score for the indicator, "It has a neat look," was 4.23. Additionally, the mean score for the indicator, "Menu position on the packet tracer media is easy to remember by students," was 4.42. These results indicate that students found the application's design to be aesthetically pleasing and easy to navigate.

Overall, the mean score for all indicators was 4.28, indicating that students had an overall positive view of the application's utilization in terms of multimedia document, navigation, and design media.

Also, it can be inferred that Packet Tracer is an effective tool for facilitating learning in network design. The high scores for multimedia document, navigation, and design media suggest that the application is user-friendly and aesthetically pleasing, which can enhance student engagement and motivation. Therefore, educators and instructional designers should continue to incorporate Packet Tracer into their lesson plans and training programs to enhance learning outcomes in network design.

Criterion	Indicator	Mean	Interpretation
MULTIMEDIA DOCUMENT	It has a menu that help students	4.24	Agree
NAVIGATION	Navigate in packet tracer media makes it easy to operate	4.26	Agree
	Navigation buttons are consistent across packet tracer application	4.27	Agree
	It has a lay out design interesting	4.26	Agree
	It has a neat look	4.23	Agree

DESIGN MEDIA	Menu position on the packet tracer media is easy tc remember by students	4.42	Agree
	Overall	4.28	Agree

Performance of I.T. Students in the Advanced Networking Subject

Based on the distribution of grades among the 365 IT students in the survey, it appears that the majority of students received a grade of 1.25 (26%) or 1.5 (40.5%). A smaller percentage of students received a grade of 1 (9.9%), 1.75 (18.6%), or 2 (1.9%). Only a very small percentage of students received grades of 1.3 (0.8%), 2.25 (0.3%), 2.75 (0.3%), 3 (0.8%), or 5 (0.8%).

The distribution of grades appears to be roughly symmetrical, with the majority of students receiving grades around the mean grade of 1.44 (calculated as the weighted mean of the grades using the frequency and percent columns). The presence of a relatively large percentage of students receiving a grade of 1.25 suggests that this grade may have been used as a default or median grade in the grading system.

Overall, the distribution of grades among the 365 IT students in the survey appears to be relatively balanced, with the majority of students receiving grades in the upper range of the grading scale. This suggests that the students generally performed well on the survey and had a good understanding of the topics covered by the survey.

Final Grade	Frequency	Percent
1	36	9.9
1.25	95	26
1.3	3	0.8
1.5	148	40.5
1.75	68	18.6
2	7	1.9
2.25	1	0.3
2.75	1	0.3
3	3	0.8
5	3	0.8
Total	365	100

Effects of the Packet Tracer Application Utilization on the Performance of the Students

The regression test was conducted to determine the relationship between the final grade of the students and the following predictors: Technical Quality, Instruction Usefulness, Accessibility, Usability, Material Compatibility, Learning Design, Learning Usage, Multimedia Document, Navigation, and Design Media.

The Model Summary shows that the regression model had a very low R-squared value of 0.006, indicating that only a small proportion of the variance in the final grade was explained by the predictors. The Adjusted R-squared value of -0.022 suggests that the model did not fit the data well. The F-test result also shows that the overall model was not significant ($F(10, 354) = 0.211$, $p > 0.05$).

Looking at the Coefficients table, the standardized coefficients (Beta) for all predictors were

very small, ranging from -0.113 to 0.117. This indicates that none of the predictors had a strong impact on the final grade of the students. The p-values for all predictors were greater than 0.05, indicating that none of the predictors were statistically significant in predicting the final grade of the students.

Thus, the results of the regression test suggest that there was no significant relationship between the final grade of the students and the predictors included in the model. Therefore, the predictors may not be useful in predicting the final grade of the students in the context of the survey. It is possible that other variables not included in the model may have a stronger influence on the final grade of the students.

Model Summary

					Change Statistics				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	R Square Change	F Change	df1	df2	Sig. F Change
1	.077[a]	.006	-.022	.43252	.006	.211	10	354	.995

a. Predictors: (Constant), Design Media, Technical Quality, Multimedia Document, Instruction Usefulness, Accessibility, Usability, Learning Design, Material Compatibility, Navigation, Learning Usage

ANOVAa

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	.394	10	.039	.211	.995[b]
	Residual	66.224	354	.187		
	Total	66.618	364			

a. Dependent Variable: Final Grade

b. Predictors: (Constant), Design Media, Technical Quality, Multimedia Document, Instruction Usefulness, Accessibility, Usability, Learning Design, Material Compatibility, Navigation, Learning Usage

Coefficientsa

	Unstandardized Coefficients		Standardized Coefficients			95.0% Confidence Interval for B		Correlations			Collinearity Statistics	
Model	B	Std. Error	Beta	t	Sig.	Lower Bound	Upper Bound	Zero-order	Partial	Part	Tolerance	VIF
1 (Constant)	1.434	.163		8.804	.000	1.114	1.755					

Technical Quality	.014	.072	.024	.194	.846	-.129	.157	.018	.010	.010	.189	5.299
Instruction Usefulness	.020	.047	.037	.431	.667	-.073	.113	.026	.023	.023	.387	2.584
Accessibility	-.024	.059	-.042	-.415	.678	-.140	.091	.000	-.022	-.022	.275	3.640
Usability	.022	.066	.036	.333	.739	-.109	.153	.013	.018	.018	.240	4.170
Material Compatibility	-.067	.091	-.113	-.730	.466	-.246	.113	-.010	-.039	-.039	.118	8.482
Learning Design	.030	.070	.048	.425	.671	-.107	.166	.018	.023	.022	.218	4.585
Learning Usage	-.067	.107	-.112	-.623	.533	-.277	.144	.011	-.033	-.033	.086	11.595
Multimedia Document	.060	.071	.117	.850	.396	-.079	.200	.026	.045	.045	.147	6.787
Navigation	-.004	.099	-.007	-.044	.965	-.199	.191	.003	-.002	-.002	.097	10.273
Design Media	.027	.107	.043	.254	.800	-.182	.237	.006	.014	.013	.099	10.138

a. Dependent Variable: Final Grade

The second regression test was conducted to examine the relationship between the final grade of the students and the following predictors: Software Engineering Aspect, Learning Aspect, and Display Aspect.

The Model Summary shows that the regression model had a very low R-squared value of 0.001, indicating that only a small proportion of the variance in the final grade was explained by the predictors. The Adjusted R-squared value of -0.008 suggests that the model did not fit the data well. The F-test result also shows that the overall model was not significant (F (3, 361) = 0.062, p

> 0.05).

Looking at the Coefficients table, the standardized coefficients (Beta) for all predictors were very small, ranging from -0.045 to 0.043. This indicates that none of the predictors had a

strong impact on the final grade of the students. The p-values for all predictors were greater than 0.05, indicating that none of the predictors were statistically significant in predicting the final grade of the students.

Hence, the results of the second regression test suggest that there was no significant relationship between the final grade of the students and the predictors included in the model. Therefore, the predictors may not be useful in predicting the final grade of the students in the context of the survey. It is possible that other variables not included in the model may have a stronger influence on the final grade of the students.

Model Summary

					Change Statistics				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	R Square Change	F Change	df1	df2	Sig. F Change
1	.023[a]	.001	-.008	.42947	.001	.062	3	361	.980

a. Predictors: (Constant), Display Aspect, Software Engineering Aspect, Learning Aspect

ANOVAa

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	.034	3	.011	.062	.980[b]
	Residual	66.584	361	.184		
	Total	66.618	364			

a. Dependent Variable: Final Grade

b. Predictors: (Constant), Display Aspect, Software Engineering Aspect, Learning Aspect

Coefficientsa

	Unstandardized Coefficients		Standardized Coefficients			95.0% Confidence Interval for B		Correlations			Collinearity Statistics	
Model	B	Std. Error	Beta	t	Sig.	Lower Bound	Upper Bound	Zero-order	Partial	Part	Tolerance	VIF
1 (Constant)	1.452	.155		9.359	.000	1.147	1.758					

Software Engineering Aspect	.029	.083	.043	.343	.732	-.135	.192	.016	.018	.018	.177	5.649
Learning Aspect	-.029	.137	-.045	-.215	.830	-.299	.240	.007	-.011	-.011	.063	15.891
Display Aspect	.009	.150	.014	.062	.951	-.286	.305	.010	.003	.003	.052	19.236

a. Dependent Variable: Final Grade

Advantages of the Packet Tracer Application

The following are the identified advantages of the Packet Tracer Application.

1. Technical Quality. The high mean score for "Packet tracer media has provided service to many users" suggests that the application is widely used and has been tested by many users, indicating its reliability and quality.

2. Accessibility. The high mean score for "Packet tracer media is easy to run in various software and hardware" indicates that the application is versatile and can be used on different devices and operating systems.

3. Usability. The high mean score for "Packet tracer media is easy to use in the group learning process" suggests that the application is well-suited for collaborative learning activities. The high mean score for "Packet tracer media is comfortable in operating it" further supports this idea.

4. Learning Design. The high mean score for "Packet tracer media facilitate students in learning design networking" suggests that the application can help students learn networking design concepts effectively. Illustrations of images accompany the high mean score for "The material in packet tracer media to make it easier for students to understand," suggests that the application can help students visualize and understand networking concepts better.

Overall, the advantages of the Packet Tracer application identified suggest that it is a valuable tool for learning and teaching networking design. It is easy to use, versatile, and well- suited for collaborative learning activities. It can also help students visualize and understand networking concepts better, making it a valuable addition to the learning environment.

Problems Encountered

The survey and regression analysis did not directly address the problems or challenges encountered by the students when using the Packet Tracer application. However, based on the results, it is possible to speculate on some potential problems or challenges that students may face when using the application. These include:

1. Technical difficulties. Although the study found high scores for technical quality and accessibility, it is possible that some students may experience technical difficulties or issues

when using the application on their devices or systems.

2. User interface. Although the study found high scores for usability and instruction usefulness, it is possible that some students may find the user interface of the application confusing or difficult to navigate.

3. Limited features. Although the study found that the Packet Tracer application was useful for learning and teaching network design concepts, it is possible that some students may find the application limited in terms of its features or capabilities.

4. Lack of support. If students encounter technical difficulties or challenges when using the application, they may require additional support or guidance from instructors or technical support staff, which may not always be available or easily accessible. It is important to note that these potential problems or challenges are based on speculation and further research would be necessary to determine the specific issues that students may face when using the Packet Tracer application.

5. Conclusions And Recommendations

The descriptive analysis of the survey results suggests that the Information Technology students generally had a positive perception of the Packet Tracer application, with high mean scores across all criteria and indicators. It indicates that the Packet Tracer application is an effective tool for learning and teaching network design.

However, the regression tests showed that the predictors included in the models had a very low impact on the student's final grade. It suggests that the factors measured by the survey may not be directly related to the student's academic performance or that other variables not included in the models may have a stronger influence on academic performance.

These results highlight the importance of using rigorous statistical methods to examine the relationships between various factors and academic performance. They also suggest that further research is needed to identify the specific factors that may influence academic performance in the context of the survey. In addition, the results emphasize the need for educators to consider various factors beyond using specific technology tools when evaluating student performance and learning outcomes.

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