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Original article

Students' Perceptions and Self-Reported Experience of Using ChatGPT for Learning IP Subnetting in Higher Education: A Student-Centric Study

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Abstract
This paper explores the use of artificial intelligence in computer networks, focusing on ChatGPT and its application to subnetting. The study examines how ChatGPT supports the calculation-based aspects of subnetting. Subnetting is an important topic in network management and security. A quantitative, questionnaire-based approach was used with 30 students enrolled in the Computer Networks course at the Department of Information Technology, Faculty of Humanities and Applied Sciences, University of Benghazi, Tocra, Libya. The questionnaire examined students' difficulties with subnetting and their perceptions of using ChatGPT across key subnetting phases, including determining the assigned IP address space, identifying borrowed host bits, determining the number of possible subnets and hosts per subnet, calculating the new subnet mask, and determining the broadcast address and the usable range of the new subnets. The findings showed that subnetting was challenging for many students, with 53.3% (n =16) describing it as complicated. Time consumption was reported as a difficulty by 80.0% (n=24), while 66.7% (n=20) identified calculations as the most difficult aspect. In addition, 93.3% (n=28) of the participants reported that ChatGPT saved time when working on subnetting. Similar proportions explained ChatGPT 'uses in all of subnetting' levels. However, 46.7% (n=14) identified over-reliance on ChatGPT as a major challenge; also, 46.7% (n=14) rated its role in automating repetitive calculations as valuable. Overall, 90.0% (n=27) supported the use of ChatGPT as a supplementary learning tool and suggested some improvements to make it more useful for learning subnetting. These results indicate that ChatGPT can provide useful support for students working on calculation-based subnetting tasks.
Keywords. Subnetting, ChatGPT, Artificial Intelligence in Education, Computer Networks Instruction.

Introduction

No doubt, with the development of digital transformation technology, communication systems have become an essential part of people's daily life. A computer network is the core of communication, encompassing many aspects of life. The need to reduce human intervention, reduce misconfiguration risks, and minimize operational costs has led to the integration of AI into computer networks, making them more intelligent: predicting failures, automating configuration processes, and ensuring consistency. The importance of AI applications in computer networks lies in achieving optimal network performance in several areas: management, security, and monitoring [1-2]. There are many network simulation tools used to design and simulate networks, such as Ns2, Ns3, OPNET, and Cisco Packet Tracer [3-5].

Subnetting is one of the important issues for network management and security. It divides a large network into smaller networks called subnets to achieve several gains: reduced network traffic, optimized network performance, simplified management, and facilitated network expansion across large geographical distances [9]. Subnetting is mainly based on dividing an IP network into smaller IP networks called subnets. Every subnet is a collection of devices that can receive broadcast traffic from each other, in what is called a broadcast domain. Sometimes a network is divided into equal-length subnetworks called Fixed Length Subnet Mask (FLSM); however, this type of subnetting often leads to wasted IP addresses, so another type is used, called Variable Length Subnet Mask (VLSM), which divides networks into variable-length subnetworks according to network requirements. FLSM is carried out through the following phases [10]:

- Determining the assigned IP address space as below

Table 1: Default IPv4 Address Classes and Their Characteristics

Class	Format	Default Subnet Mask				Default no. of Host Bits	CIDR Value/ Default Class Prefix
A	network.node.node.node	255.0.0.0				24	/8
		11111111	00000000	00000000	00000000		
B	network.network.node.node	255.255.0.0				16	/16
		11111111	11111111	00000000	00000000		

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C	network.network.network.node	255.255.255.0				8	/24
		11111111	11111111	11111111	00000000		

- Identifying the number of host bits borrowed

Borrowing bits refers to taking host bits and giving them to the network bits, as shown in the equation below:

$$2^n > (number\ of\ required\ subnets)$$

where n= number of host bits borrowed

- Determining the number of possible subnets

$$2^n$$

- Determining the number of Hosts per Subnet as below

$$2^h - 2$$

where h equals the number of host bits

$$h = default\ number\ of\ host\ bits - number\ of\ host\ bits\ borrowed$$

Binary Representation

2^0	2^1	2^2	2^3	2^4	2^5	2^6	2^7	...
1	2	4	8	16	32	64	128	...

In this step, the default subnet mask is converted to binary, and according to the default class prefix and the identified octet, the borrowed host bits are represented within the subnet mask. It is then converted back to decimal to obtain a new class prefix.

- **Calculating a new subnet mask**
  In the subnet mask, the last bit borrowed is called the Least Significant Bit (LSB) or block size, because its value determines the increment between the new IP subnets.
- **Determining a broadcast address and a usable range of the new subnets**
  To calculate a broadcast address for each subnet, identify the next subnet address, then go back one address. Calculating the usable range of IP addresses is done as follows:
  - Adding one address to a subnet address to find the first usable IP address.
  - Subtracting one address from a broadcast address to find the last usable IP address.

Given the complexity of these calculations, recent studies have explored the potential of AI-based tools, such as ChatGPT, to support students in performing them more efficiently. ChatGPT is a powerful AI tool, released by OpenAI in November 2022, based on combining conversational Artificial Intelligence with Natural Language Processing (NLP). Its main role centers around creating a dialogue between human and machine to generate instant answers. Its uses are spotlighted in a variety of applications: questions and answers, translation, content creation, summaries, and sentiment analysis. These applications are performed through several means: audio, visual, and image-based. ChatGPT's impact is demonstrated clearly across most domains, specifically in education. Its outcomes have had a positive impact on students in many aspects: interactive learning, personal help, fast and available help, while also raising some considerations: incomplete or incorrect information, lack of personal contact, overreliance, and critical thinking [11]. In recent years, ChatGPT's influence on communications has emerged clearly in several computer network issues: configuration, monitoring, management, and security [12-13]. Additionally, beyond ChatGPT's common uses, many studies have explored that it has acted as a mathematical search engine and knowledge base interface for generating appropriate instant answers [14-17].
The integration of ChatGPT into the process of learning subnetting demonstrates the importance of integrating AI with networking in the learning process in higher education. This paper has been divided into sex main sections: Section 1 provides a general background on computer networking education and the challenge of IP subnetting. Section 2 discusses related work on network simulation and the integration of AI conversational models in technical courses. Section 3 outlines the research methodology, detailing the student questionnaire and the dataset collected from the University of Benghazi. Section 4 presents the empirical analysis of the survey responses regarding subnetting difficulties and ChatGPT usage. Then, in section 5, a comprehensive discussion of the obtained results is introduced. Finally, Section 6 delivers the concluding remarks and proposes potential directions for future research.

Related work

- Nathaniel S. Tarkaa et al. (3), developed a Local Area Network (LAN) simulation model for the College of Engineering at the University of Agriculture, Nigeria, incorporating key concepts such as IP subnetting and Virtual Local Area Networks (VLANs) to segregate departmental traffic.
- Aziza Lamien Helal (4), evaluated the effective role of simulation and interactive tools through a questionnaire administered to Libyan students at the University of Tobruk, concluding that these tools significantly enhance theoretical and practical concepts in computer networking courses.

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- A study conducted in Malaysia [5] underscored the pivotal role of interactive learning environments in higher education institutions, drawing on survey data from students enrolled in data communication and networking courses.
- Steven J. Runtuwene et al. (6) evaluated interactive learning environments for teaching computer network concepts through a questionnaire administered to Indonesian students. The study indicated that virtual learning tools enhanced student engagement, facilitated concept comprehension, and provided a cost-effective alternative to physical hardware in network laboratories.
- Gardner Mwansa et al. (7) evaluated the performance of network simulation tools for learning computer networking in South Africa. Their findings highlighted enhanced student practical skills and conceptual understanding, while noting specific technical challenges encountered during implementation.
- Muhammad Nurfauzi et al. (8), reported that utilizing digital learning media in computer networking education significantly boosted student motivation, interactivity, interest, and enthusiasm.
- Shailesh N. Sisat et al. (9), emphasized that subnetting is an essential skill in network management, highlighting its core importance and the sequential stages involved in its implementation.
- Muhammad Nazrul Islam et al. (12), explored the notable role of ChatGPT in network management and monitoring through automated operations and code generation, while also noting potential obstacles that may limit network reliability and effectiveness, such as biased outputs and generated errors.
- Ghassan A. QasMarrogy et al. (13), evaluated the performance of AI tools in network configuration by applying AI-generated commands from ChatGPT to optimize and secure network designs.
- Jameson Mbale and Kauna Mufeti (18), introduced an automated teaching model for IPv4 subnetting, termed the Phase Teaching Model for Subnetting IPv4 (PTMS-IP4), which simplifies network calculations clearly and comprehensively across all subnetting levels.
- Mujahid Hamood Hilal Alzakwani et al. (19), demonstrated the efficiency of an automated system that renders subnetting easier, faster, and simpler, with significant positive impacts on computer science higher education when compared against manual subnetting calculations.
- Deepank Dixit et al. (20), proposed a mathematical model for developing an automated subnetting system, enabling engineers and students to verify subnetting results and ensure network efficiency.
- B Sujatmiko et al. (21), applied a project-based learning model to address student difficulties with subnetting material, demonstrating that the model facilitates the learning process and yields higher improvements in student learning outcomes.
- Hamzh Hammoda Alaiat (22), emphasized the integration of computer networks with artificial intelligence by relying on ChatGPT to configure complex network configurations automatically.

While AI networking emphasizes making networks more intelligent, efficient, and reliable, students frequently encounter significant difficulties when calculating and executing network partitioning, particularly IP subnetting. This paper aims to explore students' perceptions and self-reported experiences toward AI's performance in networking education by employing ChatGPT to assist them with subnetting calculations.

Methods

This study used a quantitative approach to collect data, particularly focused on students in the Department of Information Technology, Faculty of Humanities and Applied Sciences, University of Benghazi, Tocra, Libya. A questionnaire was administered to 30 students enrolled in the Computer Networks course during the fifth semester. The study was conducted over two consecutive semesters during the 2025-2026 academic year. The selection criteria were based only on the targeted students who had completed the basic Computer Networks course, including fundamental concepts for designing computer networks. The identified sample was 35 students; however, only 30 of them responded to the questionnaire. In this study, the participants used a calculation-based manual method and then ChatGPT through their smartphones for learning subnetting, keeping pace with technological advancements in the learning process.

A paper- based questionnaire consisted of 30 items and primarily examined the difficulties encountered by students when performing subnetting tasks. In addition, it explored the role of ChatGPT in assisting students with these challenges. Most of the questionnaire items were validated by the researcher in accordance with the objectives of the study and topics related to subnetting, while a small number of items were adapted from a relevant reference [18]. The questionnaire consisted of a combination of items, Yes/No questions, multiple-choice questions, and open-ended questions to allow participants to provide their views and suggestions regarding their difficulties with learning subnetting. It covered the main phases of subnetting in computer networks, including determining the assigned IP address space, identifying borrowed host bits, determining the number of possible subnets, determining the number of hosts per subnet, calculating the new subnet mask, and calculating the broadcast address and the usable range of the new subnets. The analysis of the questionnaire was carried out based on the statistical tools of Microsoft Excel. Descriptive statistics were employed to summarize the participants' responses, and the study outcomes were presented in tables and figures.

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Results

The research sample comprised 30 students, consisting of 11 males and 19 females.

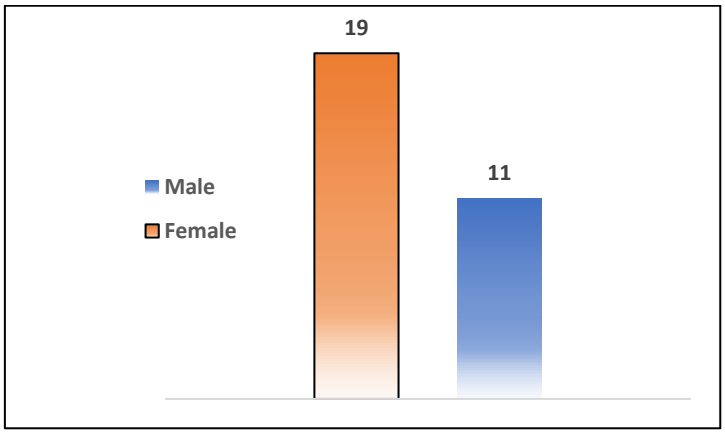


Figure 1. Sample Characteristics.

When asked about the subnetting topic, student responses were distributed as follows:

- 8 students reported that it is easy.
- 16 students found it complicated.
- 5 students stated that it is difficult.
- 1 student indicated that it is very difficult. (Detailed in Table 2).

Table 2. Implementation Responses

Response	Percentage	Number Students
Easy	26.7%	8
Complicated	53.3%	16
Difficult	16.7%	5
Very difficult	3.3%	1

Students encountered several difficulties throughout the subnetting phases. It is worth noting that each difficulty was analyzed independently within the sample, as detailed in Table 3.

Table 3. Implementation Difficulties.

No. difficulty	Description	Percentage	Number Students
Diff.1	Type of class	**20.0%**	***6***
Diff.2	Recognition of Network Address/Broadcast Address	**56.7%**	**17**
Diff.3	Determining the default subnet mask/ default class prefix/default host Bits	**43.3%**	***13***
Diff.4	Binary representation	**43.3%**	***13***
Diff.5	Conversion operations from Binary to Decimal	**46.7%**	***14***
Diff.6	Conversion operations from Decimal to Binary	**46.7%**	***14***
Diff.7	Determining appropriate Formulas for Subnetting	**56.7%**	**17**
Diff.8	Calculating Borrowed Bits	**23.3%**	**7**
Diff.9	Calculating number of hosts per subnet	**33.3%**	**10**
Diff.10	Calculating a new subnet mask/ new prefix	**46.7%**	***14***
Diff.11	Calculating new subnets	**36.7%**	**11**
Diff.12	Determining the broadcast address of new subnets	**40.0%**	**12**
Diff.13	Determining usable range of the new subnets	**46.7%**	***14***
Diff.14	Determining LSB (block size)	**60.0%**	**18**
Diff.15	Time-consume	**80.0%**	**24**
Diff.16	Confirming the solution	**50.0%**	**15**

When asked, "What is the primary difficulty you encounter during subnetting?", student responses were as follows:

- 20 students selected calculations.
- 5 students cited time constraints.
- 2 students indicated the large number of equations.
- 3 students selected other reasons.

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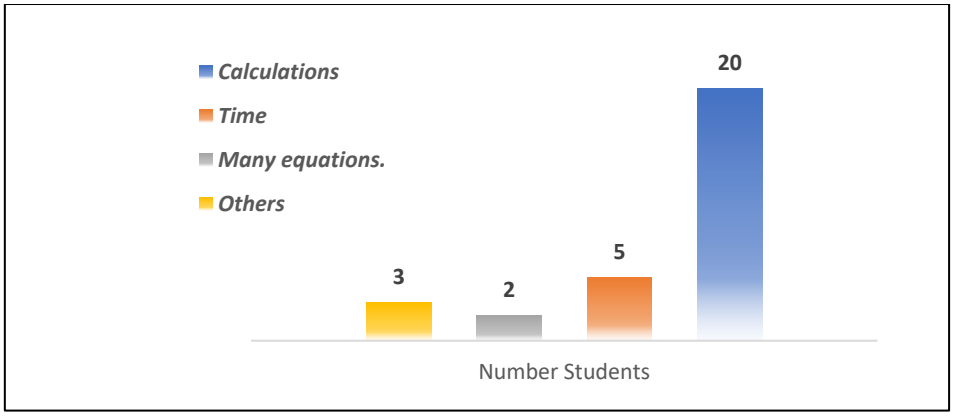


Figure 2. The most difficulty of subnetting.

Taking into consideration that each item was evaluated within the sample independently, students' responses regarding the use of ChatGPT for subnetting are detailed in Table 4.

Table 4. ChatGPT's uses for subnetting

No. equation	Description	Percentage	Number Students
Q1	Did you use ChatGPT previously for subnetting?	80.0%	24
Q2	Did you note any different in the result of subnetting between manual method and ChatGPT?	73.3%	22
Q3	Did you help ChatGPT to understand subnetting step by step?	90.0%	27
Q4	Did you help ChatGPT to explain subnetting simply?	90.0%	27
Q5	Did you save time ChatGPT to understand subnetting?	93.3%	28
Q6	Do you think ChatGPT is an effective tool for learning subnetting?	86.7%	26
Q7	Do you think ChatGPT ameliorated your skills for subnetting more than manual method?	66.7%	20

When asked, "Which subnetting components do you use ChatGPT to learn?", the responses were as follows:

- 3 students indicated the new subnet mask.
- 1 student selected " new subnets ".
- 2 students reported the broadcast address.
- 6 students selected the " usable range of the new subnets".
- 1 student indicated both the new subnet mask and new subnets.
- 2 students reported using it for new subnets and the usable range of new subnets.
- 2 students indicated the new subnet mask alongside other features.
- 2 students selected the new subnet mask, new subnets, and the broadcast address.
- 1 student chose the new subnet mask and the usable range of new subnets.
- 1 student selected the new subnet mask, new subnets, and the usable range of new subnet.
- 5 students indicated using it for all mentioned components.
- 4 students indicated other specific uses. (See Figure 3 for the detailed usage distribution).

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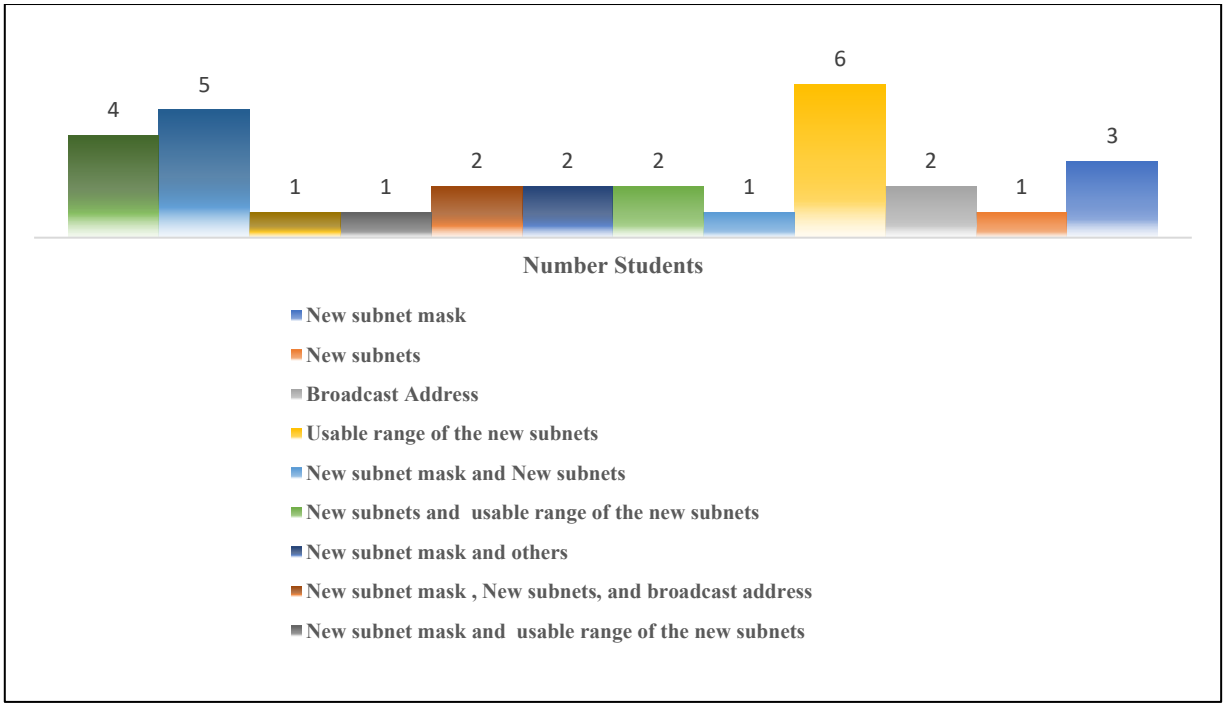


Figure 3. ChatGPT's uses for learning subnetting.

Regarding the question, "What is the main challenge you encounter when using ChatGPT?", the responses are detailed in Table 5.

Table 5. Implementation Challenges

Challenge Type	Percentage	Number Students
Answer Formulation	23.3%	7
Minimizing thinking skills	16.7%	5
Overreliance	46.7%	14
Others	6.7%	2
Nothing	6.7%	2

Students' evaluations of ChatGPT's overall effectiveness for learning subnetting varied across categories (See Table 6).

Table 6. Perceived Effectiveness.

Rating	Percentage	Number Students
Excellent	46.7%	14
Very Good	40.0%	12
Good	6.7%	2
Not Bad	6.7%	2
Bad	0.0%	Nobody

Based on the question, "Do you recommend using ChatGPT for subnetting?", the responses were distributed as follows:

- 27 participants recommended its use.
- 3 participants did not recommend its use.

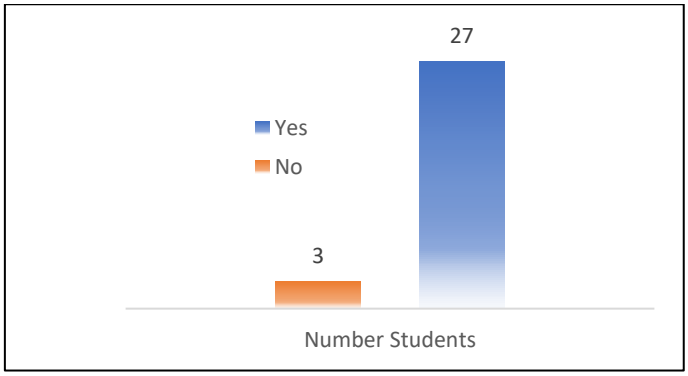


Figure 4. Recommendations for future use

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Students' suggestions on how ChatGPT could become a more effective tool for subnetting included:

- 10 students suggested that no improvements were needed.
- 4 students recommended providing clearer explanations.
- 4 students suggested simplifying the responses.
- The remaining 12 students offered various individual suggestions to improve ChatGPT, including: video-based explanations, reducing unnecessary solution steps, enhancing response credibility and accuracy, delivering well-organized output, providing complete answers in a single prompt, lowering subscription costs while expanding support for image and PDF inputs, supplying realistic values for subnetting scenarios, adding visual and schematic diagram features for subnetting concepts, using illustrative figures, incorporating voice-based explanations with reliable references, and offering step-by-step structural guides with detailed worked examples for calculating network addresses, subnet masks, broadcast addresses, and the Least Significant Bit (LSB).

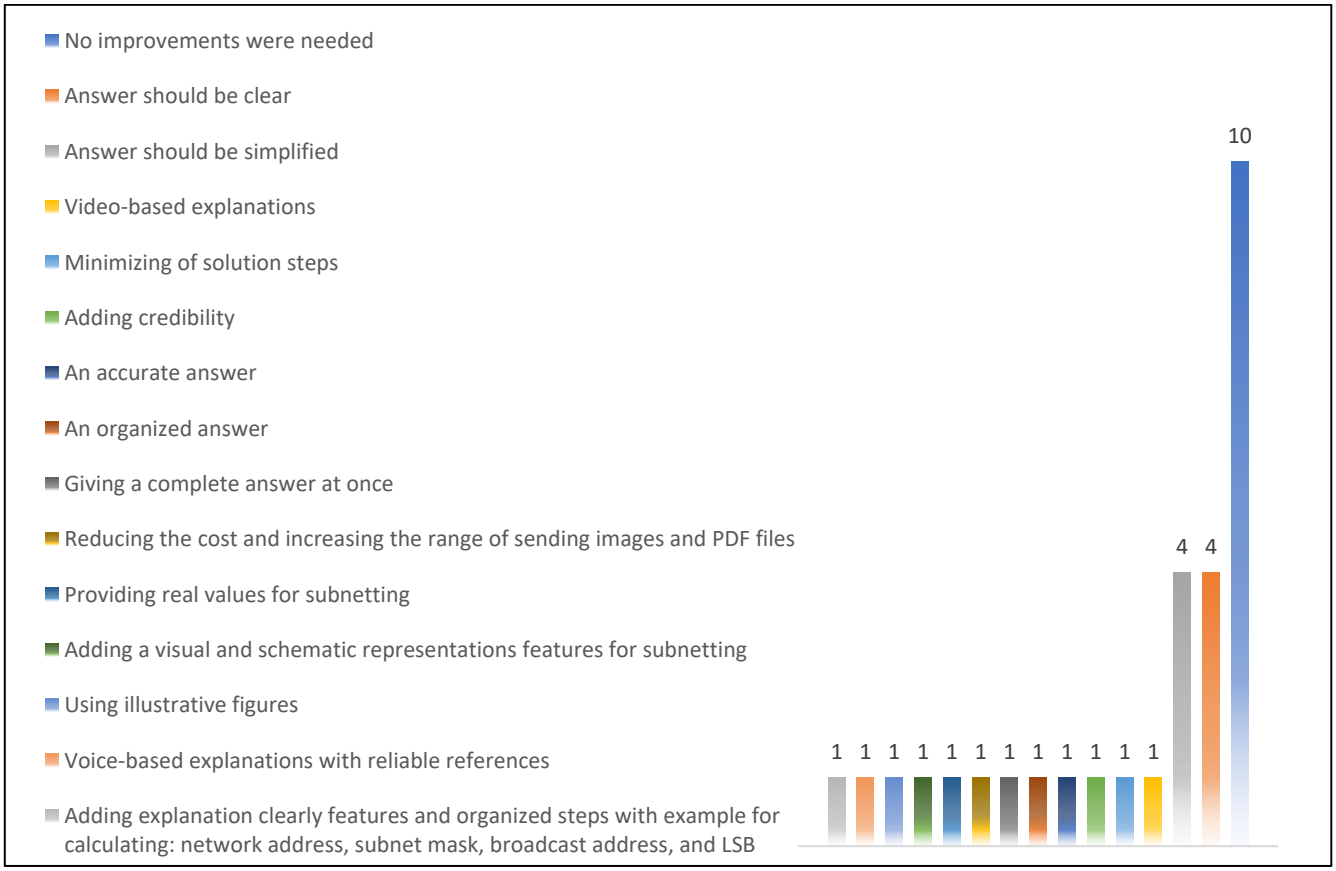


Figure 5. Suggested Improvements in the ChatGPT

Discussion

The findings of the study reflect students' views regarding the usefulness of ChatGPT and their reported experiences for learning IP subnetting within Libyan higher education. More than half of the participants (53.3%, n=16) described subnetting as "complicated". This aligns with Mujahid Hamood Hilal Alzakwani et al. (2025), who emphasized that computational complexity remains a primary obstacle in subnetting, particularly when handling large IP address spaces, thereby driving the urgent need for automated auxiliary tools.

However, this study also highlights notable operational hurdles. Students indicated specific difficulties related to address class identification (20.0%, n=6), network/broadcast address recognitions (56.7%, n=17), determining default subnet mask, class prefix and default host bits (43.3%, n=13), binary representation (43.3%, n=13), binary-to-decimal conversion (46.7%, n=14), decimal-to-binary conversion (46.7%, n=14), identifying appropriate mathematical formulas (56.7%, n=17), calculating borrowed host bits (23.3%, n=7), calculating hosts per subnet (33.3%, n=10), deriving new subnet masks and new prefixes (46.7%, n=14), calculating new subnets (36.7%, n=11), determining broadcast addresses for new subnets (40.0%, n=12), establishing usable host ranges (46.7%, n=14), determining the Least Significant Bit(LSB / block size) (60.0%, n=18), overall time-consumption (80.0%, n=24), and solution verification (50.0%, n=15). These findings closely mirror those of Jameson Mbale and Kauna Mufeti (2011), Mujahid Hamood Hilal Alzakwani et al. (2025), Deepank Dixit et al. (2018), and B Sujatmiko et al. (2020), who noted that because subnetting comprises a sequence of intricate mathematical steps, numerous frameworks have been proposed to make the process clearer, faster, and simpler.

Regarding the primary challenge encountered, two-thirds of participants (66.7%, n=20) cited specific mathematical calculations as their main difficulty. This directly supports Mujahid Hamood Hilal Alzakwani et al. (2025), who highlighted that verifying subnetting results across all structural tiers demands substantial time and exertion.

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Results regarding ChatGPT usage reveal high student engagement: (80.0%, n=24) had used it prior to the study, (73.3%, n=22) noted distinct differences between manual calculations and AI assistance, (90.0%, n=27) stated it helped them understand procedures step-by-step, (90.0%, n=27) affirmed it simplified complex concepts, (93.3%, n=28) reported significant time savings, (86.7%, n=26) viewed it as an effective learning tool, and (66.7%, n=20) believed it enhanced their overall skill sets. These outcomes correspond with findings by Meryem N., et al. (2025), Frieder S., (2023), Wardat Y., (2023), Sosas, M. R. D (2026), who evaluated ChatGPT's mathematical capabilities in delivering personalized guidance and fostering interactive learning environment.

Regarding specific subnetting components learned via ChatGPT, student responses were distributed across: new subnet masks (10.0%, n=3), new subnets (3.3%, n=1), broadcast address (6.7%, n=2), usable host ranges (20.0%, n= 6), and listed components (16.7%, n=5), and other functional tasks (13.3%, n= 4). These patterns reflect the views of Meryem N., et al. (2025), Frieder S., (2023), Wardat Y., (2023), Sosas, M. R. D (2026), Joshua Ebere Chukwuere, (2025), regarding AI's capacity to heighten student motivation and interactive participation.

Conversely, student challenges when using ChatGPT were also identified: (23.3%, n=7) cited issues with answer formulation, (16.7%, n=5) noted a reduction in critical thinking effort and a significant proportion, (46.7%, n=14) reported overreliance as a major concern. These observations resonate with reservations expressed by Annuš, N. (2023), and Joshua Ebere Chukwuere, (2025), regarding potential drawbacks of conversational AI tools.

In evaluating ChatGPT's overall utility, (46.7%, n=14) rated it as " Excellent " and (40.0%, n=12) as " Very Good ". These positive assessments reinforce findings by Jianyang Deng and Yijia Lin, (2022), who spotlighted on its clearly increased efficiency by an automate learning, Annuš, N. (2023) and Heidari A. et al. (2024), who highlighted AI's capacity to boost learning efficiency and demonstrated its growing adoption across higher education institutions.

In terms of pedagogical recommendations, the vast majority of participants (90.0%, n=27) recommended integrating ChatGPT as an auxiliary tool for subnetting instruction, emphasizing that it should complement rather than replace by human expertise. This aligns with international studies advocating AI integration in higher education, particularly within resource-contained environments like Libya.

Regarding student suggestions for optimization: (33.3%, n=10) felt no improvements were necessary, (13.3%, n=4) requested clearer response formulations, (13.3%, n=4) sought simplified explanations, while the remaining (40.0%, n=12), offered individual recommendations such as video integration, streamlined solution steps, improved response accuracy and credibility, structured complete answers in a single query, support for multi-model formals (e.g., PDF/images), visual schematic representations, and step-by-step guides with fully worked examples(including network address, and LSB calculations). As noted by Meryem Net al. (2025), addressing these user recommendations is essential for facilitating reliable AI integration in academic settings.

While the target sample size of 30 participants was sufficient for this exploratory inquiry, it represents a limitation regarding the broad generalizability of findings. Furthermore, the scope was restricted to IPv4 and FLSM, leaving VLSM and IPv6 topics for future research.

In summary, the results highlight the role of ChatGPT in aiding IPv4 subnetting education. Its integration noticeably boosted student enthusiasm and learning motivation, serving as a valuable pedagogical support tool in computer networking curricula.

Conclusion

In conclusion, this study explored students' perceptions and self-reported experiences of using ChatGPT to support IP subnetting learning among 30 students from the Department of Information Technology, Faculty of Humanities and Applied Sciences, University of Benghazi. The sample comprised students enrolled in the Computer Networks course. The findings of this study indicated that 53.3%(n=16) considered subnetting complicated. Several difficulties were mentioned; notably,80.0% (n=24) declared time consumption as a major barrier, with the primary difficulty being calculations for 66.7%(n=20) of participants. Furthermore, 93.3% (n=28) reported that ChatGPT saved time during learning; additionally, ChatGPT's use to learn subnetting showed convergent ratios across all subnetting components. Despite its benefits, 46.7% (n=14) indicated that the main challenge encountered was overreliance. However,46.7% (n=14) praised ChatGPT's notable role in subnetting, and the majority (90.0%, n=27) recommended its use as an auxiliary tool in educational institutions alongside improvements such as video-based explanations, minimizing solution steps, adding credibility, and providing complete answers at once. Future research could explore a deeper and more comprehensive understanding to investigate effectiveness of ChatGPT on network simulation and practical configuration in the learning process through incorporate objective assessments of students' subnetting performance, larger samples, and longitudinal studies, particularly in countries with resource-constrained advanced laboratories like Libya.

Informed Consent Statement

Informed consent was obtained from all study participants.

References

1. Zaman F, Bouachir O, Aloqaily M, Al Ridhawi I. Generative AI for networking. arXiv [Preprint]. 2025. arXiv:2601.02389v1.
2. Zdrojewski K. Impact of artificial intelligence on computer networks. AITEE. 2024;30:49-59. doi:10.7862/re.2023.x.

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3. Tarkaa NS, Iannah PI, Iber IT. Design and simulation of local area network using Cisco Packet Tracer. Int J Eng Sci. 2017;6(10):63-77. doi:10.9790/1813-0610026377.
4. Helal AL. Cisco Packet Tracer simulation as an effective teaching tool in computer networking classes for undergraduate students at Tobruk University. 2023;33(1). doi:10.62341/alcp2431.
5. Noor NMM, Yayao N, Sulaiman S. Effectiveness of using Cisco Packet Tracer as a learning tool: a case study of routing protocol. Int J Inf Educ Technol. 2018;8(1). doi:10.18178/ijiet.2018.8.1.1004.
6. Runtuwene SJ, Abdulgani AN, Pakan OML, Pinontoan FCG, Mangaronda DI, Kambey TN. Enhancing computer network education in higher education through network simulation: a case study using Cisco Packet Tracer. Syntax Adm. 2024;5(11).
7. Mwansa G, Ngandu MR, Dasi ZS. Enhancing practical skills in computer networking: evaluating the unique impact of simulation tools, particularly Cisco Packet Tracer, in resource-constrained higher education settings. Educ Sci. 2024;14(10):1099. doi:10.3390/educsci14101099.
8. Nurfauzi M, Parenrengi S, Sukmawat. Cisco Packet Tracer as a learning medium to improve student motivation in basic computer networking. JESTEAH. 2026;1(2):46-54.
9. Sisat SN, Bhopale PS, Barbudhe VK. IP subnetting. Int J Eng Comput Sci Eng. 2013;2(5):5-10.
10. Thomas A. Subnetting an IP address. Global Knowledge; 2024 Jun 2. (Expert Reference Series of White Papers). Available from: http://www.globalknowledge.com
11. Annuš N. Chatbots in education: the impact of artificial intelligence-based ChatGPT on teachers and students. Int J Adv Nat Sci Eng Res. 2023;7(4):366-370. doi:10.59287/ijanser.739.
12. Islam MN, Fahim FH, Akash PP, Arifeen KA, Nahian N, Baki RF. Exploring ChatGPT in network management and monitoring: benefits and challenges. In: Proceedings of the International Conference on Information and Communication Technology for Sustainable Development (ICICT4SD); 2023. doi:10.1109/ICICT4SD59951.2023.10303476.
13. QasMarrogy GA, Nahi AA, Yousif RMS. Evaluation of ChatGPT's configuration support for network connectivity and security. Cihan Univ Erbil Sci J. 2024;8(2):43-48. doi:10.24086/cuesj.v8n2y.
14. Frieder S, Pinchetti L, Chevalier A, Griffiths R, Salvatori T, Lukasiewicz T, et al. Mathematical capabilities of ChatGPT. arXiv [Preprint]. 2023. arXiv:2301.13867v2.
15. Meryem N, Mohamed H, Said A. ChatGPT chatbot in the teaching and learning of mathematics: the role of reasoning processes. Adv Nonlinear Var Inequal. 2025;28(7).
16. Wardat Y, Tashtoush AM, AlAli R, Jarrah MA. ChatGPT: a revolutionary tool for teaching and learning mathematics. Eurasia J Math Sci Technol Educ. 2023;19(7). doi:10.29333/ejmste/13272.
17. Sosas MRD, Fat AFG, Dangculos JMM, Anoba HRP, Remiscal CG, Aleguen JM. Use of ChatGPT as a supplemental learning tool in mathematics. Contemp Math Sci Educ. 2026;7(1). doi:10.30935/conmaths/17989.
18. Mbale J, Mufeti K. Phase teaching model for subnetting IPv4. Int J Internet Technol Secur Trans. 2011;3(1):1-15.
19. Alzakwani MHH, Ali RR, Al-Atrakchii KA, Yahya EB, Qahman AIA. A simulation-based approach to automating subnetting for network efficiency. Int J Innov Res Sci Stud. 2025;8(1):2752-2761. doi:10.53894/ijirss.v8i1.5051.
20. Dixit D, Kumar G, Tiwari R, Anand A. Automation and detailed analysis of subnetting problems using mathematical modeling. Int J Pure Appl Math. 2018;118(20):807-814.
21. Sujatmiko B, Rozaq F, Wibawa SC. Project-based learning as a subnetting material completion in network design studies. J Phys Conf Ser. 2020;1569:022018. doi:10.1088/1742-6596/1569/2/022018.
22. Alaiat HH. Utilizing Cisco Packet Tracer for VLAN-based network systems with an integrated chatbot and analyzing their impact on network performance. DAJAS. 2023;1(2):106-115. doi:10.71147/acyrtv44.
23. Chukwuere JE. The use of ChatGPT in higher education: the advantages and disadvantages. Int J Comput Sci. 2025;14(5). doi:10.33022/ijcs.v14i5.5009.
24. Deng J, Lin Y. The benefits and challenges of ChatGPT: an overview. Front Comput Intell Syst. 2022;2(2).
25. Wang X. Research on application of artificial intelligence in computer network technology. J Intell Netw Syst Serv. 2025;2(2). doi:10.62639/sspjinss02.20250202.
26. Heidari A, Navimipour NJ, Zeadally S, Chamola V. Everything you wanted to know about ChatGPT: components, capabilities, applications, and opportunities. Int J Intell Syst. 2024. doi:10.1002/itl2.530.

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