

Interest in Learning Queuing Theory and its Applications among Final-Year Mathematics Students

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Abstract

Queuing Theory is an important area of applied mathematics concerned with the mathematical analysis of waiting-line and service systems. Its applications extend to banking, healthcare, transportation, telecommunications, manufacturing, computer networks and other service sectors. The extent to which students are interested in learning both the theoretical concepts and practical applications of Queuing Theory is an important consideration in Mathematics education. The present study was undertaken to examine the interest in learning Queuing Theory and its applications among final-year Mathematics students. The study adopted the normative survey method. The sample consisted of 200 final-year Mathematics students drawn from Government and Private Arts and Science Colleges in Karaikal, comprising 136 undergraduate students and 64 postgraduate students. The sample included 100 male and 100 female students. An Interest Inventory on Learning Queuing Theory and Its Applications, with a maximum score of 100, was used for data collection. The overall mean score was 64.60. The mean score for interest in learning Queuing Theory was 30.24, while the mean score for interest in learning its applications was 34.36. Differential analysis was conducted using the independent-samples t-test. The results showed no significant difference between undergraduate and postgraduate students in their interest in learning Queuing Theory and its applications. However, a statistically significant difference was found between male and female students, with male students obtaining a higher mean score. The findings indicate that students demonstrated comparatively greater interest in the applications of Queuing Theory than in its theoretical component. The study highlights the importance of application-oriented approaches in teaching applied mathematics.

Keywords: Queuing Theory, Interest in Learning, Applications of Mathematics, Mathematics Students, Applied Mathematics, Undergraduate Students, Postgraduate Students

1. Introduction

Mathematics is a fundamental discipline that contributes significantly to scientific development, technological advancement, economic planning and decision-making. Although Mathematics is traditionally associated with numbers, formulae, structures and abstract reasoning, its broader significance lies in its capacity to model and solve problems encountered in real-life situations. Applied Mathematics provides a bridge between mathematical concepts and practical problems by enabling learners to understand, analyse and predict phenomena through mathematical models. One of the

important areas of Applied Mathematics is **Queuing Theory**. Queuing Theory deals with the mathematical study of waiting lines or queues. Waiting-line phenomena are common in everyday life, including queues at banks, hospitals, railway stations, airports, supermarkets, ticket counters and service centres. Similar phenomena occur in computer networks, telecommunication systems, manufacturing processes and online service systems. Queuing models provide mathematical techniques for studying arrival patterns, service mechanisms, waiting time, queue length, system utilisation and service efficiency. The study of Queuing Theory is particularly relevant to Mathematics students because it demonstrates how mathematical concepts can be applied to practical decision-making. Concepts from probability, statistics, stochastic processes and mathematical modelling are brought together to analyse service systems. Through Queuing Theory, students can appreciate that mathematical knowledge extends beyond classroom exercises and examination problems.

However, the effectiveness of learning a mathematical topic depends partly on students' interest in that topic. Interest may influence attention, participation, motivation and willingness to explore a subject. When students perceive a mathematical topic as meaningful and relevant to real-life situations, they may develop greater enthusiasm for learning it. Therefore, studying students' interest in Queuing Theory and its applications can provide useful information for Mathematics educators. The present study focuses on final-year Mathematics students because they have reached an advanced stage of their undergraduate or postgraduate programme and are expected to possess adequate mathematical maturity to understand applied mathematical concepts. The study includes students from both Government and Private Arts and Science Colleges in Karaikal, thereby providing representation from different institutional settings.

2. Need and Significance of the Study

Queuing Theory has considerable practical importance because waiting-line problems occur in almost every service-oriented system. Efficient management of queues can reduce waiting time, improve service quality, optimise resources and support managerial decision-making. Consequently, knowledge of Queuing Theory is valuable not only for Mathematics students but also for learners interested in Operations Research, statistics, data analysis, management science and related fields.

Despite its practical relevance, students may sometimes perceive mathematical topics such as Queuing Theory as abstract or highly theoretical. If students are unable to recognise the connection between mathematical models and practical situations, their interest in learning may be reduced. Therefore, examining students' interest in both theoretical learning and practical applications can provide useful pedagogical insights. The present study is significant because it examines two dimensions of students' interest: interest in learning Queuing Theory and interest in learning its applications. The distinction is important because students may respond differently to theoretical concepts and practical applications. The study is also significant because it includes both undergraduate and postgraduate Mathematics students. Comparing these two groups can provide an indication of whether academic level is associated with differences in interest. Similarly, the inclusion of male and female students permits an examination of gender-wise differences. The findings may help Mathematics teachers identify students' level of engagement with Queuing Theory and design instructional strategies that make applied mathematical learning more meaningful. The findings may also be useful to curriculum planners, teacher educators and researchers interested in Mathematics education and Operations Research education.

3. Statement of the Problem

The problem of the present investigation is stated as:

“Interest in Learning Queuing Theory and its Applications among Final-Year Mathematics Students.”

4. Operational Definitions

4.1 Interest in Learning: Interest in learning refers to the degree of liking, curiosity, attention, willingness and positive inclination expressed by students towards learning a particular subject or area of knowledge.

4.2 Queuing Theory: Queuing Theory refers to the mathematical study of waiting-line systems involving elements such as arrival patterns, service mechanisms, waiting time, queue length and system utilisation.

4.3 Applications of Queuing Theory: Applications of Queuing Theory refer to the use of mathematical Queuing concepts and models to analyse waiting and service problems in practical situations such as banking, healthcare, transportation, telecommunications and industrial systems.

4.4 Mathematics Students: In the present study, Mathematics students refer to final-year undergraduate and postgraduate students specialising in Mathematics and studying in selected Government and Private Arts and Science Colleges in Karaikal.

5. Objectives of the Study

The study was conducted with the following objectives:

To determine the level of interest in learning Queuing Theory and its applications among final-year Mathematics students.

To determine the mean scores of students in interest towards learning Queuing Theory and interest towards learning its applications.

To find out whether there is a significant difference in the interest in learning Queuing Theory and its applications among final-year Mathematics students with respect to **level of study**.

To find out whether there is a significant difference in the interest in learning Queuing Theory and its applications among final-year Mathematics students with respect to **gender**.

6. Hypotheses of the Study

The following null hypotheses were formulated:

H₀₁: There is no significant difference in the interest in learning Queuing Theory and its applications among final-year Mathematics students with respect to level of study.

H₀₂: There is no significant difference in the interest in learning Queuing Theory and its applications among final-year Mathematics students with respect to gender.

7. Methodology

7.1 Research Method: The normative survey method was adopted for the present investigation. The method was considered appropriate because the purpose of the study was to assess the existing level of interest among Mathematics students and examine differences between selected groups.

7.2 Population of the Study: The population consisted of final-year undergraduate and postgraduate Mathematics students studying in Government and Private Arts and Science Colleges in Karaikal.

7.3 Sample of the Study: A total of 200 final-year Mathematics students participated in the study. The sample included both undergraduate and postgraduate students from Government and Private Arts and Science Colleges in Karaikal.

Table 1: Distribution of the Sample According to Level of Study

Level of Study	N	Percentage
Undergraduate	136	68.00
Postgraduate	64	32.00
Total	200	100.00

Table 1 shows that 136 students (68%) were undergraduate Mathematics students and 64 students (32%) were postgraduate Mathematics students.

Table 2: Distribution of the Sample According to Gender

Gender	N	Percentage
Male	100	50.00
Female	100	50.00
Total	200	100.00

Table 2 shows that the sample consisted of 100 male students and 100 female students, each representing 50% of the total sample.

8. Research Tool

An **Interest Inventory on Learning Queuing Theory and Its Applications** was used for collecting the required data.

The inventory was designed to assess students' interest in two major areas:

- Interest in Learning Queuing Theory**
- Interest in Learning Applications of Queuing Theory**

The maximum possible score of the inventory was **100**.

The obtained mean scores for the two dimensions were:

- Interest in Learning Queuing Theory = **30.24**
- Interest in Learning Applications = **34.36**

Hence, the overall mean score was **64.60 out of 100**.

9. Data Collection Procedure

The investigator administered the Interest Inventory to the selected final-year Mathematics students after obtaining the necessary cooperation from the concerned institutions. The purpose of the study was explained to the respondents, and they were instructed to provide responses honestly. The completed inventories were collected, scored and organised for statistical analysis.

10. Statistical Techniques

The following statistical techniques were used:

- Percentage analysis
- Mean
- Standard Deviation

d) Independent-samples t-test

The independent-samples t-test was used to examine differences in students' interest according to **level of study** and **gender**.

11. Analysis and Interpretation

11.1 Overall Interest in Learning Queuing Theory and Its Applications

Table 3: Mean Scores of Students in the Two Dimensions of Interest

Dimension	Mean Score
Interest in Learning Queuing Theory	30.24
Interest in Learning Applications	34.36
Overall Interest Score	64.60

Table 3 indicates that the mean score for interest in learning Queuing Theory was **30.24**, whereas the mean score for interest in learning its applications was **34.36**. The overall mean score was **64.60** out of a maximum possible score of 100.

The results indicate that students demonstrated a comparatively higher level of interest in the **applications of Queuing Theory** than in the theoretical component. This finding suggests that practical contexts may increase students' engagement with applied mathematical concepts. Students may find Queuing Theory more meaningful when they can understand its relevance to real-life situations.

The finding supports the pedagogical importance of connecting mathematical theories with authentic applications rather than presenting concepts exclusively through formulae and theoretical explanations.

12. Level-of-Study-wise Differential Analysis

The first hypothesis was tested using the independent-samples t-test.

Table 4: Difference in Interest in Learning Queuing Theory and Its Applications According to Level of Study

Level of Study	N	Mean	SD	t-value	df	Significance
Undergraduate	136	65.28	6.43	1.96	198	Not Significant
Postgraduate	64	63.32	6.98			

Interpretation

Table 4 shows that undergraduate Mathematics students obtained a mean score of 65.28 with a standard deviation of 6.43, whereas postgraduate Mathematics students obtained a mean score of 63.32 with a standard deviation of 6.98. The obtained t-value of 1.96 is slightly lower than the critical value of approximately 1.97 at the 0.05 level of significance for 198 degrees of freedom. Hence, the difference between undergraduate and postgraduate students is not statistically significant at the 0.05 level.

Therefore, H_{01} is accepted. This indicates that undergraduate and postgraduate Mathematics students do not differ significantly in their overall interest in learning Queuing Theory and its applications. Although undergraduate students recorded a slightly higher mean score than postgraduate students, the difference is not sufficiently large to be considered statistically significant. The finding suggests that academic level may not substantially influence students' interest in Queuing Theory among the students included in the present study.

13. Gender-wise Differential Analysis

The second hypothesis was tested using the independent-samples t-test.

Table 5: Difference in Interest in Learning Queuing Theory and Its Applications According to Gender

Level of Study	N	Mean	SD	t-value	df	Significance
Male	100	66.78	6.56	6.04	198	Significant
Female	100	61.32	6.21			

Interpretation

Table 5 indicates that male students obtained a mean score of 66.78 with a standard deviation of 6.56, whereas female students obtained a mean score of 61.32 with a standard deviation of 6.21.

The obtained t-value of 6.04 is considerably higher than the critical value of approximately 1.97 at the 0.05 level of significance. Therefore, the difference between male and female students is statistically significant. Hence, H_{02} is rejected. The result indicates that male Mathematics students demonstrated significantly higher interest in learning Queuing Theory and its applications than female Mathematics students in the present sample.

The difference in mean scores is 5.46 points, indicating a meaningful descriptive difference between the two groups. However, the finding should be interpreted within the context of the present sample and should not be taken to imply an inherent difference in mathematical interest between males and females. Other educational, motivational, instructional and contextual factors may contribute to the observed difference.

14. Consolidated Results of Hypothesis Testing

Table 6: Summary of Hypothesis Testing

Hypothesis	Comparison	t-value	Decision	Result
H_{01}	Undergraduate vs Postgraduate	1.96	Accepted	Not Significant
H_{02}	Male vs Female	6.04	Rejected	Significant

Table 6 provides a consolidated view of the differential analysis. The difference between undergraduate and postgraduate students was not significant, whereas the difference between male and female students was significant.

15. Major Findings of the Study

The major findings of the investigation are as follows:

1. The study comprised 200 final-year Mathematics students from Government and Private Arts and Science Colleges in Karaikal.
2. The sample consisted of 136 undergraduate students (68%) and 64 postgraduate students (32%).
3. The sample included 100 male students (50%) and 100 female students (50%).
4. The maximum score of the Interest Inventory was 100.
5. The mean score for interest in learning Queuing Theory was 30.24.
6. The mean score for interest in learning applications of Queuing Theory was 34.36.
7. The overall mean score was 64.60.

8. Students demonstrated a comparatively higher mean score for interest in applications of Queuing Theory (34.36) than for interest in learning the theoretical component (30.24).
9. Undergraduate students obtained a mean score of 65.28, while postgraduate students obtained a mean score of 63.32.
10. The obtained t-value of 1.96 indicated that there was no significant difference between undergraduate and postgraduate students at the 0.05 level.
11. Male students obtained a mean score of 66.78, while female students obtained a mean score of 61.32.
12. The obtained t-value of 6.04 indicated a significant gender difference in interest in learning Queuing Theory and its applications.
13. Male students demonstrated higher overall interest scores than female students in the present sample.

16. Educational Implications

The findings have important implications for Mathematics educators and curriculum planners.

- Since the mean score for interest in applications was higher than that for theoretical learning, teachers should provide greater opportunities for students to explore the practical significance of Queuing Theory.
- Teachers may introduce examples from banking, hospitals, transportation, telecommunications, supermarkets, airports, railway stations and computer networks to demonstrate the relevance of Queuing models.
- Students can be encouraged to develop simple mathematical models based on real-life Queuing situations. Such activities can help students understand how mathematical assumptions and parameters are used to represent practical systems.
- Computer-based simulations can be incorporated into teaching to demonstrate arrival rates, service rates, waiting times, queue lengths and system utilisation.
- Problem-based activities can be used to encourage students to identify Queuing problems in their surroundings and propose mathematical approaches for analysing them.

17. Recommendations

Based on the findings, the following recommendations are proposed:

1. Queuing Theory should be taught using a combination of theoretical explanation and practical application.
2. Mathematics teachers should provide real-life examples while introducing Queuing models.
3. Students may be encouraged to conduct mini-projects involving queues in banks, hospitals, transport systems and other service environments.
4. Simulation tools may be incorporated into the teaching-learning process.
5. Teachers may use case-based and problem-based learning strategies to improve students' engagement.

18. Limitations of the Study

The study has the following limitations:

- The study was restricted to final-year Mathematics students.
- The sample consisted of 200 students from selected Government and Private Arts and Science Colleges in Karaikal.

- Both undergraduate and postgraduate students were included, but only final-year students were considered.
- The study focused specifically on interest in learning Queuing Theory and its applications.
- The data were collected using an Interest Inventory.
- The findings should be generalised cautiously beyond the geographical and institutional context of the study.

19. Conclusion

Queuing Theory is an important component of Applied Mathematics because it enables students to understand and mathematically analyse waiting and service systems encountered in everyday life and professional contexts. The present study examined the interest in learning Queuing Theory and its applications among 200 final-year Mathematics students from Government and Private Arts and Science Colleges in Karaikal. The findings revealed an overall mean score of 64.60 out of 100. The mean score for interest in learning Queuing Theory was 30.24, whereas the mean score for interest in learning its applications was 34.36. Thus, students demonstrated comparatively greater interest in the applications of Queuing Theory than in its theoretical component. The differential analysis showed that the difference between undergraduate and postgraduate students was not statistically significant. However, a statistically significant difference was found between male and female students, with male students recording a higher mean score. The findings underscore the importance of making applied Mathematics instruction practical, contextual and meaningful. In particular, Queuing Theory can be presented through real-world situations, case studies, mathematical modelling and simulation activities. Such approaches may enable students to appreciate the relevance of mathematical knowledge beyond the classroom and develop a stronger understanding of how Mathematics contributes to solving practical problems.

References

1. Gross, D., Shortle, J. F., Thompson, J. M., & Harris, C. M. (2008). *Fundamentals of Queuing theory* (4th ed.). Wiley.
2. Kleinrock, L. (1975). *Queuing systems: Volume 1: Theory*. Wiley.
3. Medhi, J. (2003). *Stochastic models in Queuing theory* (2nd ed.). Academic Press.
4. Prasad, K. V. K. (2007). *Operations research*. Wiley India.
5. Taha, H. A. (2017). *Operations research: An introduction* (10th ed.). Pearson.
6. Winston, W. L. (2004). *Operations research: Applications and algorithms* (4th ed.). Thomson Brooks/Cole.
7. ·Habimana, S., Bizimana, B., & Maniraho, J. F. (2024). Factors affecting secondary school students' interest to learn mathematics: A review of the literature. *European Journal of Mathematics and Science Education*, 5(4), 227–240. <https://doi.org/10.12973/ejmse.5.4.227>
8. ·Papageorgiou, E., Wong, J., Liu, Q., Khalil, M., & Cabo, A. J. (2025). A systematic review on student engagement in undergraduate mathematics: Conceptualization, measurement, and learning outcomes. *Educational Psychology Review*, 37(3), Article 66. <https://doi.org/10.1007/s10648-025-10046-y>
9. ·Sengodan, V., Maat, S. M., & Mahmud, M. S. (2025). A bibliometric and systematic analysis of mathematics interest (2021–2025). *Educational Process: International Journal*, 17, e2025389. <https://doi.org/10.22521/edupij.2025.17.389>

10. Tasarib, A., Rosli, R., & Rambely, A. S. (2025). Impacts and challenges of mathematical modelling activities on students' learning development: A systematic literature review. *Eurasia Journal of Mathematics, Science and Technology Education*, 21(5), em2641. <https://doi.org/10.29333/ejmste/16398>