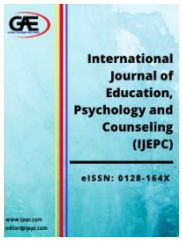
International Journal of Education, Psychology and Counseling
IJEPC
EISSN : 0128-164X
Volume 9 Issue 56 (December 2024) PP. 708-719
DOI 10.35631/IJEPC.956043



INTERNATIONAL JOURNAL OF EDUCATION, PSYCHOLOGY AND COUNSELLING (IJEPC)
www.ijepc.com

NOMINAL GROUP TECHNIQUE: ELEMENTS FOR DEVELOPMENT OF IMAGINATION ACTIVITY-MODEL TO ENHANCE INNOVATION FOR CHINESE MEDICAL STUDENT

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Article Info:

Article history:
Received date: 24.10.2024
Revised date: 10.11.2024
Accepted date: 12.12.2024
Published date: 24.12.2024

To cite this document:

Li, L., & Ariffin, A. (2024). Nominal Group Technique: Elements for Development of Imagination Activity-Model to Enhance Innovation for Chinese Medical Student. *International Journal of Education, Psychology and Counseling, 9* (56), 708-719.

DOI: 10.35631/IJEPC.956043

Abstract:

Innovation education is a crucial aspect of teaching reforms in higher education. The quality of innovation education directly impacts the quality of higher education. Strengthening research on innovation curriculum models and guiding undergraduates to develop innovation skills efficiently is a major focus of higher education reform. Chinese medical education is reforming to meet global standards and emerging healthcare challenges, improving medical training quality, clinical skills, and interdisciplinary collaboration. To address these issues, medical education programs in China should incorporate experiential learning, interdisciplinary collaboration, and mentoring programs. Promoting a culture of innovation and risk-taking can encourage students to pursue innovative healthcare solutions. The purpose of this study is to identifying the elements for development of an Imaginative Activity-Based Model to enhance Innovation for Chinese Medical Student. This research uses the Nominal Group Technique (NGT) as a method to collect data. The respondents for the study is nine (9) experts. A list of elements containing 19 imagination activities was finalized in the NGT discussion session which lasted for 3 hours. These 19 elements of imagination activity were then prioritized and ranked based on personal votes from all the experts involved. The 14th element of imagination activity in the NGT discussion got the highest priority and position while the element of imagination activity 6 got the ninth priority and the last position which is 19. The results of the study show that the priority and position of the element of imagination activity changed from the initial list given before the discussion session. The priority and position of the elements of imagination activity can help researchers to build models to enhance innovation for Chinese medical students.

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Keywords:

Chinese Medical Students, Elements of Imagination Activity, Innovation, Nominal Group Technique

Introduction

Innovation education is a crucial aspect of teaching reforms in higher education. The curriculum plays a key role in achieving higher education goals, both in quality and quantity (Hicks, 2018). The quality of innovation education directly impacts the quality of higher education. Strengthening research on innovation curriculum models and guiding undergraduates to develop innovation skills efficiently is a major focus of higher education reform (Zhao, et al., 2022).

China has made significant advances in medical studies, including genomic research, precision medicine, and genetic engineering. The China Precision Medicine Initiative (CPMI) uses genomic data for personalized healthcare, supported by AI in healthcare. China's large population and geographic diversity have led to the widespread adoption of telemedicine and remote healthcare solutions, especially in rural areas. Traditional Chinese Medicine (TCM) research continues alongside modern medical practices, focusing on the efficacy and safety of TCM treatments.

China is heavily investing in biotechnology and biopharmaceuticals, with growth in biotech startups, research institutes, and collaborations with international pharmaceutical companies (Zhou & Coplin, 2022). Notable advances include gene therapy, immunotherapy, and regenerative medicine. Chinese medical education is reforming to meet global standards and emerging healthcare challenges, improving medical training quality, clinical skills, and interdisciplinary collaboration (Liu, et al., 2023). Chinese medical institutions are also collaborating internationally on research projects, academic exchanges, and global clinical trials.

Objective

Identifying the elements for development of an Imaginative Activity-Based Model to enhance Innovation for Chinese Medical Student

Problem Statements

Taylor states that goals are central to setting a curriculum, guiding course content, implementation, and assessment. This emphasizes the importance of aligning university curriculum objectives with future higher education development (Zhou, et al., 2020).

However, China’s traditional education system prioritizes memorization and standardized tests over critical thinking and creativity, which hinders innovation among medical students. Most courses focus on theoretical aspects of innovation and rely heavily on lectures, failing to nurture students' innovation awareness. While some universities offer practical innovation activities, they often do not align with the course content, limiting their effectiveness (Zhang, et al., 2019).

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Extracurricular innovation activities are typically organized by associations or guidance departments, but they often lack engaging content and fail to meet diverse student needs. The course content formed by interdisciplinary cross-fertilization is insufficient to meet undergraduates' innovation needs (Kim, et al., 2023).

Despite the Basic Requirements for Teaching Innovation Education in General Undergraduate Universities, many innovation courses are fragmented and lack logical connections, leading to weak teaching effectiveness (Zhao Jian, Chen Xiaoming, & Zhao Zhiguo, 2022).

Medical education in China often does not prioritize opportunities for creativity and interdisciplinary collaboration. Limited exposure to other fields and real-world problem-solving hinders students' innovative thinking. The Ministry of Education's "Deep Implementation Opinion of Innovation Reform and Entrepreneurship Education in Higher Education Institutions" aims to make innovation an important indicator of talent cultivation, but such programs remain limited (Yang, et al., 2020).

Medical students in China also face limited support for entrepreneurship and healthcare innovation. They often lack access to mentors, incubators, funding, and research opportunities focused on healthcare innovation. Evaluation standards for innovation education in China are not well-established, making it difficult to assess and improve innovation education effectively (Xin, et al., 2022).

Cultural factors, regulatory barriers, and a risk-averse culture further discourage experimentation and innovation in healthcare (Torvinen & Jansson, 2023). Medical students may struggle to pursue innovative ideas due to fear of failure and bureaucratic challenges. To address these issues, medical education programs in China should incorporate experiential learning, interdisciplinary collaboration, and mentoring programs. Promoting a culture of innovation and risk-taking can encourage students to pursue innovative healthcare solutions. Researchers suggest to list the elements for developing an Imagination Activity-Model to enhance innovation for Chinese medical students.

Methodology

Research Approach

The approach used for this study is a mixed method using the Nominal Group Technique method. The Nominal Group Technique (NGT) is best described as a mixed-methods approach because it integrates both qualitative and quantitative elements (Lowe, et al., 2024). It is not strictly a qualitative method, but its core components do rely on qualitative data collection and interpretation, complemented by quantitative analysis for prioritization (Nyalela & Dlungwane, 2024).

The qualitative dimension of NGT emerges primarily during the brainstorming phase, where participants generate open-ended responses to a specific question or problem (Hugé, et al., 2023). These responses often reflect individual experiences, perspectives, and insights, which are qualitative in nature (Roberts, 2019). Furthermore, researchers or facilitators may group and interpret these responses into themes or categories, a process that involves qualitative analysis techniques such as thematic or content analysis (Ranse, et al., 2023). This step relies

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on understanding the meaning behind the ideas and grouping them based on shared characteristics (Hugé, et al., 2023).

The quantitative aspect of NGT becomes evident when participants are asked to rank or rate the generated ideas (Jiamei, et al., 2024). These rankings or ratings are numerical, allowing researchers to calculate totals, averages, or frequencies to identify the most important or prioritized ideas (Eger, et al., 2022). Statistical tools can also be applied, such as calculating medians, modes, or interquartile ranges, to analyse the consensus level among participants (Jiamei, et al., 2024). This structured ranking process introduces a quantitative element to what begins as a qualitative data collection activity (Eger, et al., 2022).

NGT combines the strengths of both qualitative and quantitative methodologies (Lowe, et al., 2024). It starts with qualitative data collection to explore a wide range of perspectives and generate a rich dataset of ideas (Nyalela & Dlungwane, 2024). It transitions into quantitative analysis to systematically evaluate and prioritize those ideas based on participants' preferences (Lowe, et al., 2024).

By blending these methods, NGT provides a comprehensive approach that captures diverse viewpoints while enabling structured decision-making (Nyalela & Dlungwane, 2024). It is particularly valuable in research contexts where both the exploration of ideas and the prioritization of actionable solutions are required (Lowe, et al., 2024).

Nominal Group Technique

The Nominal Group Technique (NGT) was introduced by Delbecq and Van de Ven in 1971. According to Delbecq and Van de Ven (1971), NGT is a structured method for small group discussions aimed at reaching an agreement (Abdul Muqsith Ahmad, Zaharah Hussin, Farazila Yusof & Mohd Ridhuan Mohd Jamil, 2017). This aligns with Aizzat Mohd. Nasurdin, Intan Osman, and Zainal Ariffin Ahmad's (2006) view that NGT is a decision-making process involving face-to-face small group discussions. Pokorny et al. (1988) also noted that NGT is highly suitable for studies requiring consensus and evaluation, as it can provide a high level of agreement (Abdul Muqsith Ahmad et al., 2017). Dang (2015) stated that NGT aims to brainstorm and generate ideas on a specific issue. This technique allows participants to argue based on their experience and knowledge, regardless of their education level or rank, as the discussions are conducted face-to-face in groups, providing a focused environment (Delp, Thesen, Motiwalla & Seshardi, 1977).

The NGT process consists of the focus group discussion (Dang, 2015). The Nominal Group Technique (NGT) is a structured method for group brainstorming that promotes inclusive participation and ensures that the input of all participants is considered (Hugé et al., 2023). The flow of the process showed in the figure 1.

1. Idea Generation: Each participant writes down their ideas independently and silently.
2. Idea Sharing: Participants take turns sharing their ideas in a round-robin fashion, without discussion or critique, and the facilitator records each idea.
3. Discussion: Once all ideas are listed, the group discusses them to clarify and evaluate their meaning and importance.
4. Ranking or Voting: Participants individually rank or vote on the ideas to prioritize them. The rankings or votes are then tallied to determine the group's overall priorities.

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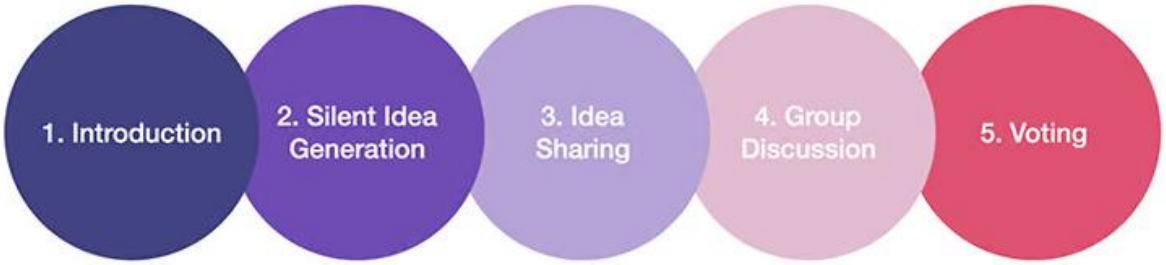

Figure 1: Nominal Group Techniques Process

The technique is designed to prevent domination by a single person and to encourage creative and diverse input from all members of the group. The process begins with the researcher presenting a list of imaginative activities suitable to enhance innovation for Chinese medical students. This list, developed from model combinations and expert discussions, serves as a reference during the workshop. However, experts can provide feedback on the initial list of activities.

At the end of the NGT process, only those activities that achieve a high level of consensus will be included in the final model.

Sample

The study sample for the Nominal Group Technique (NGT) approach in the data collection process consisted of 5 to 9 people (Van de Ven & Delbecq, 1971). Janes (2009) suggests that an expert group should have between 6 and 10 members, as larger groups tend to weaken the quality of debate (Siti Farhah A. Aziz, 2016). Therefore, this study has involved 9 experts.

The criteria for selecting appropriate experts for this study are based on the following points (Mohd. Ridhuan Mohd Jamil & Nurulrabihah Mat Noh, 2020):

1. An individual is considered skilled in a certain field if they have more than 5 years of experience (Berliner, 2004).
2. Experts should form a heterogeneous group, combining various areas of expertise (Somerville, 2014).
3. An individual is considered an expert when they have high knowledge and skills in a certain field (Swanson & Holton, 2011).
2. Experts should be willing to provide their views based on their research experience (Gambatese, Behm & Rajendran, 2008).
3. Experts should be willing and able to commit to revising findings from the study (Pill, 1971; Oh, 1974).
4. Experts should not dominate discussions and must be able to appreciate the views of other experts (Delbecq et al., 1975).

The selected experts included two curriculum drafters and seven innovation educators, all with over 10 years of experience in teaching innovation.

Instruments

The instruments used for NGT, an initial list that has been built based on previous studies continued from the questionnaire in the first phase. However, this initial list went through two

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rounds of face validity before the initial list was produced to be discussed in the NGT session. At the end of the NGT session, a questionnaire consisting of the activity elements that had been decided in the previous NGT session was made into a 5 likert scale item to get personal feedback from each expert involved for each activity element that had been agreed upon.

Data Analysis

The data obtained from the questionnaire distributed at the end of the discussion session was converted into Microsoft Excel software for the purpose of data analysis. The data analyzed is to obtain the total for each element that has been listed. The total amount of each item for all respondents will determine the priority value for the element in question. After that, the position of the element will be determined based on the priority value of the element obtained.

Findings

The validity test was conducted to test the validity of the elements that had been collected from the survey of previous studies. This validation process is done 2 times. However, the validity that is tested is only the face validity of which the elements that have been listed, are given to experts to evaluate whether they are appropriate to be included in the model that will be developed. In the first round, a total of 30 activity elements were listed by the researcher. This list is known as the alpha 1 list. The alpha 1 list is submitted to two innovation experts for evaluation. The feedback received from expert 1 states that this list of alpha 1 is too much and that the number of activity elements should be reduced. The same thing was also raised in expert 2's response, and it was also stated that there are some elements that need to be corrected in the sentence structure. After the response for the alpha 1 list was received, the researcher processed the list to make a list of alpha 2 activity elements. For alpha 2, the list was shortened from 30 activity elements to 19 activity elements only. The alpha 2 list is submitted back to the two experts for evaluation. Based on the responses received, it shows that the alpha 2 list is accepted with minority corrections (sentence structure) for 3 activity elements. After being fixed, the alpha 2 list was named as the initial list and used in the discussion with 9 selected experts for the NGT session.

The application of the modified Nominal Group Technique (NGT) pinpointed the instructional activities to be incorporated into the model. At the conclusion of the NGT meeting, the experts reviewed and agreed upon the final list of instructional activities. Table 1 illustrates the ranking and prioritization of these activities, based on the individual votes of the experts. The voting process, conducted during the final phase of the NGT, retained all proposed learning activities as the experts had already finalized their decisions. The goal was to rank each learning activity according to the experts' personal preferences on a scale of 1 to 5.

The discussion session lasted for three hours. At its onset, the researcher clarified the study's purpose and objectives. Subsequently, an initial list containing 19 elements for model development was distributed to all participating experts. The initial list of elements is as follows:

1. Gather students in an environment conducive to creative thinking.
2. Introduce the concept of innovation in medicine and its importance in improving patient outcomes and medical delivery.
3. Brainstorm a list of current challenges or areas for improvement in healthcare.
4. Choose one or more challenges from the brainstorm list.

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5. Encourage students to delve deeper into the chosen challenge to understand the underlying issues and identify specific problems that need to be addressed.
6. Divide students into small groups or pairs.
7. Each group/pair chooses a specific problem to solve.
8. Give them time to think of potential solutions to the identified problems. Encourage them to think outside the box and consider innovative approaches.
9. Encourage students to create detailed sketches, diagrams, or even prototypes of their innovative solutions.
10. They can also provide a brief description of how their solution addresses the identified problem.
11. Invite each group to present their innovative solution to the rest of the class.
12. Encourage constructive feedback and discussion from peers. Questions can focus on the feasibility, effectiveness and potential impact of the proposed solution.
13. Facilitate a reflection session where students discuss what they learned from the activity and how they can apply creative thinking and innovation in their future medical practice.
14. Encourage interested students to continue developing and refining their innovative solutions outside the classroom.
15. Provide resources or support to help students implement their ideas, such as connecting them with mentors, industry experts or relevant organizations.
16. Foster a supportive and non-judgmental environment where students feel comfortable expressing their ideas.
17. Emphasize the importance of collaboration and interdisciplinary thinking in healthcare innovation.
18. Highlight real-world examples of successful healthcare innovation to inspire and motivate students.
19. Encourage students to continue exploring and experimenting with new ideas even after the activity is over.

Experts are allocated 15 minutes to review the provided list of elements. Subsequently, a discussion of each element ensues. The discussion results indicate a minor difference of opinion, primarily due to misunderstandings regarding the structure of the intended sentences. However, this was effectively resolved following a thorough explanation. Ultimately, all elements in the initial list were unanimously approved by the specialists. Following this, each specialist received a questionnaire listing all the elements, allowing them to provide written feedback and indicate their level of acceptance for each element by marking the appropriate response field. The questionnaires were collected after 15 minutes. The gathered data were then analyzed to determine the scores for each item, which would establish the priority and position of the elements within the constructed framework. Table 1 below shows the results obtained from the NGT session that took place.

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Table 1: Element Priority and Position

NO.	ITEMS	TOTAL	PRIORITY	POSITION
1.	Gather students in an environment conducive to creative thinking.	40	6	15
2.	Introduce the concept of innovation in medicine and its importance in improving patient outcomes and medical delivery.	43	3	3
3.	Brainstorm a list of current challenges or areas for improvement in healthcare.	41	5	12
4.	Choose one or more challenges from the brainstorm list.	39	7	16
5.	Encourage students to delve deeper into the chosen challenge to understand the underlying issues and identify specific problems that need to be addressed.	41	5	13
6.	Divide students into small groups or pairs.	37	9	19
7.	Each group/pair chooses a specific problem to solve.	39	7	17
8.	Give them time to think of potential solutions to the identified problems. Encourage them to think outside the box and consider innovative approaches.	43	3	4
9.	Encourage students to create detailed sketches, diagrams, or even prototypes of their innovative solutions.	42	4	7
10.	Provide a brief description of how their solution addresses the identified problem.	41	5	14
11.	Invite each group to present their innovative solution to the rest of the class.	42	4	8
12.	Encourage constructive feedback and discussion from peers. Questions can focus on the feasibility, effectiveness and potential impact of the proposed solution.	43	3	5
13.	Facilitate a reflection session where students discuss what they learned from the activity and how they can apply creative thinking and innovation in their future medical practice.	42	4	9
14.	Encourage interested students to continue developing and refining their innovative solutions outside the classroom.	45	1	1
15.	Provide resources or support to help students implement their ideas, such as connecting them with mentors, industry experts or relevant organizations.	44	2	2

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16.	Foster a supportive and non-judgmental environment where students feel comfortable expressing their ideas.	42	4	10
17.	Emphasize the importance of collaboration and interdisciplinary thinking in healthcare innovation.	42	4	11
18.	Highlight real-world examples of successful healthcare innovation to inspire and motivate students.	38	8	18
19.	Encourage students to continue exploring and experimenting with new ideas even after the activity is over.	43	3	6

Figure 2 indicate the priority of each element.

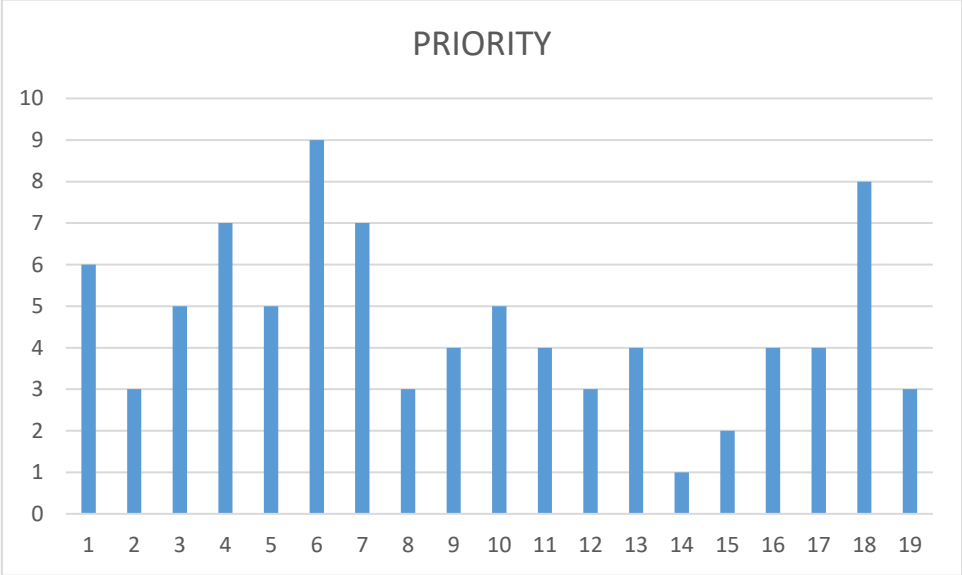

Figure 2: Summarization of Priority Elements

Referring to Table 1, the results from the NGT process highlight 19 learning activities as key components for developing an innovation model. The table also presents the ranking scores assigned by the experts for each learning activity. The lowest score given was four (2) for 'Disagree,' while the highest score was five (5) for 'Strongly Agree.' The cumulative scores establish the priority ranking for each learning activity. Based on the priority and ranking values calculated in Table 5.1, the learning activities can be organized as follows:

1. Encourage interested students to continue developing and refining their innovative solutions outside the classroom.
2. Provide resources or support to help students implement their ideas, such as connecting them with mentors, industry experts or relevant organizations.
3. Introduce the concept of innovation in medicine and its importance in improving patient outcomes and medical delivery.
4. Give them time to think of potential solutions to the identified problems. Encourage them to think outside the box and consider innovative approaches.
5. Encourage constructive feedback and discussion from peers. Questions can focus on the feasibility, effectiveness and potential impact of the proposed solution.

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6. Encourage students to continue exploring and experimenting with new ideas even after the activity is over.
7. Encourage students to create detailed sketches, diagrams, or even prototypes of their innovative solutions.
8. Invite each group to present their innovative solution to the rest of the class.
9. Facilitate a reflection session where students discuss what they learned from the activity and how they can apply creative thinking and innovation in their future medical practice.
10. Foster a supportive and non-judgmental environment where students feel comfortable expressing their ideas.
11. Emphasize the importance of collaboration and interdisciplinary thinking in healthcare innovation.
12. Brainstorm a list of current challenges or areas for improvement in healthcare.
13. Encourage students to delve deeper into the chosen challenge to understand the underlying issues and identify specific problems that need to be addressed.
14. Provide a brief description of how their solution addresses the identified problem.
15. Gather students in an environment conducive to creative thinking.
16. Choose one or more challenges from the brainstorm list.
17. Each group/pair chooses a specific problem to solve.
18. Highlight real-world examples of successful healthcare innovation to inspire and motivate students.
19. Divide students into small groups or pairs.

Summary

The Nominal Group Technique (NGT) process has played a significant role in helping researchers identify the elements of imaginative activities essential for model building, thereby achieving the study's objectives. The findings indicate that the experts unanimously agreed upon 19 elements of imaginative activity, as presented prior to the session, with slight adjustments to their structure. These finalized elements can now serve as the foundation for developing an Imaginative Activity-Based Model aimed at enhancing innovation among Chinese medical students.

However, the study faced certain challenges and limitations. One challenge was ensuring that the experts fully understood the scope and context of the imaginative activity, which required detailed explanations and clarifications during the session. Another limitation was the relatively small number of experts involved in the process, which, while conducive to achieving consensus, may not fully represent the diversity of perspectives within the broader field. Additionally, the slight modifications to the original elements highlight the inherent subjectivity in expert judgment, which could vary depending on the composition of the group. Despite these challenges, the study successfully identified and validated key elements for the proposed model.

Acknowledgment

I would like to thank my PhD supervisor Azli Ariffin for his patience, guidance and help in gaining insights and improving my skills. From the selection of thesis topic to repeated revisions, he always encouraged me until the completion of the thesis. Also, I thank your journal for giving me the opportunity to present my research results.

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