# Nominal group technique application towards design of components and elements of non-digital game framework

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**ABSTRACT**

Non-digital games are a tool that can help children to build and improve problem solving skills in early mathematics learning. Teachers need to design a learning activity using non-digital games taken account problem solving skills in the learning activities. However, the application of problem-solving skills in early mathematics learning activities is challenging, as there is no specific reference that can be used as a guide in implementing effective learning activities. The nominal group technique (NGT) approach is used to design the main components and elements of ProSkiND non-digital games framework based on the expert validation. A total of 12 experts were selected to validate the proposed main components and elements of the ProSkiND non-digital game using NGT online workshop. There were five main components with 41 elements were proposed: activity objective, teacher's preparation, teacher's role, children's role, and activity evaluation. In this study, experts are asked to evaluate the ProSkiND non-digital games main components and elements based on the percentage value of agreement. The value of percentage of agreement that exceeds 70% (≥70%) is acceptable. The findings in this phase are used to develop main components and elements of the ProSkiND non-digital game framework based on problem solving skills for preschool early mathematics using the interpretive structural modelling (ISM) approach.



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## 1. INTRODUCTION

Playing is the best teaching and learning experience, and it is a priority in early childhood education [1]. Therefore, the appropriate teaching approach for the children can provide a fun and joyful teaching and learn for children [2]. Problem-solving skills is one of the most significant cognitive skill for children aged between four to six years [3]–[6]. Problem-solving skills are a measuring tool aimed for assessing the necessary level of mastery to solve problems related to mathematics of the children at that age [4], [7], [8].

Games are an approach that can help to encourage and develop the essential skills among the children. Before entering primary school, problem-solving skills are necessary and crucial for children [9]. According to the curriculum and assessment standard document (DSKP), problem-solving skills are one of the skills that children need to master in 21st century learning [10]. This statement is also supported [4], [8], [11], [12], where problem-solving skills is one of the essential skills, children needed as a preparatory step to meet the learning challenges of the 21st century.

Based on past studies, the level of mastery in early mathematics of preschool children especially in problem solving skills is low [8], [9], [11], [12]. The cause is due to children finding it difficult to practice existing knowledge to solve problems and failing to solve problems in daily life [6]. This needs to be taken seriously because problem solving skills in mathematics should be formed and reinforced at an early stage so that more complex knowledge and skills can be developed along with children’s development [11], [12].

Realizing this value, children do not possess problem-solving skills naturally, but it needs to be developed. Children's problem-solving skills needed to be developed in line with the age and developmental stage of the child [4]. Stated that problem-solving skills needed to be developed as early as the age of three by play games [9]. Children need to solve problems from one scenario to another according to the right steps. So that teachers play a role in training and directing children to acquire these skills to develop problem-solving skills in line with the level of cognitive, psychomotor, mental, social, and psychosexual development of preschool children [13]. Therefore, teachers need to plan teaching and learning in the classroom by adopting a problem-solving skills’ element in each activity.

Besides, one of the challenges in mathematics learning is the application of problem-solving skills among the teachers to the children [14]. Teachers need to apply different elements of problem-solving skills (expertise, skills, and values) during the learning process. To apply problem-solving skills in learning activities, teachers, need to have an apparent mastery of problem-solving skills, steps and strategies to solve problems appropriate to the child's level of development [14], [15]. However, in carrying out these learning exercises, there are no transparent reference sources that can be used as a guide for students. That study related to learning experiences focused on problem-solving skills for pre-school children is less emphasized in the literature [14]. Most of the studies mainly focused on the implementation of learning activities based on problem-solving skills for primary schools [16], secondary schools [17], and institutions of higher learning [18]. Moreover, previous studies have developed games specific for a particular age of the audience or students only (secondary, tertiary education) [19], [20].

Based on the previous finding, there is no clear clarification of components and elements required in implementing learning activities by using non-digital games focused on early mathematics problem-solving skills. Based on the challenges and issues, it shows that there is a need to develop a non-digital game framework (ProSkiND) that focuses on problem-solving skills elements specifically for preschool teachers. In early mathematics learning. Therefore, this study aimed to design the main components and elements of the non-digital game, ProSkiND framework based on problem-solving skills for preschool early mathematics. This design process involves selecting expert validation, therefore, several research questions were developed namely: i) What are the main components that need to be included in developing ProSkiND non-digital game framework based on problem solving skills for preschool early mathematics based on expert views; ii) What are the elements for each of the main components that need to be included in developing ProSkiND non-digital game framework based on solving skills for preschool early mathematics based on expert views; iii) What are the main components of ProSkiND non-digital game framework based on solving skills for preschool early mathematics based on expert agreement; and iv) What are the elements of each of the main components of ProSkiND non-digital game framework based on solving skills for preschool early mathematics based on expert agreement.

## 2. RESEARCH METHOD

Generally, this study adopted the design and development research (DDR) approach, which was introduced by Richey and Klein [21] and consists of three main phases which are needed analysis, design, and development and evaluation. In this paper, researcher focus on second phase of the development of ProSkiND non-digital game framework based on problem solving skills for preschool early mathematics. Based on the findings of need analysis shows clearly that there is a need to develop a non-digital game framework specifically for preschool teachers who focus on steps to carry out learning activities to solve early mathematics problems by using non-digital games. After nominal group technique (NGT) process, this phase was continued adopted the interpretive structural modelling (ISM) approach. However, before the development ProSkiND framework, the researcher had adopted the NGT to design and verify the main components and elements of the ProSkiND framework based on problem solving skills for preschool early mathematics. The NGT used in the design and development phase is a process of contributing to discuss about the issues and problems and designing a framework to be developed [22]. Figure 1 shows the phase and method using in DDR approach.

| Phase and Method |
|---|
| **Phase 1: Need Analysis Phase** |
| Statistic Descriptive (Mean Score and Standard Deviation) |
| **Phase 2: Design and Development Phase** |
| Design Phase: Nominal Group Technique (NGT)<br>Development Phase: Interpretive Structural Method (ISM) |
| **Phase 3: Evaluation Phase** |
| Fuzzy Delphi Method (FDM) |

Figure 1. Phase and method using in DDR approach

### 2.1. Definitions of NGT

NGT is a structured variation of a small-group discussion to reach consensus [23]. It is also a technique of obtaining research data based on face-to-face meetings and aimed to get the expert consensus in identifying and accepting the components or the elements [24]. Besides that, NGT is often used and applied in the study to obtain exact findings and is not perceptive views. It is also a process of semi-quantitative and structured because this technique is able to combine qualitative methods [25]. It is supported by the fact that O'Neil and Jackson [25], where the process begins with the process of 'acceptance of ideas without judgment' (qualitative) and is followed by the process of ordering the priority of ideas based on the order of numbers. In this study, NGT is used for designs the main component and elements in ProSkiND framework based on problem solving skills for early mathematics of preschool.

### 2.2. Participants of NGT

There has been debate as to what constitutes the optimal size of group for NGT. The NGT groups should be made up of no more than five to nine participants, but that large group (9-more than 200) can be accommodated within this process [26]. Identified his groups as ranging from 9-12 persons. Besides, Harvey and Holmes [27] asserted that the most ideal group of study participants is 6-12 persons. Therefore, there were 12 experts involved in this NGT session. A panel of experts were involved to validate ProSkiND main component and the elements using online workshop platform (Cisco WEBEX). Table 1 shows the list of experts involved in the design of the main components and elements in each main component for the development of the ProSkiND non-digital game framework.

Table 1. List of experts involved in NGT

| Expert | Level of education | Field of expertise | Years of experience |
|---|---|---|---|
| P1 | Doctor of Philosophy | Early childhood education | 8 years |
| P2 | Bachelor | Mathematics | 14 years |
| P3 | Doctor of Philosophy | Problem solving<br>Instructional design | 10 years |
| P4 | Bachelor | Early childhood education | 7 years |
| P5 | Doctor of Philosophy | Instructional design Reka Bentuk<br>Early childhood education | 15 years |
| P6 | Bachelor | Early childhood education | 14 years |
| P7 | Doctor of Philosophy | Research methodology<br>curriculum | 7 years |
| P8 | Doctor of Philosophy | Research methodology<br>Preschool curriculum | 13 years |
| P9 | Doctor of Philosophy | Problem solving | 14 years |
| P10 | Bachelor | Early childhood education | 10 years |
| P11 | Bachelor | Mathematics | 15 years |
| P12 | Degree | Early childhood education | 13 years |

The criteria of the experts involved in the group which are: i) Individuals with extensive experience, background and experience related to the scope of study; ii) Timely reliability and suitability to participate; iii) Have good communication abilities; and iv) Have more than five years' experience. The criteria in the selection of experts are a person who at least have five years' experience in early childhood education, mathematics experts, instructional design experts, problem solving experts, methodology experts, and preschool curriculum experts. In this session, a panel of experts was discussing on the improvement, evaluation and validation of the main components and elements needed in the development of the ProSkiND non-digital game framework. Experts were required to validate the main components and elements to design ProSkiND non-digital game framework based on the given questionnaire.

### 2.3. Instrument of NGT

The instrument used in NGT is a questionnaire and the items generated from literature review based on three existing models. The models are problem-solving model [28], TASC model [29], and Magic model [30]. This questionnaire has three main parts which are part A is the demographic of the respondents (experts), part B is the main component, and part C is the element part of each main component.

In terms of validity and reliability of the questionnaire of the NGT is referring to the selection of group members (experts) who fulfil the scope of this study and the items to be discussed in the session NGT related to the background of the experts involved. This is supported by previous study [31], which stated that the validity and reliability of this technique can be improved by determining the criteria for selection of group experts, through pilot studies and determination of correct discussion questions. The NGT questionnaires was given (emailed) to the experts a day before the online NGT workshop. During the NGT session, experts were asked to provide views and opinions on all main components and elements. They need to vote by marking on the Likert scale in NGT questionnaire ranged 1 (totally disagree) to 7 (totally agree).

### 2.4. Implementation of NGT

The implementation of NGT involves experts who have been selected according to the scope of the study and this workshop was using online workshop platform (Cisco WEBEX). The online workshop was conducted by a moderator. Moderators are as a controller of interaction in the NGT session [25]. The duration taken by the NGT workshop is about two hours. This duration time is an ideal time to implement NGT session. This period is an ideal period. The ideal period for participants to answer and actively follow the student workshop is between two hours to two hours and thirty minutes. To implementation NGT, there are five steps of specific guide which are researcher followed in this research. Table 2 shows the basic steps to carry out the NGT process as proposed [32].

Table 2. Five steps of specific guide to implement NGT session

| Step | Activity |
|---|---|
| Step 1 | A description of the study will be conducted by the moderator |
| Step 2 | Process of triggering ideas by study participants (experts) |
| Step 3 | Sharing ideas between study participants (experts) |
| Step 4 | Discussion of components and elements of the issues studied |
| Step 5 | The voting process of study participants |

In this session, experts were discussing on the improvement, evaluation and validation of the main components and elements needed in the development of the ProSkiND non-digital game framework. A panel of experts was required to select and validate the main components and elements to design ProSkiND non-digital game based on the given questionnaire. The NGT questionnaires were given (emailed) to experts a day before the online NGT workshop. During the NGT session, experts were asked to provide views and opinions on all main components and elements. They need to respond in the NGT questionnaire based on the Likert scale. A descriptive analysis was conducted such as score and the percentage was conducted to determine the percentage of agreement. The percentage of agreement should be more than 70% (≥70%) as it can be accepted for further reviews in this study.

### 2.5. Data analysis of NGT

The data analysis process for NGT is very simple because it is based on the value of percentage of agreement. Asserts that the percentage of agreement value indicates each the component and element is accepted when the value of percentage level of agreement is 70% and above [33]. The software used in this stage is a Microsoft Excel based on the template provided which is to obtain a percentage score value. Table 3 shows five steps of data analysis for NGT.

Table 3. The steps of data analysis for NGT

| Steps | Activity |
|---|---|
| Step 1 | Ensuring the number of participants (experts) involved with the study |
| Step 2 | The formation and calculation of score value is based on the templet data analysis of NGT |
| Step 3 | Convert score values into percentage form to get the value of percentage of agreement<br>$\text{Percentage }(\%) = \frac{\text{Total of score x 100}}{(\text{AxB})}$<br>A=Total of experts<br>B=Likert scale used i.e. 7 points |
| Step 4 | Determining the acceptance of components and elements based on percentage of agreement |
| Step 5 | Determine the position of the element according to the highest to lowest of percentage of agreement |

Referring to the fifth step, this step is to determine the position of each element for each component. The elements of each main components were prioritized based on the ranking number. The higher number would be the most priority elements in the list of each main components. It also helps researcher to compile and incorporate these elements into the concept star software to develop the ProSkiND non-digital game framework using ISM approach.

## 3. RESULTS AND DISCUSSION

The design phase of the main components of the ProSkiND non-digital game framework is based on three existing models. The models involved are Krulik and Rudnick problem-solving model [28], TASC model [34], and Magic model [35]. Based on the three models, three common components were selected which is the role of teachers, the role of children and assessment of activities to design ProSkiND non-digital game framework. Besides, there are two main components were added which is activities' objective aspect and teacher practices and training preparation as suggested in the literature. The justification for adding the objective activity and teacher preparation is focused on the goals and objectives to develop non-digital ProSkiND game system and serves as a complete guide and reference for pre-school teachers to use non-digital games while conducting problem-solving activities for early mathematics.

### 3.1. Research findings for design of main component and elements for ProSkiND

There were five main components of the ProSkiND non-digital game framework, namely: activity objectives, teacher preparation, teacher's roles, the role of children, and activity evaluation. To create the components, the dimensions of each model have been chosen based on these related models. Table 4 shows the related models for the design and development of the main components and elements of the main components of the ProSkiND non-digital game framework.

Table 4. Related model for design and development of ProSkiND

| Problem-solving model | TASC model | Magic model | ProSkiND based on problem-solving skills for early mathematics |
|---|---|---|---|
| Based on literature review | | | Activity objectives<br>Teacher's preparation |
| Read and think | Collecting/Organizing | Challenge | Teacher's role |
| Exploring and planning | Identify<br>Generate ideas | Reaction | Children's role |
| Choosing a strategy | Making decisions | | |
| Implement a solution | Implementation | | |
| Make revisions and reflections | Evaluate<br>Communicate<br>Learn from experience | Feedback | Activity evaluation |

Researchers defined each dimension in the creation of components for the non-digital game of ProSkiND framework. Table 5 presents the selected and validate elements for each component from three experts that experience in early childhood education. In the area of early childhood education, these experts have more experience where they are directly interested in the field.

Based on the five main components and elements of each main component of the ProSkiND non-digital game framework serves as a specific guide for teachers with reference to a framework that focuses on the steps of conducting learning activities using non-digital games for children to complete early mathematical problems. All experts agree on models focused on the design of main components and these elements as the basis for the development the non-digital game established by ProSkiND. A consensus was reached because of discussions by the experts involved, where all experts felt that all components and elements found in this system should be used as a basic guide for teachers to carry out learning exercises for children using non-digital games to solve problems in early mathematics.

Table 5. Details of main components and elements of each main component of the ProSkiND

| Main components | Elements |
|---|---|
| Activity objectives | Elements of activity objectives |
| Teacher preparation | Elements of teacher preparation |
| Teachers' role | Elements of teacher's role |
| Children's role | Elements of children's role |
| Activity evaluation | Elements of activity evaluation |

In addition, experts suggest that the application of this framework requires the creativity of teachers to translate the steps contained in this framework in the form of instructions and the use of simple language to children so that it is easily understood by children. This can encourage children to be actively involved in the activities carried out. In addition, it can guide teachers to carry out learning activities effectively, especially if it involves problem-solving in early mathematics that uses non-digital games by applying problem-solving measures appropriate to the child's developmental level. Therefore, based on this process, there are five main components and elements of each main component. All the elements of each main component have been validated and agreed by experts.

### 3.2. Verification of main components and elements for each main component framework based on expert agreement using modified NGT approach

This section is presented the finding for third and fourth research question aims to evaluate and validate the main components and elements of the ProSkiND non-digital game framework. It is to ensure that each element is appropriate and necessary according to the context of early mathematics learning takes account the problem-solving skills using non-digital game. Table 6 presents the NGT data findings for determining main component of ProSkiND non-digital game framework.

Table 6. NGT findings for the main components of the ProSkiND

| Main components | Score | Percentage | Acceptance status |
|---|---|---|---|
| Activity objectives | 76 | 90% | Accepted |
| Teacher's preparation | 77 | 92% | Accepted |
| Teacher's role | 76 | 90% | Accepted |
| Children's role | 76 | 90% | Accepted |
| Activity evaluation | 77 | 92% | Accepted |

Note: Acceptance percentage ≥70%

The details of each of the main components are discussed and improved in terms of sentence structure and the language has obtained expert approval. Expert consent is translated by marking the NGT Likert scale found in the questionnaire. After the formation of the main components of the ProSkiND non-digital game framework was accepted and agreed upon based on expert error. Action targets, teacher training, teacher roles, child roles, and activity assessment are the results obtained for the core components of the ProSkiND non-digital game system. The results of the surveys carried out by experts and the results obtained will be used to produce main components of the ProSkiND non-digital game.

The five components formed in the ProSkiND non-digital game framework is parallel with the basic components of the existing framework and model, which are objectives, the instructor preparation, the instructor role, the student role, and assessment [36]. It will be a guideline and a reference in implementing the teaching and learning process. Table 7 reveals the score values, percentages, and priority positions for the activity objective elements to be used in the ProSkiND non-digital game framework through the NGT method analysis. Table 8 shows the score values, percentages, and priority positions for the teacher preparation elements of the ProSkiND non-digital game framework through analysis of the NGT approach.

Table 9 shows the score values, percentages, and priority positions for teacher role elements in the ProSkiND non-digital game framework through analysis of the NGT approach. Table 10 shows the score values, percentages, and priority positions of the child role elements of the ProSkiND non-digital game framework through analysis of the NGT approach. Table 11 shows the score values, percentages, and priority positions of the activity evaluation elements for the ProSkiND non-digital game framework through analysis of the NGT method.

Table 7. The activity objective element of ProSkiND based on NGT method analysis

| No | Elements | Score | Percentage | Acceptance status | Ranking |
|---|---|---|---|---|---|
| 1. | Improve knowledge of early mathematics | 80 | 95% | Accepted | 1 |
| 2. | Improve knowledge of problem-solving steps in early mathematics | 79 | 94% | Accepted | 2 |
| 3. | Improve problem-solving skills in early mathematics | 79 | 94% | Accepted | 3 |
| 4. | To solve problems according to problem-solving steps, apply knowledge of early mathematics | 79 | 94% | Accepted | 4 |
| 5. | Apply early mathematical problem-solving skills in daily life | 78 | 93% | Accepted | 5 |

Acceptance percentage ≥70%

Table 8. Elements of teacher preparation in ProSkiND based on NGT method analysis

| No | Elements | Score | Percentage | Acceptance status | Ranking |
|---|---|---|---|---|---|
| 1. | Teachers plan learning content | 80 | 95% | Accepted | 1 |
| 2. | The teacher determines the topic of learning | 77 | 92% | Accepted | 2 |
| 3. | Teachers determine content standards, learning standards, and performance standards | 77 | 92% | Accepted | 3 |
| 4. | Teachers provide non-digital games that fit the title and learning standards | 77 | 92% | Accepted | 4 |
| 5. | The teacher determines the play activities that are appropriate for the non-digital games used | 77 | 92% | Accepted | 5 |
| 6. | The teacher determines the performance standards based on the level of mastery to be measured** | 76 | 90% | Accepted | 6 |
| 7. | The teacher determines the appropriate assessment method. | 76 | 90% | Accepted | 7 |
| 8. | The teacher sets the number of children in a group with a variety of levels | 76 | 90% | Accepted | 8 |
| 9. | Teachers set rules for the use of non-digital games** | 75 | 89% | Accepted | 9 |
| 10. | Teachers set time periods to carry out learning activities | 73 | 87% | Accepted | 10 |

Acceptance percentage ≥70%
**Element suggested from a panel of expert

Table 9. Teacher's role element for ProSkiND based on NGT method analysis

| No | Elements | Score | Percentage | Acceptance status | Ranking |
|---|---|---|---|---|---|
| 1. | Teachers provide appropriate examples to ensure that children understand the information presented | 79 | 94% | Accepted | 1 |
| 2. | Teachers instruct children to apply new information to existing knowledge that has been acquired | 78 | 93% | Accepted | 2 |
| 3. | Teachers encourage children to review the data provided by questioning friends and teachers | 77 | 92% | Accepted | 3 |
| 4. | The teacher asks the child to make sure the information received is clear | 76 | 90% | Accepted | 4 |
| 5. | The teacher guides the children to make plans after understanding the information before starting the problem-solving activity using games | 75 | 89% | Accepted | 5 |
| 6. | The teacher clearly explains the problem-solving activities using games to children | 74 | 88% | Accepted | 6 |
| 7. | Teachers state the standard of learning to children* | 56 | 67% | Rejected | - |

Acceptance percentage ≥70%
*Element rejected (Acceptance percentage for this element is ≤70%)

Table 10. Children's role elements for ProSkiND based on NGT method analysis

| No | Elements | Score | Percentage | Acceptance status | Ranking |
|---|---|---|---|---|---|
| 1. | Children choose the best ideas based on the results of discussions with friends in groups | 75 | 89% | Accepted | 1 |
| 2. | Each child in the group is encouraged to think of alternative ideas to solve problems using games | 73 | 87% | Accepted | 2 |
| 3. | Children identify problems found in activities with peers in groups | 72 | 86% | Accepted | 3 |
| 4. | Children determine strategies for solving problems based on the best ideas they have chosen | 72 | 86% | Accepted | 4 |
| 5. | Children carry out problem-solving activities using games within a set period | 72 | 86% | Accepted | 5 |
| 6. | Each child in the group thinks of an idea to solve a problem in an activity that uses games with teacher guidance | 71 | 85% | Accepted | 6 |
| 7. | Children need to justify clearly why the idea was chosen | 70 | 83% | Accepted | 7 |
| 8. | Children need to review the games provided by the teacher before starting the problem-solving activity | 70 | 83% | Accepted | 8 |
| 9. | Children exchange ideas to express ideas to solve problems | 69 | 82% | Accepted | 9 |
| 10. | Children can detect errors created by using games during problem-solving tasks | 68 | 81% | Accepted | 10 |
| 11. | During problem-solving exercises using games, children will act quickly to correct errors made | 67 | 80% | Accepted | 11 |

Acceptance percentage ≥70%

Table 11. Elements of activity evaluation of ProSkiND based on NGT method analysis

| No | Elements | Score | Percentage | Acceptance status | Ranking |
|---|---|---|---|---|---|
| 1. | Children are rewarded by the teacher if they manage to solve the problem by using the game** | 77 | 92% | Accepted | 1 |
| 2. | The teacher observes the children throughout the problem-solving activity using games | 76 | 90% | Accepted | 2 |
| 3. | Children are asked by the teacher to exchange answers/assignments with friends from other groups | 73 | 87% | Accepted | 3 |
| 4. | Children are encouraged by the teacher to review the answers/assignments with other friends | 73 | 87% | Accepted | 4 |
| 5. | Children relate the answers/results obtained to daily life | 72 | 86% | Accepted | 5 |
| 6. | Children can inform a friend if there is an error in the answer/result of his friend's assignment | 71 | 85% | Accepted | 6 |
| 7. | Children can identify mistakes found in the answers/results of a friend's assignment. | 69 | 82% | Accepted | 7 |
| 8. | The child explains the answer/result of the assignment to a friend. | 69 | 82% | Accepted | 8 |
| 9. | Children can act immediately to improve errors on answers/results of tasks that have been notified by friends. | 68 | 81% | Accepted | 9 |

Acceptance percentage ≥70%
**Element suggested from a panel of experts

### 3.3. Discussion

From the Table 6 to Table 11, all the components obtained from the literature and related model were validated by the expert during NGT session. In addition, the elements found in each component are also appropriate to the context of the study. Therefore, after obtaining agreement in expert discussions, some of elements that have been improved in terms of sentence structure and language for further research. Based on the results, the elements were grouped based on the percentage of acceptance according to the priority. The priority position is important because it is one of the procedures needed to integrate with the concept star software during the process of developing a non-digital game framework adopted the ISM approach. This finding will be used for the development of the elements for each of the main components of the ProSkiND non-digital game framework and shall reported in the subsequent publication.

Based on the finding for elements of activity objectives, the findings are parallel stated that the objectives of the model or framework are based on the knowledge possessed by students, skills mastered by students and the ability of students to apply knowledge and skills [37]. To produce effective learning, teachers need to know and be clear about the objectives of the activity. This statement is supported states that a good learning objective should include the following elements that are objectives must be more specific, objectives must clearly include knowledge and skills, objectives can be measured, and objectives can be assessed through observation and test. To develop higher order thinking, teaching framework or model, the elements must include are preparation of objectives, selection of content, content, organization, selection of learning experiences and the preparation of learning activities [14]. Based on the statement, a guide must have components that have a relationship with each other so that the guide can impact the teaching and learning process.

The findings of the teacher preparation elements also parallel with the arguments of the study [38], preparation before starting the teaching and learning process should be done by teachers. Among the preparations that need to be done by teachers are such as determining content standards and learning standards, determining the duration of learning activities, determining the size of student groups, determining the game materials to be used in learning activities and determining the assessment methods to be used to assess students. This finding is the preparations that need to be done by teacher are planning to learn topics, determining learning themes, determining learning objectives, providing learning materials and setting learning period appropriate to the student level. Therefore, it can be concluded that teacher preparation before teaching and learning process is an important component where it is one of the determinants of the effectiveness of learning objectives.

For teacher's role elements, it can be concluded that the findings for the formation of the element's teacher’s role are parallel with the previous research. The role of teachers is one of the important aspects of the effectiveness in the learning process [36]. That the elements of instructor commitment are instructor is responsible for guiding students to gather information, instructors ask students to compare information obtained from discussions with peers, instructors guide students to complete a given task and instructors are created to stimulate student interest during induction sessions.

Overall findings for the formation of an element's role of children are supported by previous study [39], where the role of children in the learning process will be able to increase motivation, responsibility, integrity, experiences, active involvement in activities and in applying the skills acquired in their daily lives.

The students' commitments are students can relate the material given by teacher with learning theme, students are punctual during learning activities, students ask and answer the questions with the instructor and students pay attention to the instructions and information presented by the instructor.

Lastly is the finding of formation of the activity evaluation element are parallel with several studies [40]–[43], where the evaluation conducted by teachers after the activity is an important aspect because it can measure students learning outcomes and the quality of teaching of the teacher. In assessment dimension, instructors can make observations throughout the learning process, students help each other to redevelop the information obtained, instructors should be transparent when making assessments, fair instructors make assessments of student work, instructors honest to correct student mistakes, the student is confident in presenting the work to the instructor and the student needs to reflect their self after learning activity [44]. Thus, in assessment, teachers and students need to play role so that the objectives of the activities that have been set can be achieved and produce effective learning.

## 4. CONCLUSION

Based on the findings, main components, and elements of ProSkiND non-digital game framework was designed using NGT method. An expert validation was conducted to determine the level of agreement for each selected component and elementary. The final component and element obtained in the study, will be further used in the development phase of ProSkiND non-digital game framework adopted the ISM approach. As mentioned, the component and elements selected in this study are mainly focused on the problem-solving skill development in early childhood education, especially in mathematics subject. This framework is intended aimed as reference and guidance for teachers in designing and mastering effective early mathematics learning activities using non-digital games. Therefore, the knowledge, skills and values in early mathematics can be applied by teachers to children during learning activities carried out using non-digital games. It also helps children improve their problem-solving knowledge and skills in early mathematics and children can apply these skills in their daily life.

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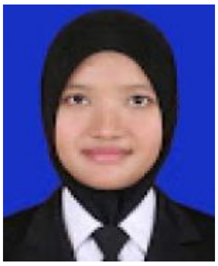

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