Knowledge Creation Process Within Group Problem Solving Among Students in Academic Institutions

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Abstract. This paper proposed the knowledge-creation process model within a group problem-solving process, and the discussion was driven by a research interest to improve the platform currently used in higher education, which fails to fully capture and represent knowledge creation within group problem-solving efforts in academic institutions. This research was carried out in four stages: knowledge acquisition, data collection, analyses of data, and presentation of the findings. The axiomatic theory and conflict resolution theory were used to explain group problem solving. The research findings show that the knowledge-creation process within the group problem-solving process encompass four distinctive steps: defining of the problem, identification of solutions, development of the action plan, and implementation and evaluation. A new group problem-solving process developed in this study provided more appropriate steps to initiate the knowledge-creation process and highlighted benefits from the problem-solving processes based on the knowledge gained through the quantitative analysis. This research contributes to the development of a new knowledge-creation process using qualitative data.

Keywords: Knowledge creation · Group problem solving · Theoretical approach

1 Introduction

Recently, there has been increasing interest in processing knowledge creation as a vital organizational resource. According to [1], the gap between knowledge creation and group problem solving arises because groups can formulate and solve problems based on existing, well-known knowledge without having to create new knowledge. In addition, the two scholars indicate that problem solving may downplay tacit knowledge and stress explicit knowledge. Here, a group may know the necessary parameters of a problem and may develop a solution based on the right combinations of such parameters, representing an emphasis on explicit knowledge. However, knowledge creation represents a crucial aspect of developing effective and lasting solutions to group problems [2, 3]. In this case, the place of knowledge creation in group problem solving lies in the steps of identifying its root cause, generating alternative solutions,

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evaluating alternatives, and agreeing on the best alternative [4]. Whether generating and evaluating options follow a "truth wins" or "truth supported" basis, the group has to handle and share explicit and tacit knowledge among the members before a solution can be selected. According to [5], knowledge creation occurs when establishing alternatives and when evaluating such alternatives. Knowledge has been considered a main resource underpinning the development processes of organizations and can potentially hurt the development and transfer of knowledge [6]. Fundamentally, knowledge creation is a necessity in the educational system and can never be claimed to be sufficient, especially in the present era, when it has been widely integrated into the learning framework to facilitate innovation and knowledge-based development processes central to Saudi Arabia's development strategies in organizations [5]. To varying degrees, group work has been shown to immensely contribute to knowledge transfer and referred to as an enabler in small and medium enterprises [7].

2 Literature Review

The process of knowledge creation within group problem solving is evident in how the individual members interact and share with each other in the production of a group solution. Overall, the creation of knowledge is what enables a group to establish new strategies of action and the enhanced capacity to act which underlies problem solving [3]. During the step of identifying its root cause and generating alternative solutions, the group members undertake tacit-to-tacit and tacit-to-explicit knowledge creation involving socialization and the sharing of insights, language, and mental models [8, 9]. The steps of evaluating alternatives and agreeing on the best alternative may involve tacit-to-tacit, tacit-to-explicit, and explicit-to-explicit knowledge creation. Here, the steps of socialization, externalization, and combination help in the deliberations toward an acceptable solution [10]. After agreeing on the best alternative, developing an action plan while implementing and evaluating the action plan entails internationalization, involving the conversion of explicit, systemic knowledge into organizational tacit knowledge forms, such as organizational knowhow in solving a problem [8, 11]. As a result, the process of knowledge creation fits in the steps of identifying, evaluating, and selecting solutions while leaving the individuals and the organization richer in knowledge.

Knowledge creation has become a key theme in corporate practice [8]. Hence, knowledge focuses mainly on practical techniques and incorporates both disseminating and exploiting knowledge using appropriate practices. Conversely, the literature asserted that knowledge depicts knowing-in-action and interprets knowledge as being mainly tacit, socially constructed, embedded in practice, and context dependent [2].

In the present day, knowledge not only plays a critical role in the competitive strategies of companies, but also more specifically demonstrates its strategically central role in establishing knowledge-intensive group work. This is evidenced by the progressive and empirically distinguishable changes in the range of services offered in the public sector and their modes of delivery in Saudi Arabia [4]. Therefore, the creation of knowledge and its sharing in group work have now explicitly become key channels for

transferring value among workers and to clients [12] and are critically needed in Saudi Arabia [13] for the rapid transformation of industries as a technology-based society [14].

However, in a study focusing on investigating the barriers to knowledge creation and management generated awareness that the value of knowledge is very important for both organizations and their clients because knowledge itself is essential for product development and management [14]. In Saudi Arabia, the subject of knowledge creation through group work has become more specifically needed and can be conveniently applied by describing the knowledge creation within group problem solving.

3 Methodology

This research adopted a descriptive form of qualitative research, as the objective of the research was to comprehensively describe and build in-depth understanding of the knowledge-creation process within the group problem-solving process; thus, a qualitative approach is most appropriate. "The key idea behind qualitative research is to learn about the problem or issue from participants and engage in the best practices to obtain that information" [15]. Strategically, the method of inquiry adopted in this study is a case study. It is considered appropriate because it investigates the phenomenon within its real-life context of the study environment [16]. As the objective of this study is confined to the development of a knowledge-creation process model in group problem solving, it is necessary to apply a case study method of inquiry in this study. This strategy of inquiry allows for the use of a focus group to develop a generalized understanding of knowledge creation in group problem solving. However, a case study could be referred to as an exploratory or explanatory method of inquiry used for the individual, group, or event [16] and will be applied in this study to generate substantial information from prior studies with the aim of clearly understanding the relationship effect of knowledge creation on group problem solving. A study by [9] defined a case study as an empirical means of inquiry that investigates a contemporary phenomenon in a real-life context when the boundaries between the research factors are not clearly explained. Therefore, the case study method of inquiry in this study provides a clear analytical frame based on which the study is established. The present case study is confined to knowledge creation in group problem solving in the educational sector of Saudi Arabia. When conducting qualitative research, the researcher has to care about the validity of the results. To ensure the validity of research results, steps are taken to verify the credibility of scientists [17]. However, in Saudi Arabia, the sharing of knowledge in group work has ushered in the rapid transformation of leveraging intellectual capital [18], although there has not been a clear process of knowledge creation within group problem solving to resolve chronic problems among the group (Table 1).

The data collection method was based on an in-depth focus group within the context of the study population. The in-depth focus group obtained direct information on the present situation in the respective universities about the knowledge-creation process within group problem solving.

This research was conducted in a public university, the University of Ha'il. The university was established in 2005 as part of the King Fahd University of Petroleum

Table 1. Operational framework of planning and literature review.

Steps	Objectives	Method	Deliverables
Phase 1: Literature review	1. Explore existing related literature work 2. To support present study 3. To present progress made in the research area 4. To review and analyse relationships between prior literatures work 5. To guide the concept of the present research using available materials	Content analysis	– Research problems – Research objectives – Research questions – Support present study – Compare previous findings
Phase 2: Data collection	1. To gather sufficient data 2. To collect data directly based on the present situation 3. To use data that clearly represent the study location 4. Collect data based on the study scope	– Focus group – Observation	– Address specific needs for the study – Ensure that the data is from a reliable source – Evaluate research findings – To systematically capture quality evidences
Phase 3: Result and Discussion	1. Present analysed data 2. Answer the research questions of the study 3. Analyse group problem solving 4. To discuss research findings	Mapping	– Develop knowledge-creation process model – Increase knowledge on problem solving group – Support and discuss credible answers to research question

and Minerals, with four branch campuses distributed in all cities throughout the large province. The university was chosen because it is one of the strong emerging universities in the field of technology in the country; hence, it offered opportunities for a rich and deep understanding of knowledge creation based on group problem solving.

This demographic information was collected for supplemental analysis. Twelve participants—six males and six female—were involved in the research in two separate groups. To ensure confidentiality, participants' names were not used; instead, each participant was identified by a coding form (e.g., M1, M2,… M6 for males and F1, F2, … F6 for females). All participants had experience using technology and had earned at least a Specialist Learning Resource diploma. Thus, all participants could be considered highly educated individuals who understood the relevance of technology in group learning. The experiences of the informants were obvious when solving the problem; for instance, they gave long and informative answers and explanations for their solutions to the problem.

3.1 Data Analysis

After collecting the qualitative data for this research, the next step was a scenario strategy analysis of the focus group. As a qualitative research with a case study approach, the study procedure analysed and coded the participants' responses to the

research questions. In the scenario process, the focus group was both video and audio recorded. The researcher also made notes of responses, which were transcribed into text and reviewed many times to identify the concepts. The answers were analysed a coded line by line to identify key concepts through free coding into categories and subcategories. The researcher conducted a qualitative research exercise in the interpretation of the data [15].

3.2 Research Findings

Participants were providing with the following scenario: "The science teacher is absent. The supervisor asked Khalid, the mathematics teacher, to teach science for the day. Khalid is not a science specialist. How can you help him solve this problem as a specialist of learning resource centres, based on the problem-solving steps you learned during your studies?" Both male and female groups answered this question by using a group problem-solving process. The researcher identified some new steps during their processes. For example, the female group used a new step, a plan B, in the "developing an action plan" step of group problem solving. Another new step occurred in the "implementing" step, with the addition of the tool of implementation. Moreover, they integrated the eight steps into four total according to the knowledge-creation steps and the time available for moving to the next step. The Fig. 1 shows how the group problem-solving process was based on the knowledge-creation process.

Group Problem Solving Stage. The group problem-solving process entails defining the problem, identifying its root cause, generating alternative solutions, evaluating alternatives, agreeing on the best alternative, developing an action plan, and implementing and evaluating the action plan. The first stage is defining the problem. The group agrees that a problem exists and identifies the problem, which involves considering the current situation and comparing it with the desired situation [19]. After all members agree on the problem, the next step entails undertaking a gap analysis to determine the root cause of the problem, which includes brainstorming among the group members [20]. In addition, this problem exploration step involves examining the causes rather than merely focusing on the symptoms of the problem, which is essential if the group desires to establish a solution capable of addressing the problem in its entirety rather than its consequences alone [21]. The second stage is finding solutions; after the group members identify the root cause of the problem, the group then has to generate possible solutions to the problem. The objective of this step is to generate rather than evaluate, given that a problem may have various solution approaches, in which case a wide and thorough range of alternative solutions is beneficial [19]. The third stage is the development of an action plan; the selected solution then informs a collaborative action plan designed by the group members, which may also involve selecting the best from a list of action plan approaches. The action plan should be seen as a key step in group problem solving, given that some members may view the previous step of selecting a solution as the last necessary step of involvement [21]. The fourth stage is implementation and evaluation. After designing an action plan, the group should then implement the selected solution. Evaluation should accompany the

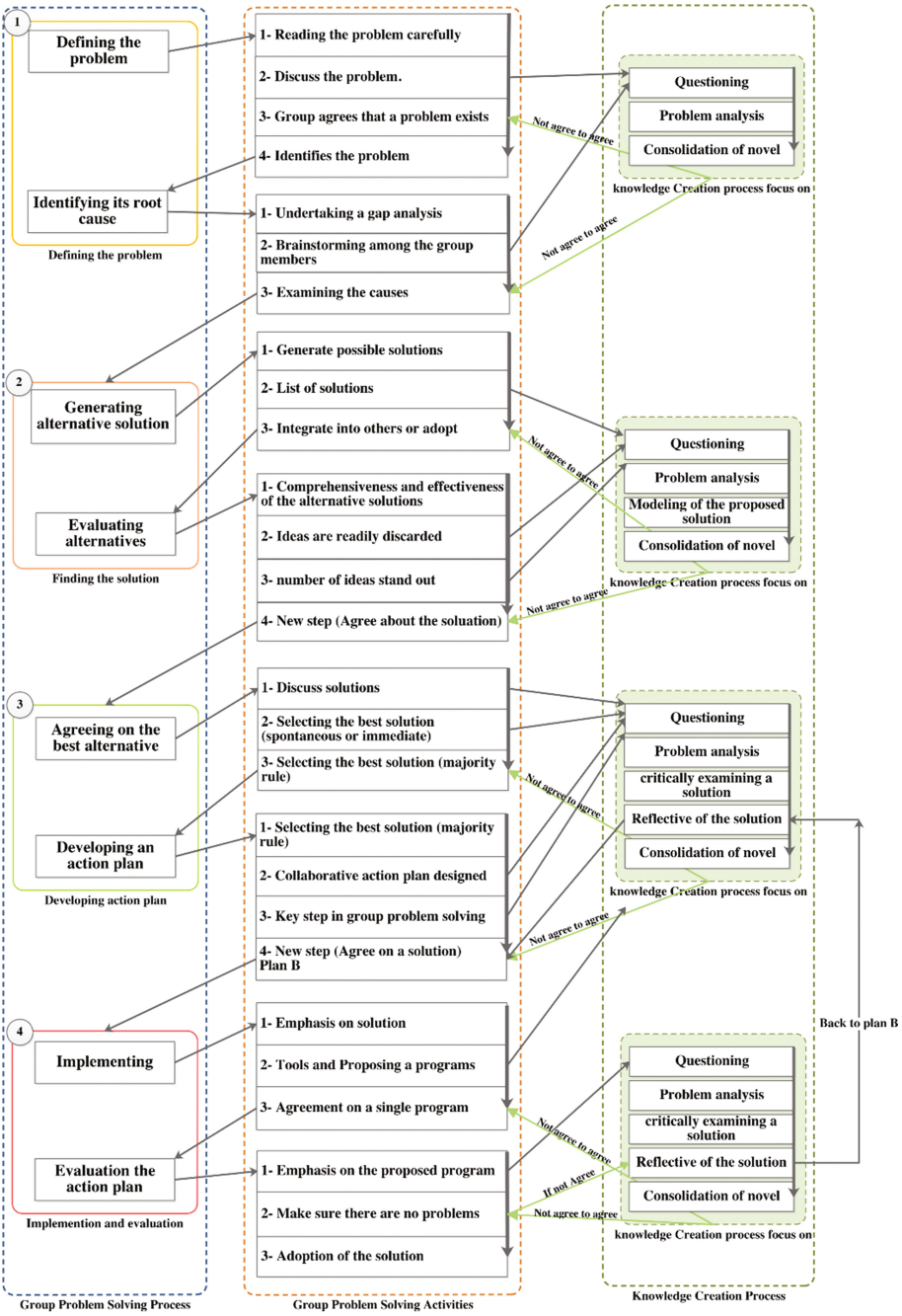

Fig. 1. The knowledge creation process in group problem solving process.

Table 2. Group Problem Solving Among Students in Academic Institutions.

Phases	Process	Activities
Defining the problem	1. Defining the problem	1. Group agrees that a problem exists 2. Identifies the problem
	2. Identifying its root cause	1. Undertaking a gap analysis 2. Examining the causes 3. Brainstorming among the group members
Finding Solution	1. Generating alternative solution	1. Generate possible solutions 2. List of solutions 3. Integrate into others or adopt
	2. Evaluating alternatives	1. Comprehensiveness and effectiveness of the alternative solutions 2. Ideas may be readily discarded 3. A number of ideas stand out
Development of action plan	1. Agreeing on the best alternative	1. Selecting the best solution (spontaneous or immediate) 2. Selecting the best solution (majority rule)
	2. Developing an action plan	1. Collaborative action plan designed 2. Key step in group problem solving 3. Plan B (New step)
Implementation and evaluation	1. Implementing	1. Tools of the Implement (New step) 2. Implement the selected solution
	2. Evaluating the action plan	1. Accompany the implementation of the action plan 2. Loop - Discrepancies

implementation of the action plan to ensure that the solution appropriately addresses the problem. In case of discrepancies, such evaluation should inform remedial measures, closing the loop on the group problem-solving cycle [19] (Table 2).

Learning in a group establishes values capable of developing an academic mind set. This form of a learning approach is designed for students to improve their academic skills, with the opportunity to assess learning needs via problem solving and improvements to their knowledge creation. The incorporation of knowledge creation within group problem solving tends to improve students' learning more extensively than traditional techniques based on textbooks and note-taking. In addition, students are provided with the opportunity to explore solutions from expert in different areas to add to their knowledge and experience. A new technological platform for knowledge creation in solving group problems can be improved based on the findings of the present study. Success in the use of technology can be instrumental in developing organizational structures for problem solving to increase profitability and minimize the emergence of risks. A flaw is indicated in the learning system used in education, as evidenced by the dissimilarity in solving a problem in a group between male and female students in the same school. Data analysed in the present study showed that females are more familiar with solving problems than males because of certain religious restrictions imposed on females in an attempt to restrict their movement on

campuses in Saudi Arabia. By law, female students have no interaction with male students within the school environment, even if they are couples. This ongoing monitoring tends to create a barrier in knowledge-transformation activities presently in place in most universities. The variation in knowledge creation was confirmed through the quality of teaching and solutions to the problem. In addition, the average experience between male and female students is 8.5:7.3, meaning that female students have greater experience than male students in solving problems in a group that can be applied to transforming the learning landscape.

4 Conclusion

This study identified the knowledge-creation process within the group problem-solving process in academic institutions, which includes defining of the problem, identification of solutions, development of the action plan, and implementation and evaluation. The study findings might provide useful insights for the administrations of universities to exploit and utilize the more useful group problem-solving process to enhance its performance. This research also contributes to current and future research on developed platforms, especially in academic institutions. As this research focused solely on the knowledge-creation process within the group problem-solving process among students in academic institutions, it is recommended that future research study the group problem-solving process among other staff in academic institutions, such as academic staff and non-academic staff.

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