CROWDSOURCING SOLUTIONS FOR SUPPORTING COLLABORATIVE LEARNING: A CASE OF UNDERGRADUATE MANAGEMENT STUDENTS

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Abstract

Collaborative learning processes in workshops often involve substantial collaboration among students. However, considerable information resource capacity exists on the Internet in journal articles, published literature, published reports, expert communities, or internet forums—referred to as crowds. Effectively using crowd resources to support collaborative learning is an interesting and challenging topic. This paper defines the collaborative learning problem in a crowd environment as an “workshop-assignment problem”. This study uses a greedy approach with four heuristic strategies to solve the problem. This is called the crowdsourcing-based collaborative learning approach. This approach includes two phases, clarifying the problem phase and collaborative learning phase. The clarifying the problem phase transforms the original problem into a TASK problem. The collaborative learning phase solves the TASK using heuristic strategies. A prototype system, called the Collaborative Learning System (CLS), is also implemented. The experiment results show that the proposed heuristic algorithms produce good quality approximate solutions in an acceptable timeframe.

Keywords: Crowdsourcing, Collaborative learning, Heuristic techniques, Information and Communication Technology.

1 INTRODUCTION

Heurez, heuristic method of teaching, so-called looking for a teaching method based on creating a situation by the lecturer that allows students to solve tasks by themselves using thought operations or referring to experience. Heurez used Socrates in antiquity, it was a popular method among the supporters of the school of work, popularized by them and also by those educators who opposed the transmission of ready-made messages to students. Team thinking is considered the most effective.

The team gives the opportunity to diversify opinions, attitudes, experience, intellectual capabilities, etc. of all team members analysing a given problem. It also provides opportunities for constant cooperation and development of communication skills. The sense of a team bond also makes it easier to bear failures. Methods based on the collective generation of free associations, the so-called heuristic methods. The name comes from the Greek “heuriska”, which means the ability to make discoveries. The heuristics itself is a skill, the ability to detect new facts and build connections between these facts. We distinguish several teamwork techniques.

<table>
<thead>
<tr>
<th>Basic heuristic methods</th>
<th>Characteristic</th>
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<tr>
<td>Transfer of concepts method</td>
<td>Involves the transfer of concepts from one field to another</td>
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<tr>
<td>Definition method</td>
<td>It consists in refining the definition of commonly used words assuming that the determination of terminological issues is often relevant to the merits of the problem</td>
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<td>Renewal method</td>
<td>Inclusion of new achievements in a given field into a given doctrine, which allows a new interpretation of already known facts</td>
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<tr>
<td>The &quot;black boxes&quot; method</td>
<td>Relying on the unknown system in such a way that the results of this action can be used to formulate conclusions regarding this system.</td>
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<tr>
<td>Method</td>
<td>Description</td>
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<td>The &quot;new look&quot; method</td>
<td>It is based on the assumption that moving away from a specific problem in space or time, one finds a &quot;new look&quot; on this problem, regenerates and enriches the imagination and changes the way of thinking. The so-called &quot;thinking alongside&quot; moves interests from the center of the problem to its periphery, leads to the study of its genesis for the benefit of its essence. Therefore, it is beneficial to change the environment or postpone, stopping the solution for some time.</td>
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<td>Method of incompetence</td>
<td>It is based on gathering the views of a number of non-specialists, laymen in the field of the problem under the assumption that if, say, a thousand of presented projects, nine hundred and ninety-nine is absurd and worthless, one can turn out to be valuable and different from the proposals that the specialists could present.</td>
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<td>The &quot;discovery matrix&quot; method</td>
<td>It consists in examining, by means of cross tables (matrices), a combination of features of the studied subject. Empty fields of the array signify unexplored possibilities.</td>
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<tr>
<td>The &quot;rest&quot; method</td>
<td>It is based on the use of views, theories, ideas and solutions previously rejected.</td>
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<td>Teratological method</td>
<td>It is based on the principle that the pathological situation sheds light on the normal situation, which allows criticism of abnormal solutions and elimination of false hypotheses.</td>
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<td>The analogous transfer method</td>
<td>To examine the possibility of using a certain right to describe similar patterns but occurring in another field. The essence of this method is to look for analogies among objects, systems or phenomena that are seemingly different but structurally similar, and then use the experience or insights gained in relation to the field that interests us.</td>
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<td>The &quot;brainstorming&quot; method or the Osborn method</td>
<td>It was founded in the USA in 1937 and relies on the free search for ideas to solve a problem, according to the idea: Even from crazy words, wise choose something - Chinese wisdom. First, various ideas appear, and then their analysis and selection of the best one takes place. The optimal number of participants in the idea generation session is 10 people. It is important that participants know the problem they are discussing. The topic of discussion should be known several days ahead, so that everyone can get ready. The duration of the session should also be predetermined.</td>
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<td>Discussion 66 (Philips Buzz Session)</td>
<td>In this method 6 teams work for 6 minutes over intensive creation of as many ideas as possible. The rules for determining ideas are analogous to &quot;brainstorming&quot;. All 5 creative bands work on the same subject that is precisely defined in advance. Groups work in separate rooms. After 6 minutes the teams meet on the so-called plenary session and exchange work results. The results of the plenary session + the conclusions are discussed again in small teams and again summed up together. So gradually the team comes to solutions accepted by all participants.</td>
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<td>BrainWriting 365</td>
<td>Instead of speaking out loud their ideas, each of the 6-person team writes them on the prepared individual sheets. At the beginning, each person puts 3 ideas on the sheet and passes a card to the neighbour. The neighbour writes another three ideas on this sheet. Of course, ideas must be new, modifying or developing previously submitted proposals. To save 3 ideas, the session participant has 5 minutes each. The procedure is repeated until the form has completed a full turnover between the participants. Thanks to that, 18 ideas are submitted in a short time, which may be subject to general discussion.</td>
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Source: own study based on ([1], [2], [3], [4], [5], [6]).

Each of these methods should follow the so-called a creative cycle of problem solving:
- Providing and identifying the problem
- Formulation of the heuristic task
- Appointment of a team to solve a task
- Generating ideas Valuing and selecting ideas
- Constructing options for solving the problem
- Valuation and selection of the solution variant
- Developing a project to solve the problem.

In team creativity there is a need to put aside beliefs from sources of our knowledge or experience. It is necessary to depart from the technical model of thinking, which consists in finding solutions that are obvious and known. Heuristic methods allow to reach to this part of our potential and potential of our employees, which in everyday work often remains hidden, which consists of: fantasy, intuition, emotions and logical thinking ([1], [2], [3], [4], [5], [6]).

Collaborative learning is a situation in which two or more people learn or attempt to learn something together. Unlike individual learning, people engaged in collaborative learning capitalize on one another's resources and skills (asking one another for information, evaluating one another's ideas, monitoring one another's work, etc.). More specifically, collaborative learning is based on the model that knowledge can be created within a population where members actively interact by sharing experiences and take on asymmetric roles [7].

2 METHODOLOGY

The study was conducted in April 2019 in the group of n = 100 undergraduate students of “Sport and Tourism Management” at Academy of Physical Education in Katowice - Poland. The students worked in accordance with the assumptions of three previously selected heuristic methods: Brainstorming, Discussion 66 (Philips Buzz Session) and BrainWriting 365. The aim of the study was to test the use of heuristic methods, to name barriers and to assess student behaviour during Collaborative learning processes in workshops.

Cognitive goal: The use of heuristic methods extends the analysis of phenomena. Going beyond the linear cause and effect analysis, the heuristic methods indicate to students the broad possibilities of creating new solutions in the area of organization and management.

Practical purpose: Developing the ability to apply heuristic techniques to solve problems related to work organization and introducing organizational innovations. Develop students’ ability for creative thinking and creativity. The study was attended by 100 respondents aged 18-26; most of them were women (60% women, 40% men). The graph below presents the distribution of respondents in terms of their place of residence. The dominant group are students from towns from 50 thousand up to 500,000.

3 RESULTS

All respondents assessed each of the issues. Students of relations and Commitment and individual contribution rated the highest. Students had to evaluate each of the areas listed in the study - referring to a scale from 1 to 5, where 1 meant very bad, 2 - bad, 3- I have no opinion, 4 – well and 5 – very good. The following areas were assessed regarding participation in the implementation of tasks using heuristic methods with the use of modern technologies; including case study using scientific portals, databases, forums and other resources available via the Internet.

<table>
<thead>
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<th>Category</th>
<th>Elements of category</th>
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<tbody>
<tr>
<td>Results</td>
<td>Degree of implementation; Quality of results; Timeliness of results; Customer satisfaction</td>
</tr>
<tr>
<td>Process</td>
<td>Precision of the allocation of sentences; Leading a team; Work monitoring; Evaluating work; Clarity and consistency of the process; Commitment and individual contribution</td>
</tr>
<tr>
<td>Relations</td>
<td>A method of referring to each; Commitment and individual contribution; The level of support from others; Level of trust; A sense of appreciation for others</td>
</tr>
<tr>
<td>Sources of information</td>
<td>Authorship; Timeliness; Precision; Objectivity relevancy; Credibility</td>
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</table>

As the first experiences, respondents assessed the results of their work. Analyzing the results, it can be noticed that the results of the team work were rated very high (well-almost 50%, very good - almost...
From the remaining factors, the highest rated degree of implementation and customer satisfaction. The respondents said the results were not evaluated negatively, or only to a small extent. A detailed summary of the results is presented in the diagram below.

Figure 1. Results (Source: own study).

All respondents, while evaluating the process of heuristic methods, usually assessed it well (50% of responses). There are negative opinions - "bad", but they do not exceed 5% of respondents’ answers. The most problematic element of the process, in the students’ opinion, was clarity and consistency of the process. A detailed list is provided in the chart below.

Figure 2. Process (Source: own study).

Relationships in the opinion of respondents were rated the highest of all the groups assessed by the respondents of the factors. Almost 60% of respondents rated "very good" relations and the method of referring to each. Against the background of other groups of factors, the least or the most negative responses were given here.
Very important areas of research are data sources, their value, validity or authorship. Unfortunately, this area, according to the assumptions of the authors, is not known to students. The most common ratings are "I have no opinion". The general feeling of respondents regarding Sources of information is good (well-almost 50%). Autorship (50%) received the most neutral responses; then timeless (42% of the respondents indicated "I have no opinion"). Quite a high rating during the relevency test (well - 40%); credibility (well - 35%) and objectivity (well - 35%). High - very good 25% - rated Precision of information. It can be seen that students do not attach much importance to the sources of information received. Even directed by the investigators to search for articles posted on scientific websites - they did not pay any attention to the authors of the publication, their validity or timeliness. A detailed list of respondents’ answers can be found in the chart below.

The second group of factors analysed by students was the analysis of three previously selected "Brainstorm" methods (Osborn method), Discussion 66 (Philips Buzz Session) and BrainWriting 365.
The highest grade, in the opinion of students, was "Brainstorm" (Osborn method), the lowest BrainWriting 365. Detailed results are given in the chart below.

Marking the barriers respondents during the Brainstorm method indicated mainly personality and generational differences. While evaluating the second heuristic method – Discussion 66 – the biggest barrier has become lack of willingness to integrate. The last of the Brain Writing 365 methods was classified as the most problematic, in this case the most barriers were focused on rivalry. The least barrier respondents noted in the Discussion 66 method; in the Brainstorm method the largest defined barrier was Preronality and generational differences. Students working in groups did not feel or lack of trust, which could affect the quality of work and be a barrier to the task. A detailed presentation of barriers classified by students is presented in the chart below.

Benefits from small groups using crowd resources to support collaborative learning include:

- Celebration of diversity. Students learn to work with others, no matter their cultural or economical background. During small-group interactions, they find many opportunities to reflect upon and reply to the diverse responses fellow learners bring to the questions raised. Small groups also allow students to add their perspectives to an issue based on their cultural differences. This exchange inevitably helps students to better understand other cultures and points of view.
• Acknowledgment of individual differences. When questions are raised, each student will have a variety of responses. Each of these can help the group create a product that reflects a wide range of perspectives and is thus more complete and comprehensive, taking into account their needs and opinions.

• Interpersonal development. Students learn to relate to their peers and other learners as they work together. This can be especially helpful for students with social skills barriers. They can benefit from structured interactions with others.

• Actively involving students in learning. Each member has opportunities to contribute in small groups. Students are apt to take more ownership of their material and to think critically about related issues when they work as a team.

• More opportunities for personal feedback. Because there are more exchanges among students in small groups, students receive more personal feedback about their ideas and responses. This feedback is often not possible in large-groups.

These benefits can also help students meet national, state, or local standards. Cooperative and collaborative activities can have many different objectives, ranging from mastery of basic skills to higher-order thinking. Because the specifics of a cooperative-learning project depend on the objectives of the particular teacher, the teacher can easily orient the project toward meeting these standards.

4 CONCLUSIONS

The heuristic method—called the method of creative thinking—is a way of thinking and solving research problems, in which it is important to look for new facts and relationships between them, formulate new hypotheses and discover new truths. So it may be better to call the heuristic method any way of thinking, in which ready patterns and patterns are rejected (especially those that are arbitrarily imposed on us) and allows the possibility that one may be wrong or that the other person may have the same subject other a sentence than our own, neither worse nor better, but also leading to the knowledge of the truth.

The combination of the ancient - Delphi's method with the possibilities of using modern technologies gives both students and teachers a huge field of development, increasing knowledge, changing the point of view. The use of knowledge available on science portals creates the opportunity to develop new horizons. However, care should be taken that students check the credibility of sources from which they derive information. As results from the research indicate, unfortunately, students do not pay attention to, or pay little attention to, credibility, up-to-date or the author of information.

The results of the research, as well as the process of their conducting, indicate a great interest of students in the heuristic models for solving case studies. Crowdsourcing has been used by the classroom [teacher and students] for creating educational contents, providing practical experience, facilitating the exchange of complementary knowledge, and augmenting feedback within members of the collaborative group. Barriers were defined and divided into main groups to facilitate the examination process. Students did not notice barriers outside the list - they had the opportunity to describe their experiences. However, it is necessary to remember to train students on the principles of how to use source materials, how to check the authenticity of the material, the validity of the data placed there - this area is found by the authors as an area to work with students.

The use of modern technologies in teaching is a good direction of development and work with students ([8], [9]); However, during everyday classes at the university, one cannot forget about the use of individual heretical methods, which in a creative way will allow to work more effectively or over barriers.

REFERENCES


