How to organize learning that supports the mastery of collaborative problem solving skills

K Harjito*, W Hardyanto, S Wardhani, and W Sumarni
Postgraduate Science Department, Universitas Negeri Semarang, Indonesia

*Corresponding author: harjito@mail.unnes.ac.id

Abstract. One of the important competencies for teachers to master is the skills to organize 21st century learning and assessment (Assessment and Teaching of 21st skill / ATC21S). One of the learning models recommended so that teachers have these skills is the collaborative problem solving model (CPS). Learning the CPS model can be done face-to-face or online. Students learn in pairs or in small groups collectively to solve the problems presented. There are at least two domains involved in learning activities, namely social prayer and cognitive domains. Assessment based on activities is based on a context of problems that can only be solved if students have cognitive mastery and require interaction with other people. To measure the results of CPS, various data can be used such as video recordings, conversation recordings, log data, tests, interviews and self-efficacy.

1. Introduction
Collaborative problem solving skills are one of the skills emphasized in 21st century learning. How the preparation model in learning becomes the focus of the writer’s attention. Changes that occur in the world view that skills, one of which is collaborative problem solving, are more important than just academic achievement [1]. How learning is designed through being designed so that problem-solving activities can take place is very basic [2]. Therefore learning how collaborative solving skills are taught in schools is of concern to researchers.

Searching for research articles with the keyword “Collaborative Problem Solving” in articles published in Taylor and Francis Online gave significant results. Search was limited from 2011 to 2020. Search results provide significant search results. This shows that collaborative problem solving is a serious concern of many researchers in various countries.

This research is a literature research. There are two objectives to be achieved. First, to find out how research trends on collaborative problem solving are happening in various parts of the world. Second, to identify how collaborative problem solving is organized in the field of education.
Table 1. Article relevance criteria

| Relevance   | Indicator                                                                 |
|-------------|---------------------------------------------------------------------------|
| Very high   | the term "collaborative problem solving" is found in titles and abstracts  |
|             | High the term "collaborative problem solving" is only found in the title or abstract |
| Moderate    | the terms "collaborative" and "problem solving" are found in the title and abstract but not as one term |
| Low         | the terms "collaborative" and "problem solving" are only found in the title or abstract but not as one term |
| Very low    | the term “collaborative” or “problem solving” is only one of those found in the title or abstract and not both |
| Irrelevant  | the term "collaborative" or “problem solving” are not mentioned in the title or abstract |

2. Methods
The research was conducted through a quantitative-qualitative approach. The quantitative approach is intended to study research trends regarding collaborative problem solving skills published in Taylor and Francis from 2011 to the present. Bibliographic searches were conducted with the keyword "Collaborative Problem Solving". Search results are organized into tables, and filtered by relevance. The measure of relevance is based on the criteria presented in Table 1. Articles that are not the result of research are sidelined.

All search results are categorized into two fields namely education and others. This criterion is based on the name of the publisher’s journal. The article categorization is presented in Table 2. Mapping research results related to collaborative problem solving using the VOSViewer application [3].

Qualitative analysis is carried out by identifying the research objectives, the participants, how the research was conducted, the findings generated and the limitations that emerged during the study. The analysis was carried out only for educational articles which have high and very high relevance.

3. Result and Discussion

3.1. Research trends on collaborative problem solving
The article search was carried out on July 15, 2020. The keyword used was “collaborative problem solving”. The search results resulted in 1,264 article titles published by 546. Based on the categories using the criteria as written in Table 2, the articles published by educational journals were 582 titles in 162 journals, while the remaining 682 titles were in 384 journals. Based on these data, there were slightly more articles in the non-education sector. The distribution of publication years for all journals is presented in Table 3.
Table 2. Article relevance criteria

| Category          | Criteria                                                                 |
|-------------------|---------------------------------------------------------------------------|
| Education         | There are the words education, school, teaching, learning in the name of the publisher’s journal |
| Miscellaneous     | There is no word education, school, teaching, learning in the name of the publisher’s journal |

Table 3. Distribution of articles by year of publication

| Research Field   | Publication year |
|------------------|------------------|
|                  | 2011  | 2012  | 2013  | 2014  | 2015  | 2016  | 2017  | 2018  | 2019  | 2020  | Total |
| Formal Education | 141   | 139   | 134   | 140   | 138   | 143   | 134   | 140   | 138   | 142   | 582   |
| Miscellaneous    | 163   | 155   | 164   | 158   | 156   | 166   | 153   | 161   | 160   | 170   | 682   |
| Total            | 304   | 294   | 308   | 308   | 304   | 310   | 297   | 301   | 308   | 312   | 1264  |

Table 4. Distribution of articles based on relevance

| Relevance     | Education | Miscellaneous | Total  |
|---------------|-----------|----------------|--------|
| Very high     | 7         | 4              | 11     |
| High          | 8         | 10             | 18     |
| Moderate      | 1         | 0              | 1      |
| Low           | 7         | 4              | 11     |
| Very low      | 143       | 119            | 262    |
| Irrelevant    | 416       | 545            | 595    |

From the data presented in Table 3, it can be seen that there is an increasing trend in many articles related to collaborative problem solving, both in the educational and non-educational fields. For 2020, although the number is lower than the previous year, 2020 does not fully reflect the entire article, due to data collection in the middle of the year. There is a possibility that the number will double, meaning that research related to 2020 the increase is estimated to double compared to the previous year.

Analysis based on the relevance provided shows that search engines do not always provide results that are relevant to the keywords we use. Educational articles only gave 15 out of a total of 582 articles in the high and very high categories, while the miscellaneous articles gave a result of 14 out of a total of 682 (Table 4). Very small results, therefore we need to do meta data analysis before we use an article as a reference source because it is very much influenced by how citation is done in the article [4].

From the results of content analysis, the preparation of collaborative work in learning requires the preparation of an assessment framework that is structured hierarchically [1]. This is necessary to
measure individual skills and collaborative work. The data obtained can come from actions, conversations [1], [5], interviews or questionnaire [6]. Several researchers used the problems created by PISA for what Care, Scoular, and Griffin [1] and Fujita, Doney, Flanagan, et al. [7] did. From several studies, it is revealed that the success of collaborative problem solving is influenced by the intervention factors carried out by the teacher. Both in terms of frequency and intensity as reported by Hofmann and Mercer [8], as well as grouping. Most researchers agree with small groups of 3-5 people. Good grouping will increase the value added of the group (VAG) while poor grouping will decrease the added value of the group (VDG). Uniquely VAG and VDG are influenced by gender [7]. There is no agreement yet on how the actual implementation of the CPS is. So far, research on the CPS learning model is still a claim [1]. However, CPS is a model that can be a learning solution in the 21st Century era, because it meets the criteria of a modern curriculum that emphasizes 4 aspects, namely knowledge, skills, character and meta-learning [9].

Collaborative Problem Solving (CPS) is one of the essential skills to be mastered in the 21st century learning era. Various studies have been conducted starting from how to group students [10], how to model collaborative learning and its measurement [11], how the interactions that occur in groups [12], what is the proper scaffolding [13] and what is the role of teachers in collaborative learning [14]. Through this analysis, it is hoped that a complete understanding of collaborative learning can be obtained, in terms of various dimensions in learning activities. The role of teachers in the 21st century is becoming increasingly important [15] in facilitating learning activities. Collaborative problem solving cannot be done individually. To facilitate these activities the problems presented must be interdisciplinary, so that awareness arises about the need for collaboration [16]. A sense of interdependence [13] must be created in problem solving. The interaction between students in the group becomes a scaffold that must be prepared in the classroom [17].

4. Conclusion

From the results of the analysis of the articles that have been carried out, it can be seen that the CPS research trend has increased even though it is sloping. However, in 2020, there is a potential for a two-fold increase compared to the previous year. Although it cannot be predicted with certainty, considering that the number of publications for 6 months is almost the same as one year in the previous period, it is estimated that this year the number of research related to CPS is expected to increase. From several selected articles that have been analyzed, it is revealed that research related to CPS in the education sector takes place in various aspects such as the development of instructional designs, evaluation tools, intervention models and even grouping methods. This certainly opens up opportunities for new research in the CPS field.

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