JIPF (JURNAL ILMU PENDIDIKAN FISIKA)
p-ISSN: 2477-5959 | e-ISSN: 2477-8451 *Vol. 7 No. 1, January 2022, Page 82-93*

Profile of Students' Physics Problem-solving Skills and Implementation of Quizizz-based Team Games Tournament (QTGT) Method in Physics Learning

Octa Qamar Rachmawati [1], Binar Kurnia Prahani [2*)], Husni Mubarok [3]
Universitas Negeri Surabaya, Indonesia[1,2], National Taiwan University of Science and Technology, Taiwan[3]
[*)]Corresponding E-mail: binarprahani@unesa.ac.id[2]

Received: June 14th, 2021. Revised: October 5th, 2021. Accepted: October 7th, 2021

Keywords :
Problem-Solving Skills; Team Games Tournament; Quizizz

ABSTRACT
This research was conducted to describe the implementation of teaching and learning activities using the Quizizz-based Team Games Tournament (QTGT) method in improving the physics problem-solving skills of senior high school students. The method of this study used preliminary research with data collection techniques in the form of written tests, which data acquisition will be analyzed descriptively qualitatively. The research was conducted on 100 students of 11th science grade from one of the Islamic high school in Gresik Regency. The results of the research show that: 1) The problem-solving skills of students in the low category with a score range of 0-50 as many as 92 students divided into 11 male students and 81 female students and the medium category in the range of score 51-75 as many as 8 students divided into 2 male students and 6 female students. 2) The lowest problem-solving skills criteria are found in the indicator C - Conceptualize the strategy (outlining the steps to be used in problem-solving) with an average score of 4.31, 3) The application of the Quizizz-based Team Games Tournament (QTGT) method is expected to improve students' physics problem-solving skills. So, it can be concluded that to improve students' physics problem-solving skills, the need for innovations in the implementation of learning such as the application of learning models and cutting-edge learning media that are packaged attractively and adapted to the current era of globalization.

INTRODUCTION

Learning is a technique in the development of knowledge, skills, and behavior in a new realm that occurs when a person interacts with the environment and the information he has obtained. In addition to the interaction between students and their environment, the learning process can take place because

of the relationship between teachers and students. During learning activities, a condition will arise where students feel less interested in the material presented by the teacher. In general, teachers only carry out learning with the same model and are carried out continuously without any variation in the implementation of learning, and as a result, the learning process of students will seem boring.

Problem-solving skills or problem-solving is one are part of Higher-Order Thinking Skills (HOTS) [1]. The skills to solve problems are the highest level of HOTS these skills combine creative and critical thinking to form perfect decisions that are expressed and re-examined. (Manik P, et al. 2020). In line with this opinion, Yuliantaningrum & Sunarti [2] suggesting that problem-solving is the last part of the higher-order thinking process that links the skills to think critically and creatively to get the final output correctly. Some of the benefits that students will get when they have problem-solving skills, according to Dzaki and Nur [3] include : 1) In solving problems on questions, students will find many ways (divergent thinking) and find more than one possible solution to a problem on the problem, 2) Trained to explore, have logical reasoning, and think comprehensively, as well as 3) Good communication and socialization skills will be created through group work. For this reason, it is very important to train students' problem-solving skills.

Students' problem-solving skills can be known through the use of : A – *Assen the problem*, C – *Create a drawing*, C – *Conceptualize the strategy*, E – *Execute the solution*, S – *Scrutinize result* [4]. In indicator A, students identify the principle of the problem, so that students know how to find solutions according to the principles of the problems that have been identified. In indicator C, students express their understanding of the problem in the form of pictures. In the next C indicator, students formulate steps systematically to facilitate the problem-solving process. In indicator E, students use equations that can facilitate problem-solving. In the S indicator, students explain the reasons that underlie the answers with categories of sure and not sure [5]. By using the indicator of problem-solving skills, it can trigger students to think more critically and creatively.

The teacher's role in realizing this is very necessary to choose the right learning model that will help achieve an effective and fun learning pattern and will support the improvement of problem-solving skills in students. The use of cooperative learning models, especially the Team Games Tournament (TGT) type, is very helpful in the learning process in question because the learning model can build learning relationships between students and involve students to be more active during the learning process [6]. The elements of games and reinforcement in the Team Games Tournament (TGT) type of cooperative learning model will be very easy to apply and can involve the activities of all students [7].

Renewal efforts in technological developments in the field of science are increasingly having a positive impact on a more effective learning process. Therefore, teachers are required to master the use of technology and renewable media to support the learning process. One way that can be done by teachers to be more responsible for the development of their students is by utilizing e-learning-based learning media. One type of e-learning-based learning media is Quizizz, where the results of answering quizzes in games on Quizizz can be used as evaluation material for teachers. With the use of Quizizz learning media which is applied in conjunction with the Team's Games Tournament method, it is expected to be able to improve students' physics problem-solving skills in high school.

Based on the explanation of the problems above, the researcher intends to conduct a research with the title “Profile of Students' Physics Problem-solving Skills and Implementation of Quizizz-based Team Games Tournament (QTGT) Method in Physics Learning”, which aims to analyze the profile of students' physics problem-solving skills as a material for consideration in the application of learning models and media that can improve the physics problem-solving skills of high school students.

METHOD

This research was preliminary research that is descriptive in nature by not testing the hypothesis. The results of the research will be used as material for consideration in the application of learning models

and media that can improve the physics problem-solving skills of senior high school students. Research instruments used to determine students' physics problem-solving skills include problem-solving skills tests, questionnaires, and interviews with teachers of physics subjects.

The questions for testing the students' problem-solving skills of students which amounted to 10 test questions are equipped with indicators of problem-solving abilitiy, namely: ACCES. Student response questionnaires after working on the questions, in the form of 10 questions about the learning experience of students and the learning process carried out by the teacher in the classroom, where the questionnaire used is a standardized questionnaire and has been tested for validity and reliability. Interviews with students and teachers aim to obtain further information on the teaching and learning process in the classroom, whether or not activities have been carried out to practice problem-solving skills, and the use of electronic learning media, namely Quizizz during the learning process, is also intended to harmonize the answers between the two.

The research was conducted online from one of the Islamic high school in Gresik Regency with 100 students from four classes of 11^{th} grade, held in the even semester of the 2020/2021 academic year. The data analysis technique used the results of the problem-solving skills test, questionnaire, and interviews with the physics subject teacher. The data analysis technique used in this research is a qualitative descriptive technique to describe the concrete situation according to the facts. The method used by the researcher is briefly described in ***Figure 1.*** below.

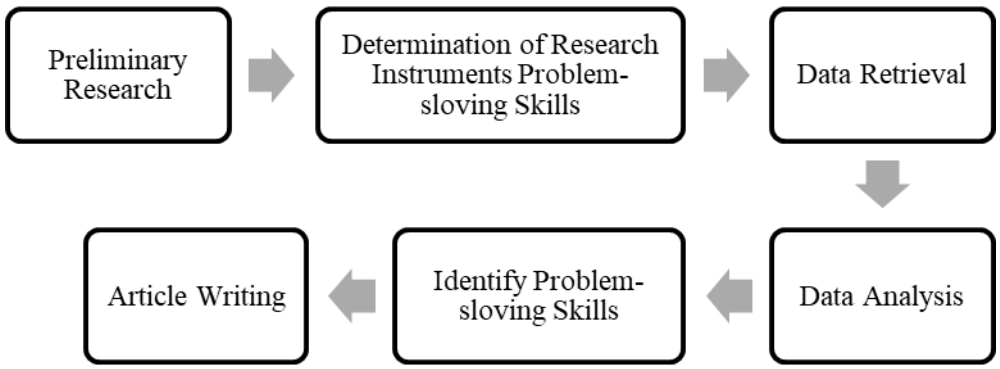

Fig 1. *Research method*

RESULTS AND DISCUSSIONS

Physics Problem-solving Skills Test

Physics problem-solving skills require different reasoning. Everyone has a way of solving problems. Therefore, in this research, 10 test questions were given based on the skills to solve physics problems on sound wave material. The test answer sheet is equipped with an indicator of problem-solving skills (ACCES), where students are required to answer according to the instructions listed in the answer sheet. After doing this research, the results of the physics problem-solving skills test are shown in the following figure.

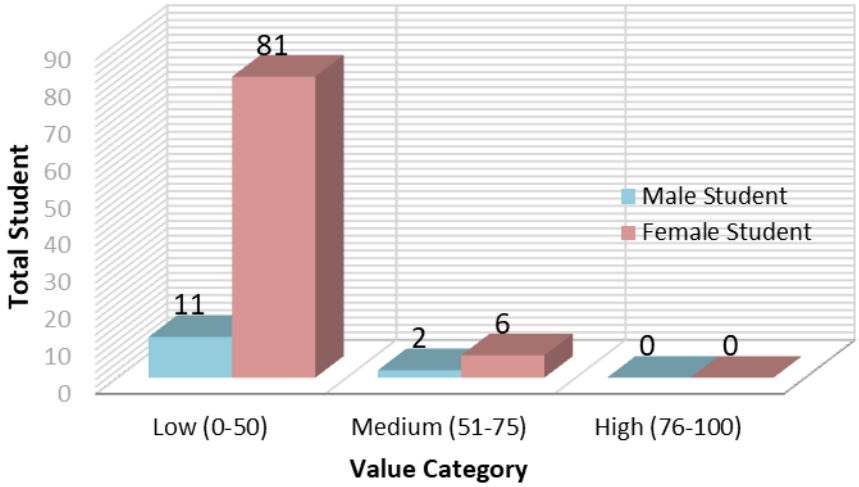

Fig 2. *The relationship between the number of students and grade categories ACCES*

Figure 2. shows the number of students who have scored in the low (0-50), medium (51-75), and high (76-100) categories. These results are obtained from giving scores to the answers to 10 test questions based on ACCES indicator problem-solving skills, each question has a score of 10 with each indicator worth two, so that the total maximum score of 10 questions is 100. The total number of students in the low-grade category was 92 students and the medium-grade category was eight students. In contrast to the two categories, the results of the students' questions are not categorized as high scores.

The results in ***Figure 2.*** above, it is known that students still have difficulty solving problem-solving skills-based test questions. These results were obtained from the process of analyzing students' answers in each item on the answer sheet which has been equipped with ACCES problem-solving skills indicators which include :

1. *A – Assen the problem (Identify the problem principles needed to solve the problem)*
   On the indicator A – Assen the problem, students are asked to show an understanding of the principles of the problem needed to solve the problem in the problem. Based on the analysis of answers from students, students can explain the principles of the problem on the question according to what is expected, where it relates to the frequency of the sound source. These are shown in ***Figure 3.*** below.

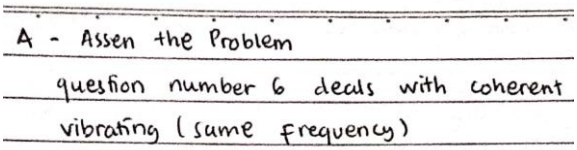

Fig 3. *Examples of student answers on indicators assen the problem*

2. *C – Create a drawing (Translating words in the form of a picture that contains instructions in solving problems)*
   On the indicator C – *Create a drawing*, students are asked to show the results of the translation of words and sentences in the problem in the form of pictures containing the instructions needed to solve the problems in the problem. Based on the analysis of answers from students, students can translate words and sentences in the question in the form of a picture that is equipped with additional information, which is follow what is expected. These are shown in ***Figure 4.*** below.

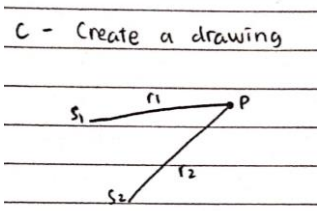

Fig 4. *Examples of student answers on indicators create a drawing*

3. *C – Conceptualize the strategy (Outlines the steps to be used in troubleshooting)*
   On the indicator C – *Conceptualize the strategy*, students are asked to show the steps needed to solve the problem in the problem. Based on the analysis of answers from students, students have not been able to describe the steps clearly, such as examples of equations or formulas that will be used are not listed as expected. These are shown in ***Figure 5.*** below.

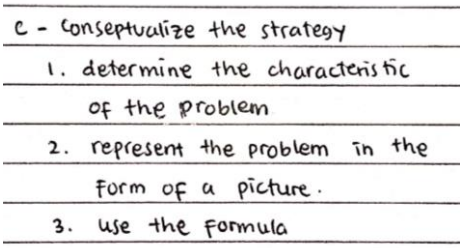

Fig 5. *Examples of student answers on indicators Conceptualize the strategy*

4. *E – Execute the solution (Apply formulas to solve problems)*
   On the indicator E – *Execute the solution*, students are asked to show the application of the formula needed to solve the problem in the problem. Based on the analysis of answers from students, students can apply the formula according to what is expected, but the final result of the calculation using the formula is still not correct. These are shown in ***Figure 6.*** below.

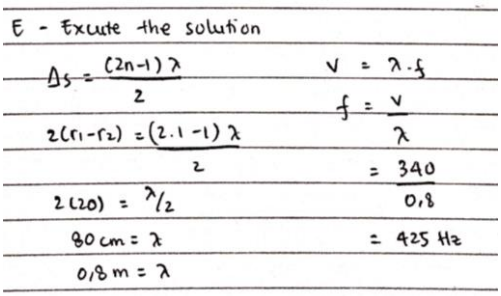

Fig 6. *Examples of student answers on indicators execute the solution*

5. *S – Scrutinize your result (Are you sure about your answer? Why?)*
   On the indicator S – *Scrutinize your result* , students are asked to show their level of confidence accompanied by reasons regarding the answers that have been described in the previous indicators in the process of solving problems in the questions. Based on the answers from students, students feel confident with the answers that have been described in the previous indicators, but there are no clear reasons why students feel confident with the answers. These are shown in ***Figure 7.*** below.

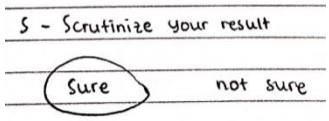

Fig 7. *Examples of student answers on indicators scrutinize your result*

From the results of the data acquisition above, it is known that students still have difficulty solving test questions based on problem-solving skills. This is closely related to students who are still not accustomed to answering questions based on indicators of problem-solving skills. In addition, problems in the Higher Order Thinking Skills (HOTS) category make students feel that the questions given are too difficult to be described according to the indicators of problem-solving skills. However, in some of these indicators, there are more prominent results. These are described in ***Figure 8.*** below.

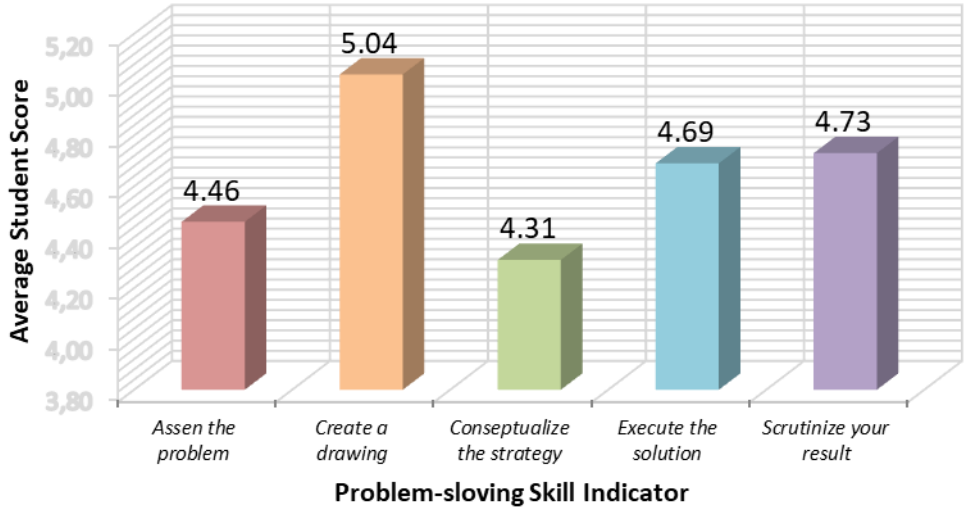

Fig 8. *The average score of students on each indicator of problem-solving skills*

If you pay attention, in ***Figure 8.*** it is known that the highest average value of 100 students is shown in the C – Create a drawing indicator, which shows that students can translate words and sentences in questions in the form of pictures that are equipped with additional information. While the lowest average score of 100 students is found in the indicator C – Conceptualize the strategy, which in other words shows that students have not been able to describe the steps clearly, such as examples of equations or formulas that will be used to solve problems. on the question.

Student Response Questionnaire

To find out the response of working on the physics problem-solving skills test questions, a questionnaire was given containing several questions about the learning experience of students and the teacher's delivery during the physics learning process. Students are welcome to choose Strongly Agree (SA), Agree (A), Disagree (D), or Strongly Disagree (SD) with the statements that have been given. The questionnaire was given online using the google form platform.

The following is the result of student responses from the questionnaire that has been given, it can be seen that (1) physics is not difficult and not boring, (2) discussion with friends is able to increase students' knowledge about physics subjects, (3) students prefer offline learning, (4) teachers often combine lecture and simulation methods or media during the learning process, (5) students will be much more active and easy to understand physics learning accompanied by simulations or media, (6) the sound wave material in physics lessons is a little difficult to understand, (7) the teacher has trained problem-solving skills to solve physics problems, (8) students have difficulty when they have to answer problem-solving skills test questions, (9) important problem-solving skills to be taught, and the last one, (10) teachers have used Quizizz during the physics learning process. The results of student responses from the questionnaires that have been given are shown in ***Table 1.*** below.

Table 1. Student Response Questionnaire Results

Statement	Presentase (%)			
	SA	A	D	SD
Physics is very difficult and boring	5	34	56	5
Discussions with friends can increase my knowledge about physics subjects	28	66	5	1
I prefer learning online than offline	9	11	49	31
Teachers often use the lecture method compared to learning by using simulations or media	9	44	42	5
I am more active and easy to understand physics learning accompanied by simulations or media	14	60	22	4
The material for sound waves in physics lessons is easy to understand	2	47	48	3
The teacher has trained problem-solving skills to solve physics problems	17	73	9	1
I have difficulty when I have to answer the problem-solving skills test questions	16	54	30	0
Problem-solving skills are important to teach	39	58	2	1
The teacher has used Quizizz during the physics learning process	14	47	34	5

Teacher Interview

From the results of the student response questionnaire, to complete the information according to the conditions in the field, interviews were conducted with the physics subject teacher at the school. Based on the results of interviews, the teacher said that problem-solving skills had been trained on students, with its application depending on the material to be delivered. The teacher also states that problem-solving skills really need to be trained on students, this is done with the aim that students can try or find out for themselves in obtaining the basic concepts of the material presented. So that by applying these skills, the concept of the material will be more attached to students and much easier to understand by students.

In the process, there are several obstacles such as the tendency of students who are already accustomed to the physics learning method without an explanation of the concept first. Students prefer learning directly with physics formulas or their understanding. In addition, there is a time constraint, where the teacher needs more time to condition the class. This is because, when applying problem-solving skills, students tend to have different thoughts which must later be combined into the same thought on a physics concept that is being taught. Therefore, it takes a longer time for teachers to apply problem-solving skills.

The teaching method used by the teacher is to combine the lecture method and also provide media or simulations in the form of simple teaching aids that can support understanding in students. The Teams Game's Tournament (TGT) learning model has been used by teachers in physics learning activities, in which students are very enthusiastic and enthusiastic so that the class becomes more lively. During the online learning process, the teacher also uses several application media such as Quizizz. The media makes it very easy for both teachers and students to carry out the evaluation process or practice questions during the learning process. According to the teacher’s, the methods, models, and learning media depending on how students understand the concept and comfort during the learning process, so that learning can take place properly according to the desired output.

Relevant Research

To determine the effectiveness of the development of the Quizizz-based Team Games Tournament (QTGT) method in improving the physics problem-solving skills of senior high school students, an analysis was carried out on several previous research from national and international journals in results with a span of 2017-2021. The following is a summary table of the results of the analysis that has been carried out :

Table 2. Relevant research in 2017-2021

Author (Year)	Research Purposes	Research Design	Research Result
Ayumniyya, et al (2021) [8]	Describe the profile of students' higher-order thinking skills in solving problems in Newton's Law material	• Quantitative descriptive research • Instrument development with the ADDIE method • Data collection in the form of tests and questionnaires	Analysis of the profile of senior high school students' skills in high-order thinking in solving problems categorized as moderate
Cindikia, et al (2020) [4]	Describe the profile of students' problem-solving skills and the implementation of guided inquiry models in high school	• Preliminary research with qualitative descriptive analysis • Collecting data in the form of written tests, student interview questionnaires, and teacher interview questionnaires	Problem-solving skills in students are still in the low category
Herayanti, et al (2020) [9]	Proving the effectiveness of the collaborative inquiry-based blended learning model to practice physics problem-solving skills	• The development research uses a 4-D model (define, design, develop, and disseminate), with testing on a one-shot case study pre-post test design. • Collecting data in the form of observation sheets and student response questionnaires.	The collaborative inquiry-based blended learning model is very effective for practicing physics problem-solving skills
Hidaayatullaah, et al (2019) [10]	Describe the implementation of learning using the Problem Based Learning (PBL) model to practice physics problem-solving skills	Pre-experimental research with one-group pretest-posttest design	Learning physics using the Problem Based Learning (PBL) model is very well done in practicing physics problem-solving skills
Kusuma, et al (2019) [11]	Describe the implementation of learning using Complex Problem Solving (CPS) learning models to practice physics problem-solving skills	Pre-experimental research with one-group pretest-posttest design	The overall average of three different classes in each phase of learning physics using creative problem-solving models.
Wahyuni, et al (2019) [12]	Describe the implementation of the Team Games Tournament (TGT) cooperative learning model with the couple card technique to improve learning outcomes	Pre-experimental quantitative research design, one-group pretest-posttest	Learning using a cooperative model of the Team Games Tournament (TGT) type of couple card technique is very well done
Sulastri, et al (2019) [13]	Interpreting the effect of Quizizz application	Quantitative research with a quasi-experimental design	The application of the LAPS-Talk-Ball

Author (Year)	Research Purposes	Research Design	Research Result
	on the LAPS-Talk-Ball learning model in improving students' Complex Problem Solving (CPS) skills	type nonequivalent control group design	learning model integrated with Android-based interactive games is able to train students' Complex Problem Solving (CPS) skills
Trianggono M., et al (2018) [14]	Describe the differences in the characteristics of creative thinking skills based on gender in the context of solving physics problems.	• Quantitative descriptive research • Data collection is in the form of giving a description test in the form of 10 physics problem-solving questions.	Male subjects tend to express a lot of ideas and reasoning varied answers, while female subjects tend to detail the answers they put forward in detail.
Olaniyan, et al (2018) [15]	Knowing the effectiveness of Polya Problem-Solving and Target-Task learning approaches in high school physics electrical materials	• Quasi-experimental study design control group pre-test and post-test non-randomized, non-equivalent, and post-test	Polya Problem-Solving and Target-Task collaborative learning approaches improve student performance by gender and judging skills compared to conventional teaching
Batlolona J. R., et al (2018) [16]	Knowing the improvement of problem-solving and mastery of physics concepts by using the Hints and Peer Interaction Learning (HPIL) learning model.	• Embedded experimental research with tal model design with paired sample t-test analysis. • The material instrument used 25 questions of several choice items (concept mastery).	HPIL can be recommended to improve problem-solving skills and mastery of physics concepts
Habibi M., et al (2017) [17]	Proving the feasibility of the science learning device-oriented to problem-solving skills using a direct teaching model on the subject of pressure.	• Research on the development of learning devices using the Dick and Carey development model with quantitative descriptive analysis • Collecting data in the form of validation of learning tools, observing the implementation of lesson plans, learning outcomes tests, and assessing problem-solving skills	Science learning tools oriented to problem-solving skills using a direct teaching model that was developed is suitable for use in the learning process.
Argaw, et al (2017) [18]	Knowing the effect of problem-based learning strategies on students' problem-solving skills and their	• Quasi-experimental research adapted • Data collection based on inventory test and	There is no significant difference between the students' motivation to learn physics in the experimental and

Author (Year)	Research Purposes	Research Design	Research Result
	role in building motivation in students	motivation scale	comparison groups; no gender differences in problem-solving skills across groups, and there is no gender difference in motivation to learn physics across groups
Pandiangan, et al (2017) [19]	Describe the validity and effectiveness of the PIL model	• Quasi-experimental research with one group pre-test and post-test. • Data were collected from pre-test and post-test	Learning that applies the PIL model is valid, reliable, and effective to improve physics problem-solving
Trianggono M. (2017) [20]	Describe the causal relationship between conceptual understanding and students' creative thinking skills in solving physics problems	• Research literature studies with linear regression analysis and described descriptively. • Research data obtained from the results of pre-test and post-test using objective tests and descriptions.	Concept understanding and creative thinking skills have a constructive causal relationship that reinforces each other's roles in solving physics problems
Jiwangga, et al (2017) [21]	Knowing the tendency of students' physics learning achievement by using the TGT type cooperative learning model and using the conventional learning model	• Research with Quasi Experiment category, with research design used is control group • Sampling using random sampling technique, with documentation and test techniques for data collection	TGT type cooperative learning can be an alternative learning model to increase student activity in understanding concepts in science lessons, especially physics which will ultimately improve physics learning achievement

In this study, there are several research limitations, including : 1) The research was conducted on students from four classes of 11^{th} grade in one of the Islamic high school in the city of Gresik, 2) The material tested in the physics problem-solving skills test is sound waves, and 3) This research is only limited to knowing the profile of physics problem-solving skills in high school students, which will be taken into consideration in implementing the Quizizz-based Team's Games Tournament (QTGT) method in physics learning.

Based on the results of the analysis of several relevant studies from national and international journals in results with a span of 2017-2021 where is shown in the ***Table 2.*** above as well as test results of physics problem-solving skills tests for high school students, it can be the basis that the Quizizz-based Team Games Tournament (QTGT) method is expected to be implemented to improve the physics problem-solving skills of senior high school students.

CONCLUSION AND SUGGESTION

Based on the research result using the preliminary research method that has been carried out, it can be concluded that students' problem-solving skills are in a low category. This is closely related to students who are still not accustomed to answering questions based on indicators of problem-solving skills. In

addition, problems in the Higher Order Thinking Skills (HOTS) category make students feel that the questions given are too difficult to be described according to the indicators of problem-solving skills. Therefore, to improve students' physics problem-solving skills, it is necessary to have innovations in the implementation of learning such as the application of learning models and cutting-edge learning media that are packaged attractively and adapted to the current era of globalization. In other words, the Quizizz-based Team Games Tournament (TGT) method can be applied as an effort to improve students' physics problem-solving skills.

ACKNOWLEDGMENTS

The author's deepest gratitude goes to Physics teacher, all students from one of the Islamic high school in Gresik Regency, and all parties who have provided guidance, support, and direction during the process of compiling this scientific article.

REFERENCES

[1] Alfika, Z. A., & Mayasari, T. (2018, May). Profil kemampuan memecahkan masalah pelajaran fisika siswa MTs. In *Quantum: Seminar Nasional Fisika, dan Pendidikan Fisika* (pp. 583-589).

[2] Yuliantaningrum, L., & Sunarti, T. (2020). Pengembangan Instrumen Soal Hots Untuk Mengukur Keterampilan Berpikir Kritis, Berpikir Kreatif, Dan Pemecahan Masalah Materi Gerak Lurus Pada Peserta Didik SMA. *Inovasi Pendidikan Fisika*, *9*(2).

[3] Fadhlurrohman, D., Fitriyanti, N., Nasir, F., & Setiyani, S. (2020). Praktikalitas Media Interaktif Quizizz Pada Kemampuan Pemecahan Masalah Matematis Siswa. In *ProSANDIKA UNIKAL (Prosiding Seminar Nasional Pendidikan Matematika Universitas Pekalongan)* (Vol. 1, pp. 55-64).

[4] Cindikia, M., Achmadi, H. R., Prahani, B. K., & Mahtari, S. (2020). Profile of Students' Problem Solving Skills and the Implementation of Assisted Guided Inquiry Model in Senior High School. *Studies in Learning and Teaching*, *1*(1): 52-62.

[5] Meisaroh, S., Achmadi, H. R., & Prahani, B. K. (2020). Profile of Students Problem Solving Skills and Implementation Free Inquiry Model in Senior High School. *Berkala Ilmiah Pendidikan Fisika*, *8*(2): 59.

[6] Damayanti, S., & Apriyanto, M. T. (2017). Pengaruh Model Pembelajaran Kooperatif Tipe Teams Games Tournament Terhadap Hasil Belajar Matematika. *JKPM (Jurnal Kajian Pendidikan Matematika)*, *2*(2): 235-244.

[7] Kii, O. A., & Dewa, E. (2020). Simulasi Phet Sebagai Media Pembelajaran Berbasis Komputer Pada Model Pembelajaran Team Games Tournament Untuk Meningkatkan Aktivitas Dan Hasil Belajar Fisika Mahasiswa. *Jurnal Riset Teknologi dan Inovasi Pendidikan (JARTIKA)*, *3*(2): 360-367.

[8] Ayumniyya, L., & Setyarsih, W. (2021). Profil Kemampuan Berpikir Tingkat Tinggi Siswa SMA dalam Pemecahan Masalah pada Materi Hukum Newton. *Inovasi Pendidikan Fisika*, *10*(1): 50-58.

[9] Herayanti, L., Widodo, W., Susantini, E., & Gunawan, G. (2020). The effectiveness of blended learning model based on inquiry collaborative tutorial toward students' problem-solving skills in physics. *Journal for the Education of Gifted Young Scientists*, *8*(3): 959-972.

[10] Hidaayatullaah, H. N. (2019). Implementasi Problem Based Learning Untuk Melatihkan Kemampuan Problem Solving Fisika Peserta Didik. *Inovasi Pendidikan Fisika*, *8*(2).

[11] Kusuma, D., Kartono, K., & Zaenuri, Z. (2019). Creative Thinking Ability based on Students'

Metacognition in Creative Problem Solving Learning Model With Recitation and Self-Assessment in Ethnomatematics. *Unnes Journal of Mathematics Education Research*, *8*(1): 25-34.

[12] Wahyuni, M., & Achmadi, H. R. (2019). Penerapan Pembelajaran Kooperatif Tipe Teams Games Tournament (TGT) Teknik Couple Card Untuk Meningkatkan Hasil Belajar Pada Materi Hukum Newton Tentang Gerak. *Inovasi Pendidikan Fisika*, *8*(3).

[13] Sulastri, S., Asfar, A. I. T., Asfar, A. I. A., Jamaluddin, J., Ayuningsih, A. N., & Nurliah, A. (2019, December). Pengaplikasian Quizizz Pada Pembelajaran Laps-Talk-Ball Dalam Melatih Kemampuan Complex Problem Solving Siswa. In *Seminar Nasional Hasil Penelitian & Pengabdian Kepada Masyarakat (SNP2M)* (pp. 341-346).

[14] Trianggono, M. M., & Yuanita, S. (2018). Karakteristik keterampilan berpikir kreatif dalam pemecahan masalah fisika berdasarkan gender. *Jurnal Pendidikan Fisika dan Keilmuan (JPFK)*, *4*(2): 98-106.

[15] Olaniyan, A. O., & Govender, N. (2018). Effectiveness of polya problem-solving and target-task collaborative learning approaches in electricity amongst high school physics students. *Journal of Baltic Science Education*, *17*(5): 765-777.

[16] Batlolona, J. R., Baskar, C., Kurnaz, M. A., & Leasa, M. (2018). The improvement of problem-solving skills and physics concept mastery on temperature and heat topic. *Jurnal Pendidikan IPA Indonesia*, *7*(3): 273-279.

[17] Habibi, M., Zainuddin, Z., & Misbah, M. (2017). Pengembangan perangkat pembelajaran ipa fisika berorientasi kemampuan pemecahan masalah menggunakan model pengajaran langsung pada pokok bahasan tekanan di smp negeri 11 banjarmasin. *Berkala Ilmiah Pendidikan Fisika*, *5*(1): 1-17.

[18] Argaw, A. S., Haile, B. B., Ayalew, B. T., & Kuma, S. G. (2016). The effect of problem based learning (PBL) instruction on students' motivation and problem solving skills of physics. *Eurasia Journal of Mathematics, Science and Technology Education*, *13*(3): 857-871.

[19] Pandiangan, P., Sanjaya, G. M. I., & Jatmiko, B. (2017). The validity and effectiveness of physics independent learning model to improve physics problem solving and self-directed learning skills of students in open and distance education systems. *Journal of Baltic Science Education*, *16*(5): 651.

[20] Trianggono, M. M. (2017). Analisis kausalitas pemahaman konsep dengan kemampuan berpikir kreatif siswa pada pemecahan masalah fisika. *Jurnal Pendidikan Fisika dan Keilmuan (JPFK)*, *3*(1): 1-12.

[21] Jiwangga, E., & Hidayati, H. (2017). Pengaruh Model Pembelajaran Kooperatif Tipe Teams Games Tournament (TGT) Terhadap Prestasi Belajar Fisika Siswa Kelas VIII. *COMPTON: Jurnal Ilmiah Pendidikan Fisika*, *4*(1).