JPPIPA 9(11) (2023)

Jurnal Penelitian Pendidikan IPA

Journal of Research in Science Education

http://jppipa.unram.ac.id/index.php/jppipa/index

Development of SSCS-Based Teaching Materials Integrated with TPACK in Cultivating Students' Scientific Attitudes

Lissa Zikriana[1*], Fatimah[1], Bulan Nuri[2]

[1] Departement of Physics Education, Faculty of Teacher Training and Education, Almuslim University, Aceh, Indonesia.
[2] Departement od Mahthematics Faculty of Teacher Training and Education, Almuslim University, Aceh, Indonesia.

Received: September 25, 2023
Revised: October 2, 2023
Accepted: November 25, 2023
Published: November 30, 2023

Corresponding Author:
Lissa Zikriana
lissazikrianaa@gmail.com

DOI: 10.29303/jppipa.v9i11.5467

Abstract: This study aims to produce teaching materials based on SSCS integrated TPACK and determine the effectiveness of teaching materials based on SSCS integrated TPACK developed in fostering students' scientific attitudes. This type of research is Research and Development (R&D) developed by Borg and Gall. The research location used is SMP Negeri 3 Peusangan. The research subjects amounted to 30 people who were selected using purposive sampling technique. The data collection technique used an expertvalidation test sheet to measure the validity of SSCS-based teaching materials integrated with TPACK and a questionnaire sheet (questionnaire) to collect feasibility data and students' scientific attitudes. Data analysis was carried out by processing validator response data and Likert scale then converted into qualitative data. Scientific attitude data were analyzed using the N-gain formula. The results showed that the teaching materials based on SSCS integrated TPACKdeveloped were declared valid and feasible for use in learning. Teaching materials based on SSCS integrated TPACK can also foster the scientific attitude of students during learning activities, especially on Newton's Law material.

Keywords: Create and share (SSCS); Scientific attitude; Search, Solve, TPACK

Introduction

The aspect of learning resources is an important step for an educator in teaching learning materials. Teaching materials as learning resources are the basic things that must be owned by every educational unit. Teaching materials are all forms of materials that are systematically arranged to enable students to learn independently and are designed in accordance with the applicable curriculum (Magdalena et al., 2020). Every educator is required to have teaching materials as a reference in teaching at each meeting. The availability of teaching materials in each educational unit is regulated in the content standards of the education process (Nuryasana & Desiningrum, 2020). Learning resources in the form of teaching materials are one of the important elements in the formation of learning. The existence of teaching materials will help teachers in designing learning while for students, teaching materials will help them in mastering learning competencies (Wijayanti et al., 2021).

The role of an educator in designing or compiling teaching materials greatly determines the success of the learning and learning process. Teachers must have the competence to package material into a teaching material. The teaching materials presented must be able to meet the ideal criteria for students including the content according to age level, interesting, and easy to understand so that it makes it easier for students to learn the material. The teacher's ability to develop teaching materials is related to pedagogical competence and professional competence, as stated in the attachment to Permendiknas Number 16 of 2007 concerning Standards for Academic Qualifications and Teacher Competencies, section B. As professional educators, they are expected to have the ability to develop teaching materials in accordance with existing mechanisms by taking into account the characteristics and social environment of students. Teaching materials used to support learning

How to Cite:
Zikriana, L., Fatimah, & Nuri, B. (2023). Development of SSCS-Based Teaching Materials Integrated with TPACK in Cultivating Students' Scientific Attitudes. *Jurnal Penelitian Pendidikan IPA*, *9*(11), 9992–10000. https://doi.org/10.29303/jppipa.v9i11.5467

must be prepared in accordance with the applicable curriculum by taking into account the needs, characteristics and environment (Islamiyati et al., 2021).

Good teaching materials allow students to develop thinking abilities, process skills and scientific attitudes. Therefore, teaching materials developed by teachers must apply learning models that are able to direct and develop thinking abilities, process skills and scientific attitudes. Teaching materials based on the Search, Solve, Create, and Share (SSCS) learning model can direct students to foster their scientific attitudes (Carolina et al., 2017). The application of the SSCS learning model can improve KPS and scientific attitudes (Khaillasiwi et al., 2020). In the SSCS learning model there are four stages, namely search, solve, create, and share (Zikriana et al., 2021). In the search stage students will express opinions and generate ideas related to the problem given in order to identify the problem. The solve stage aims to plan and implement problem solving by looking back at the information that has been found at the search stage. Students choose the steps to solve the problem. In the create stage, students apply the design made to solve the problem to create or find a solution to the problem and reach a conclusion. The last stage of the SSCS learning model is the share stage, where at this stage students articulate their thinking through communication and interaction with their friends, receive and process feedback, and reflect and evaluate the solutions and answers they make (Pizzini, 1996).

The development of teaching materials can be combined between technology, pedagogy and subject matter. Teachers need to increase innovation by integrating pedagogy and technology utilization in the material being taught. The basic concept that emphasizes the relationship between content (subject matter), technology and pedagogy is TPACK. Technologycal Pedagogical Content Knowledge (TPACK) is the ability of teachers to organize learning by integrating learning strategies and technology. Teachers who are able to master TPACK can have a positive impact on students, both in terms of understanding, skills and motivation to learn (Khaillasiwi et al., 2020). TPACK is one approach that can be used in 21st century science learning (Bahtiar et al., 2023).

The development of TPACK has become a framework that can be used to analyze teacher knowledge related to technology integration in learning (Pribadi et al., 2021). Some research results related to TPACK include showing that mastery of TPACK skills affects readiness to become a teacher (Triwahyudi et al., 2021), the ability to develop online mathematics learning tools is influenced by high TPACK skills, TPACK development is used to provide learner learning experiences adapted from certain pedagogies and made for certain content (Winarni, 2018). The combination of content, technology and pedagogy in the basic concept of TPACK in learning can foster active learning that focuses on students (Sabaruddin et al., 2022).

Based on the observation, teachers have never used TPACK integrated teaching materials. In addition, the teaching materials used by teachers have not been developed optimally and still focus on learning resources that are already available. Teachers must be creative in developing teaching materials and have special skills in the use of technology in learning. So in presenting teaching materials, teachers must be able to adapt to the technology used. Not only must master technology well, but teachers must choose learning strategies, knowledge of teaching materials, and pedagogic which is called Technological Pedagogical Content Knowledge (TPACK) which is formed from these three knowledge (Mishra & Koehler, 2006). Science learning, especially physics, must provide direct experience to students so that the use of technology in the development of teaching materials will help increase student understanding. Science learning provides direct experience to students to strengthen their ability to absorb, remember, and apply the principles they have learned (Rapanta et al., 2020). Science learning emphasizes process, scientific attitude and application. Scientific attitude is the attitude that must exist in a scientist or academic when facing scientific problems. Scientific attitude contains two meanings, namely attitude toward science and attitude of science. The first attitude refers to the attitude towards science while the second attitude refers to the attitude attached after learning science (Amrina et al., 2022). Scientific attitude, which is one of the skills needed in 21st century learning, needs to be improved through the use of innovative and appropriate teaching materials with technology integration. Students who have low scientific attitudes tend to have low decision-making abilities that will affect problem-solving abilities (Saputri et al., 2022).

Therefore, it is necessary to develop SSCS-based teaching materials integrated with TPACK to foster students' scientific attitudes. The technology used in this study is a learning video and SSCS-based LKPD assisted by PhET simulation. PhET simulations can help learners to understand abstract concepts in physics and emphasize the relationship between real-life phenomena and the underlying science, support interactive and constructivist approaches, provide feedback, and provide a creative workplace (Ulfa, 2018).

Some of the results of previous research studies that have been conducted include those related to the development of SSCS-based e-modules in training students' creative thinking skills (Rizaldi et al., 2020), the development of SSCS-based worksheets in biology learning (Putra, 2022) and the development of SSCS-based worksheets on students' critical thinking skills (Effendi et al., 2020). From several studies that have been conducted, there has been no research that examines the development of teaching materials based on SSCS integrated with TPACK in fostering students' scientific attitudes. The purpose of this study was to produce teaching materials based on SSCS integrated TPACK and to determine the effectiveness of teaching materials based on SSCS integrated TPACK developed in fostering students' scientific attitudes.

Method

This research uses the Research and Development (R&D) method developed by Borg and Gall. Research and development is a process or steps to develop a new product or improve existing products so that they can be accounted for (Widyati & Irawati, 2021). The steps of the R&D method can be seen in Figure 1.

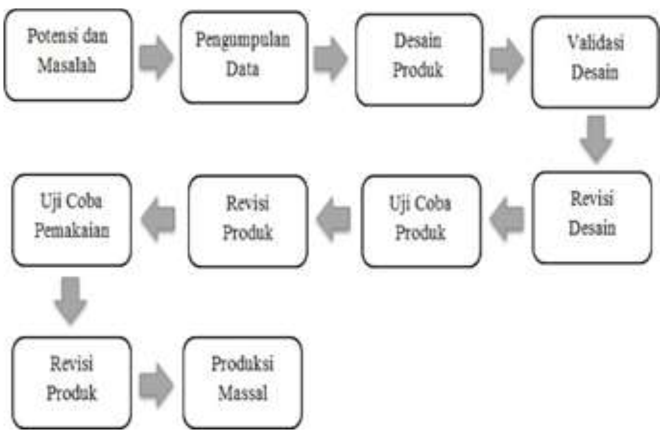


Figure 1. Steps of R&D research

The first stage of the Research and Development (R&D) method is potential and problems. At this stage researchers collect previous studies related to the potential of the Search, Solve, Create, and Share (SSCS) learning model, mastery of TPACK by teachers as well as teaching materials used in learning and problems in terms of physics learning. At the data collection stage, researchers collect data and theoretical foundations as a source in product development in the form of teaching materials. At the product design stage, researchers design teaching material products to be developed. At the design validation stage, the results of the design of the teaching material products developed were subjected to expert validation to obtain suggestions for improvement of the teaching material products developed. At the design improvement stage, researchers made improvements based on suggestions for improvements obtained in the previous stages. At the product trial stage, researchers conducted a trial of the teaching material products developed. At the product revision stage, researchers make revisions based on the results of the trials that have been carried out. At the usage trial stage, the researcher conducts trials in real conditions for a wide scope to see the effectiveness of the teaching material products that have been developed. Researchers will evaluate the teaching material products developed and if the product is effective and feasible, it will be mass produced.

The research subjects amounted to 30 students of class VIII-3 SMP Negeri 3 Peusangan. The sampling technique used purposive sampling technique. In this study, teaching materials based on SSCS integrated with TPACK were developed with a quantitative approach to analyze the validation of teaching materials and their influence on the growth of scientific attitudes of students. Data collection techniques and instruments used expert validation test sheets and questionnaire questionnaires (questionnaires). The validation test sheet is used to measure the validity of teaching materials based on SSCS integrated with TPACK and scientific attitude questionnaire. Questionnaire sheet to collect data on the feasibility of teaching materials to be implemented and measure the scientific attitudes of students. Expert validators consisted of two people including material experts and media experts.

Data analysis was carried out by processing data on validator responses and Likert scales and then converted into qualitative data. The Likert scale to measure scientific attitudes consists of four alternative answer choices, namely strongly agree (SA) with a score of 4, agree (A) with a score of 3, disagree (D) with a score of 2 and strongly disagree (SD) with a score of 1. The criteria for validation of teaching materials based on the Aiken index (V) can be seen in Table 1 (Riduwan, 2013).

Table 1. Criteria for Validation of Teaching Materials Using the Aiken Index

Validity index (V)	Category
$V > 0.80$	Very valid
$0.40 < V \leq 0.80$	Valid enough
$V \leq 0.40$	Invalid

The criteria for interpreting the feasibility of teaching materials based on the Likert scale can be seen in Table 2 (Widyaningrum & Wijayanti, 2017).

Table 2. Criteria for the Feasibility of Teaching Materials

Percentage	Criteria
81% - 100%	Very feasible
61 % - 80 %	Worth
41 % - 60 %	Decent enough
21 % - 40%	Not worth it
0% - 20%	Not worth it

Scientific attitude data were analyzed using the N-gain formula. N-gain criteria can be seen in Table 3 (Subiarto, 2010).

Table 3. N-gain Criteria

Interval	Criteria
0.70 – 1.00	High
0.30 – 0.69	Medium
0.00 – 0.39	Low

Result and Discussion

Results of Validation and Feasibility Test of Teaching Materials

The developed TPACK-integrated SSCS-based teaching materials were measured for validity with an expert agreement index based on the Aiken index (V). The results can be seen in Figure 2.

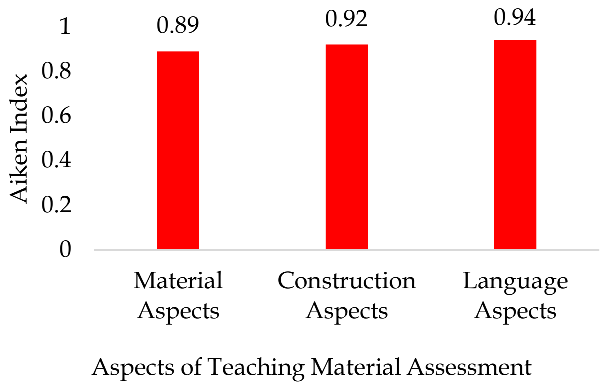


Figure 2. Results of expert validation of teaching materials based on SSCS integrated TPACK

Based on Figure 3, it can be seen that the SSCS-based teaching materials integrated with TPACK developed have a very valid validity level with an Aiken index value> 0.8. There are three aspects of assessing the validity of teaching materials including material aspects, aspects of usefulness and presentation aspects. The presentation aspect has the highest validity value of 0.94 with a very valid category and the material aspect has the lowest validity value of 0.89 with a very valid category. The results of expert validation of the scientific attitude questionnaire can be seen in Figure 3.

Based on Figure 3, it can be seen that the scientific attitude questionnaire developed has a very valid validity level with an Aiken index value > 0.8. There are three aspects of assessing the validity of teaching materials including material aspects, construction aspects and language aspects. The material aspect has the highest validity value of 0.94 with a very valid category and the construction aspect has the lowest validity value of 0.84 with a very valid category.

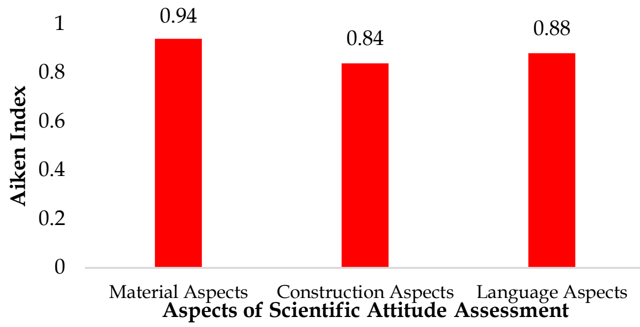


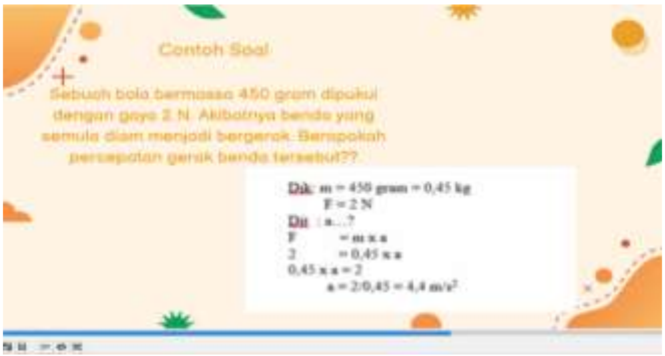
Figure 3. Results of expert validation of scientific attitude questionnaire

At the expert validation stage, there are several aspects of the teaching materials based on SSCS integrated TPACK that need to be revised. Here are some aspects of teaching materials before and after revision, namely in the example of application in everyday life (Figure 5) and in the example problem section (Figure 6). In the examples of application in daily life section, the expert suggested adding picture illustrations to clarify the material presented so that students would understand it better. In the sample problem section, experts suggest adding several sample problems to increase students' understanding.

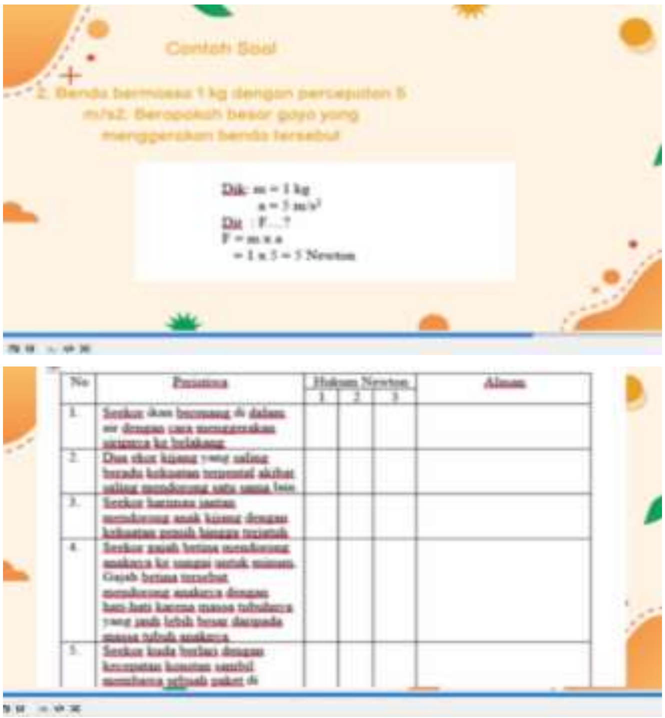
Before revision

After revision

Figure 4. Teaching materials before and after revision related to examples of application in daily life



Before revision



After revision

Figure 5. Teaching materials before and after revision related to sample questions

The SSCS-based teaching materials integrated with TPACK developed have been valid based on expert assessments so that they are continued with field trials of 3 science teachers and 10 students to ensure that the teaching materials are suitable for use. The feasibility assessment of teaching materials developed consists of several aspects, namely aspects of the appearance of teaching materials, aspects of material presentation and aspects of benefits. The results of the feasibility test of teaching materials developed for teachers can be seen in Figure 6.

In Figure 6, it can be seen that the highest percentage of feasibility testing of teaching materials based on SSCS integrated TPACK is in the aspect of material presentation of 96% while the lowest percentage is in the benefit aspect of 91% with a very feasible category. Furthermore, for the results of the feasibility test of teaching materials developed in students can be seen in Figure 7.

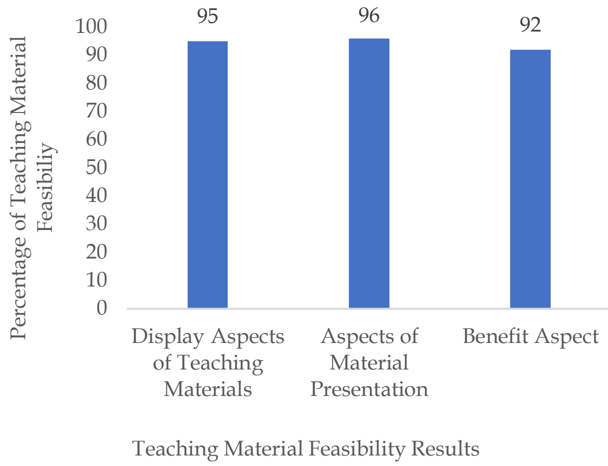


Figure 6. The results of the feasibility test of teaching materials on teacher

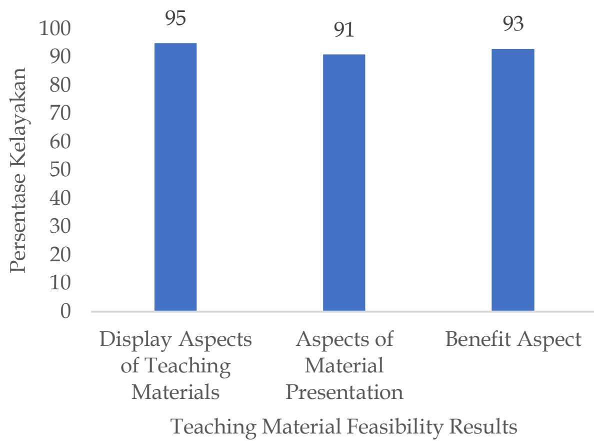


Figure 7. The results of the feasibility test of teaching materials on students

In Figure 7, it can be seen that the highest percentage of feasibility testing of teaching materials based on SSCS integrated TPACK is in the display aspect of 95% while the lowest percentage is in the aspect of material presentation of 91% with a very feasible category. Thus, the teaching materials based on SSCS integrated TPACK that have been developed are very feasible to be used as teaching materials on Newton's Law material for grade VIII SMP.

Scientific Attitude of Learners

The scientific attitude indicators measured in this study consist of curiosity, respect for facts, critical thinking, creativity, cooperation and perseverance. The average scores of pretest, posttest and N-gain of scientific attitude can be seen in Figure 8.

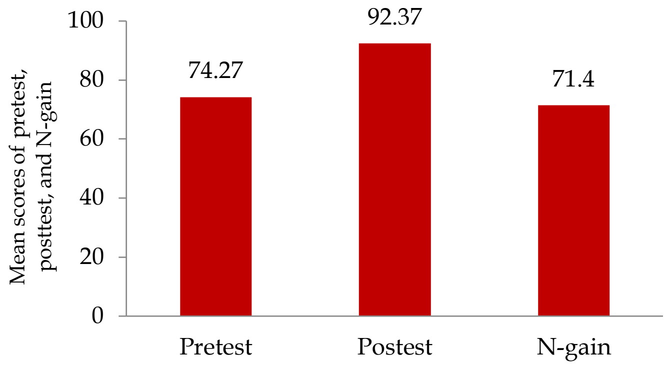


Figure 8. Average score of pretest, posttest and N-gain of scientific attitude

In Figure 8, it can be seen that the average pretest score obtained was 74.27%, the posttest was 92.37% and the N-gain value was 71.40 with each category being very high. Based on the data obtained, it shows that there is an increase in the scientific attitude of students after the use of SSCS-based teaching materials integrated with TPACK. The results of the analysis of each indicator of the scientific attitude of students can be seen in Figure 9.

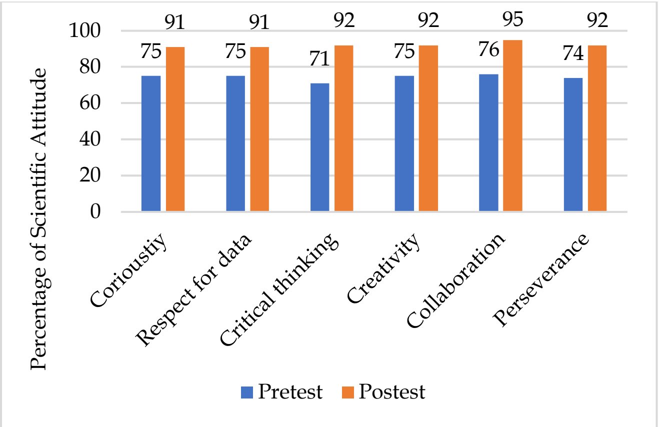


Figure 9. Percentage of scientific attitude

In Figure 9, it can be seen that in the pretest, the highest indicator was the cooperation attitude indicator, which was 76% with a moderate category. In the posttest, the scientific attitude indicator that has the highest percentage is also the cooperation indicator, which is 95% in the high category. This is due to the learning process, the Create stage, where at this stage students actively participate and share tasks in working on the LKPD provided by the teacher so that it trains cooperation between students. The lowest percentage is in the critical thinking attitude indicator, which is 71% with a medium category in the pretest, while in the posttest, the attitude indicator of curiosity and respect for data has the lowest percentage of 91% with a high category. This is because students are less specific in the problem solving process at the Solve stage. Based on the results of data analysis, it can be seen that each indicator of scientific attitude has increased. This proves that teaching materials based on SSCS integrated with TPACK can foster the scientific attitude of students during learning activities, especially on Newton's Law material.

The teaching materials developed in this study integrate technology in the form of learning videos and SSCS-based LKPDs assisted by PhET simulations so that students can understand abstract concepts in physics lessons. Based on the results of the study, it shows that the SSCS-based teaching materials integrated with TPACK developed can foster students' scientific attitudes. This is in accordance with research conducted by Widyaningrum that there is an effect of the SSCS learning model with video media on empowering students' critical thinking skills (Subiarto, 2010). Through the use of appropriate teaching materials, students will be able to develop their thinking skills (Saroji et al., 2023). In learning activities, teachers must prepare teaching materials to assist them in delivering teaching materials. Therefore, teachers must be able to prepare appropriate teaching materials in order to help students to achieve the desired competencies. The use of technology in the development of teaching materials such as the addition of videos, sounds and illustrations is an innovation to attract the attention and curiosity of students.

Scientific attitude is part of the process of science. Scientific attitudes are categorized as good if the indicators of curiosity, respect or sensitivity to data, critical thinking, creativity, cooperation and perseverance are achieved. Scientific attitudes such as curiosity, respect for data or facts, open-mindedness and cooperation in research are related to the way students act and solve problems (Yulia & Salirawati, 2023). Scientific attitudes are an important aspect that students must have to encourage them to find problems from a symptom that is used as the basis for carrying out a scientific process consisting of logical and empirical reasoning (Utami, 2020).

Scientific attitudes included in the cognitive component will have an impact on students in making decisions or taking actions (Adiansyah et al., 2021). Previous research states that there are three aspects of scientific attitudes that play an important role in the learning process, namely curiosity, open-mindedness and objectivity (Fitriani et al., 2020; Hastuti et al., 2018). Diligence, optimism, caution in work and positive thinking are also dimensions of scientific attitudes (Juhji & Nuangchalerm, 2020). If students use scientific attitudes in solving problems, the acquisition of learning outcomes will be maximized (Sa'adah & Kusasi, 2017).

Therefore, it is important to develop students' scientific attitudes because it can affect students' enthusiasm in the learning process and improve the performance of science activities (Ekawati, 2017; Erdogan, 2015; Zulirfan et al., 2018). Students who have a good scientific attitude will not easily believe and accept information that has not been proven and is not scientifically logical (Fitriani et al., 2020).

There is an increase in students' scientific attitudes after the use of SSCS-based teaching materials integrated with TPACK because the SSCS syntax encourages students to find out problems, plan problem solving, make problem solving and communicate the results of problem solving so that there is active participation from students in learning activities that can train students' curiosity, critical thinking, cooperation, perseverance, creativity and respect for data. The stages of the SSCS learning model require students to be active during the learning process and get used to doing the thinking process (Maimun & Bahtiar, 2022; Widyati & Irawati, 2021).

The application of the SSCS learning model makes students more focused in group discussions because the stages are very structured starting from the search stage, the problem solving stage, the stage of formulating solutions and the discussion stage (Yasin et al., 2020). Each stage of learning using the SSCS model involves students to investigate new situations, think about some questions and solve problems realistically (Maimun & Bahtiar, 2022).

Learners who are active in learning activities will gain direct learning experience. SSCS emphasizes the application of systematic, logical, orderly and precise thinking (Ajizah & Putu Artayasa, 2022). The process of searching for information in the problem solving process helps learners in building knowledge and developing scientific attitudes and critical thinking skills of learners. Learners will be critical to analyze problems and creative in problem solving. Likewise, the integration of TPACK in the development of learning tools can optimize learning activities and improve students' critical thinking skills (Sabaruddin et al., 2022). Therefore, teachers need to increase innovation in teaching materials used by integrating and utilizing technology.

Conclusion

Teaching materials based on SSCS integrated TPACK developed are declared valid based on the results of expert validation which includes aspects of material, aspects of usefulness and aspects of presentation. The results of the feasibility test involving teachers and students stated that the developed TPACK integrated SSCS-based teaching materials were feasible to use in the learning process. The results of the implementation of TPACK integrated SSCS-based teaching materials can foster the scientific attitude of students during learning activities, especially on Newton's Law material. Teaching materials based on SSCS integrated TPACK can be an innovation in accordance with the development of the 21st century which requires the integration of technology in learning.

Acknowledgments

We would like to thank Bima Kemdikbud for funding this research. We would also like to thank the SMP Negeri 3 Peusangan school for supporting the implementation of this research.

Author Contributions

Developing teaching materials – controlling implementation and collecting data, L. Z.; analyzing data and drafting articles, F.; and helped to develop TPACK-integrated teaching materials and prepared research instruments used in data collection, B. N.

Funding

This research was independently funded by Bima Kemdikbud.

Conflicts of Interest

The authors declare no conflict of interest but release this article for scientific publication as evidence of performance.

References

Adiansyah, R., Corebima, A. D., Zubaidah, S., & Rohman, F. (2021). The Correlation Between Metacognitive Skills and Scientific Attitudes Towards The Retention of Male and Female Students in South Sulawesi, Indonesia. *International Journal of Evaluation and Research in Education*, *10*(4), 1272–1281. https://doi.org/10.11591/IJERE.V10I4.21597

Ajizah, E., & Putu Artayasa, I. (2022). Validitas Bahan Ajar IPA Berbasis Problem Based Learning Untuk Meningkatkan Keterampilan Berpikir Kritis dan Sikap Ilmiah Peserta Didik. *Journal of Classroom Action Research*, *4*(2), 147–153. https://doi.org/10.29303/jcar.v4i1.1855

Amrina, Z., Anwar, V. N., Alvino, J., & Sari, S. G. (2022). Analisis Technological Pedagogical Content Knowledge Terhadap Kemampuan Menyusun Perangkat Pembelajaran Matematika Daring Calon Guru SD. *Jurnal Cendekia : Jurnal Pendidikan Matematika*, *6*(1), 1069–1079. https://doi.org/10.31004/cendekia.v6i1.1313

Subiarto, A.W. (2010). *Pentingnya Praktikum Dalam Pembelajaran IPA*. Yogyakarta: Universitas Negeri Yogyakarta.

Effendi, M. A., Hasruddin, & Harahap, F. (2020). Developing The Search, Solve, Create, and Share

(SSCS)-Based Student Worksheets in Biology Learning. *Jurnal Pendidikan Indonesia*, *2*(1), 161–170. https://doi.org/10.36418/japendi.v2i1.85

Ekawati, E. Y. (2017). A Model of Scientific Attitudes Assessment by Observation in Physics Learning Based Scientific Approach: Case Study of Dynamic Fluid Topic in High School. *Journal of Physics: Conference Series*, *795*(1). https://doi.org/10.1088/1742-6596/795/1/012056

Erdogan, S. C. (2015). Investigating Pre-service Gifted Education Teachers' Self-efficacy Toward Science Teaching and Scientific Attitudes. *Eurasian Journal of Educational Research*, *59*, 133–148. http://dx.doi.org/10.14689/ejer.2015.59.8

Fitriani, A., Zubaidah, S., Susilo, H., & Al Muhdhar, M. H. I. (2020). PBLPOE: A Learning Model to Enhance Students' Critical Thinking Skills and Scientific Attitudes. *International Journal of Instruction*, *13*(2), 89–106. https://doi.org/10.29333/iji.2020.1327a

Hastuti, P. W., Nurohman, S., & Setianingsih, W. (2018). The Development of Science Worksheet Based on Inquiry Science Issues to Improve Critical Thinking and Scientific Attitude. *Journal of Physics: Conference Series*, *1097*, 1–7. https://doi.org/10.1088/1742-6596/1097/1/012004

Islamiyati, A. D., Sugiharto, B., & Prayitno, B. A. (2021). Needs Analysis of Teaching Materials Biology Learning Strategy. *Jurnal Penelitian Pendidikan IPA*, *7*(SpecialIssue), 340–344. https://doi.org/10.29303/jppipa.v7ispecialissue.1194

Juhji, & Nuangchalerm, P. (2020). Interaction between Science Process Skills and Scientific Attitudes of Students towards Technological Pedagogical Content Knowledge. *Journal for the Education of Gifted Young Scientists*, *8*(1), 1–16. https://doi.org/10.17478/JEGYS.600979

Khaillasiwi, O., Purwanto, S., & Meiliasari. (2020). Pengaruh Model Pembelajaran SSCS (Search, Solve, Create, and Share) terhadap Kemampuan Koneksi Matematis Siswa SMA Negeri 45 Jakarta. *Jurnal Riset Pembelajaran Matematika Sekolah*, *4*(1), 44–50. https://doi.org/10.21009/jrpms.041.07

Magdalena, I., Prabandani, R. O., Rini, E. S., Fitriani, M. A., & Putri, A. A. (2020). Analisis Pengembangan Bahan Ajar. *Jurnal Pendidikan Dan Ilmu Sosial*, *2*(2), 170–187. Retrieved from https://ejournal.stitpn.ac.id/index.php/nusantara

Maimun, M., & Bahtiar, B. (2022). Effect of Search, Solve, Create, And Share (SSCS) Learning Models Assisted Multimedia Interactive to Improve Creative Thinking Ability and Student Learning Outcomes. *Jurnal Penelitian Pendidikan IPA*, *8*(4), 2130–2136. https://doi.org/10.29303/jppipa.v8i4.1983

Mishra, P., & Koehler, M. J. (2006). Technological Pedagogical Content Knowledge: A Framework for Teacher Knowledge. *Teachers College Record: The Voice of Scholarship in Education*, *108*(6), 1017–1054. https://doi.org/10.1177/016146810610800610

Nuryasana, E., & Desiningrum, N. (2020). Pengembangan Bahan Ajar Strategi Belajar Mengajar Untuk Meningkatkan Motivasi Belajar Mahasiswa. *Jurnal Inovasi Penelitian*, *1*(5), 967–974. https://doi.org/10.47492/jip.v1i5.177

Pizzini, E.L. (1996). *Implementation Handbook for the SSCS Problem Solving Instruction Model*. Lowa: The University of Lowa.

Pribadi, R. A., Ningsih, S. A., Dewi, A. P., & Auwalulfitri, A. (2021). Optimalisasi TPACK Pada Pembelajaran Jarak Jauh di SDN Kragilan 3 Kabupaten Serang. *Jurnal Pendidikan Tambusai*, *5*(3), 9181–9189. Retrieved from https://www.jptam.org/index.php/jptam/article/view/2441

Putra, B. P. (2022). Development of SSCS-Based E-Modules (Search, Solve, Create, Share) to Practice Creative Thinking Skills of Students on Wave Materials in High School. *IJOEM: Indonesian Journal of E-Learning and Multimedia*, *1*(1), 19–25. https://doi.org/10.58723/ijoem.v1i1.3

Rapanta, C., Botturi, L., Goodyear, P., Guàrdia, L., & Koole, M. (2020). Online University Teaching During and After the Covid-19 Crisis: Refocusing Teacher Presence and Learning Activity. *Postdigital Science and Education*, *2*(3), 923–945. https://doi.org/10.1007/S42438-020-00155-Y/FIGURES/1

Riduwan. (2013). *Skala Pengukuran Variabel-Variabel Penelitian*. Bandung: CV Alfabeta

Rizaldi, D. R., Jufri, A. W., & Jamaluddin, J. (2020). PhET: Simulasi Interaktif dalam Proses Pembelajaran Fisika. *Jurnal Ilmiah Profesi Pendidikan*, *5*(1), 10–14. https://doi.org/10.29303/jipp.v5i1.103

Sa'adah, & Kusasi, M. (2017). Meningkatkan Sikap Ilmiah dan Pemahaman Konsep Menggunakan Model Pembelajaran Inkuiri Terbimbing (Guided Inquiry) Pada Materi Kesetimbangan Kimia. *QUANTUM, Jurnal Inovasi Pendidikan Sains*, *8*(1), 78–88. Retrieved from https://ppjp.ulm.ac.id/journal/index.php/quantum/index

Sabaruddin, S., Nur, M., Fadli, M., & Mazlan, M. (2022). Content Validity of KIP-K Scholarship Instruments at Higher Education Using Aiken's Coefficient Validity Scale. *AL-TANZIM: Jurnal Manajemen Pendidikan Islam*, *6*(3), 934–947. https://doi.org/10.33650/al-tanzim.v6i3.3680

Saputri, F., Rohaeti, E., Wiyarsi, A., & Ikhsan, J. (2022). Profile of Students' Scientific Attitudes Through Practicum Activities Using Student E-Worksheet Based Chemicals at Home. *Jurnal Penelitian Pendidikan IPA*, *8*(5), 2312–2318. https://doi.org/10.29303/jppipa.v8i5.2094

Saroji, A., Rosidin, U., Ertikanto, C., Herlina, K., & Azizah, M. (2023). SSCS Model Based E-Worksheet: Needs Analysis to Stimulate Critical Thinking Skills. *Jurnal Penelitian Pendidikan IPA*, *9*(6), 4172–4178. https://doi.org/10.29303/jppipa.v9i6.3528

Triwahyudi, S., Sutrisno, & Yusnaidar. (2021). Pengembangan Perangkat Pembelajaran Berbasis TPACK pada Materi Kimia SMA. *Chempublish Journal*, *6*(1), 46–53. https://doi.org/10.22437/chp.v6i1.11679

Ulfa, S. W. (2018). Mentradisikan Sikap Ilmiah Dalam Pembelajaran Biologi. *Jurnal Biolokus*, *1*(1), 1. https://doi.org/10.30821/biolokus.v1i1.314

Utami, K. B. (2020). Validitas Lembar Kerja Peserta Didik (LKPD) Menggunakan Model Pembelajaran Search, Solve, Create, and Share (SSCS) terhadap Kemampuan Pemecahan Masalah Matematika Siswa. *Jurnal JIPS*, *4*(1), 28–34. https://doi.org/10.36057/jips.v4i1.394

Widyaningrum, D. A., & Wijayanti, T. (2017). Pemberdayaan Kemampuan Berpikir Kritis Melalui Model Pembelajaran Search, Solve, Create And Share (SSCS) Dengan Media Video Pada Matakuliah Biokimia Di IKIP Budi Utomo Malang. In *Seminar Nasional Pendidikan IPA 2017 (*Vol. 2). Retrieved from https://core.ac.uk/download/pdf/267023952.pdf

Widyati, F. N., & Irawati, H. (2021). Studi Literatur: Peningkatan Oral Activity Dan Hasil Belajar Kognitif Melalui Penerapan Model Pembelajaran Search, Solve, Create and Share (Sscs) Materi Sistem Ekskresi Pada Manusia. *INKUIRI: Jurnal Pendidikan IPA*, *10*(2), 71. https://doi.org/10.20961/inkuiri.v10i2.57187

Wijayanti, H., Degeng, I. N., & Sitompul, N. (2021). Pengembangan Bahan Ajar Berbasis E-Learning Pada Pembelajaran Tematik Sekolah Dasar. *Edcomtech Jurnal Kajian Teknologi Pendidikan*, *6*(1), 26–35. https://doi.org/10.17977/um039v6i12021p026

Winarni, E.W. (2018). *Teori dan Praktik Penelitian Kuantitatif Kualitatif, Penelitian Tindakan Kelas (PTK), Research and Development (R&D)*. Jakarta: Bumi Aksara

Yasin, M., Fakhri, J., Siswadi, Faelasofi, R., Safi'i, A., Supriadi, N., Syazali, M., & Wekke, I. S. (2020). The Effect of SSCS Learning Model on Reflective Thinking Skills and Problem Solving Ability. *European Journal of Educational Research*, *9*(2), 743–752. https://doi.org/10.12973/eu-jer.9.2.743

Yulia, Z., & Salirawati, D. (2023). Pengaruh Pembelajaran Berbasis Masalah Terhadap Kemampuan Berpikir Kritis dan Sikap Ilmiah Peserta Didik di SMA Daerah Pedesaan Aceh. *Jurnal Penelitian Pendidikan IPA*, *9*(6), 4211–4217. https://doi.org/10.29303/jppipa.v9i6.3026

Zikriana, L., Syukri, M., & Khaldun, I. (2021, September). Increasing Science Process Skills and Scientific Attitudes Through the Application of Search, Solve, Create, and Share Learning Models to Static Fluid Materials. In *2nd International Conference on Science, Technology, and Modern Society (ICSTMS 2020)* (pp. 290-293). Atlantis Press. https://doi.org/10.2991/assehr.k.210909.065

Zulirfan, Iksan, Z. H., Osman, K., & Salehudin, S. N. M. (2018). Take-Home-Experiment: Enhancing Students' Scientific Attitude. *Journal of Baltic Science Education*, *17*(5), 828–837. https://doi.org/10.33225/jbse/18.17.828