JARME **Journal Authentic Research of Mathematics Education**
**Volume 6, No. 1, January 2024**
**https://doi.org/10.37058/jarme.v6i1.9079** **e-ISSN 2655-7762**

# 4-Cs: TEACHERS' EFFORTS TO TRANSFORM 21ST CENTURY SKILLS IN TEACHING AND LEARNING

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**ARTICLE INFO**

**Article history**
*Receive: 01-12-2023*
*Revised: 11-01-2024*
*Accepted: 17-01-2024*

**Keywords**
*21st century skills, 4-Cs, lesson plan, pedagogical and professional knowledge*

keterampilan abad 21, keterampilan 4-C, rencana pelaksanaan pembelajaran, pengetahuan pedagogis dan profesional

**ABSTRACT**

This research targets teachers' efforts to transform 21st-century skills in learning. A total of 30 lesson plans made by elementary school teachers participating in the Sultan Ageng Tirtayasa University Teacher Professional Education training in 2021-2022 were analyzed based on the accuracy of using operational verbs used by teachers in describing 4-Cs (critical thinking and problem solving, creativity and innovation, communication, and collaboration), compared to verbs/base outcomes on the Central Board of Secondary Education (CBSE). This research uses the content analysis method, with stages: formulating problems, selecting samples/sources of research data, categorizing, coding, clarifying summary content, analyzing coding results, and presenting and interpreting data based on theories or hypotheses of thought. Data analysis uses qualitative analysis, including data reduction, presentation, conclusion drawing, and verification. The results of the research obtained are (1) in transforming 21st-century skills, the level of teacher understanding of communication skills is the best compared to other 4-Cs, (2) teachers have low pedagogic and professional knowledge, this is shown by the mistakes made by teachers in choosing the correct operational verbs to describe 4-Cs in designing learning. This study also recommends upgrading and increasing teachers' understanding of the 4 Cs in realizing 21st-century learning by curriculum and policy achievements that are right on target.

*Penelitian ini menargetkan upaya guru untuk mentransformasikan keterampilan abad 21 dalam pembelajaran. Sebanyak 30 buah Rencana Pelaksanaan Pembelajaran (RPP) buatan guru SD peserta PPG Universitas Sultan Ageng Tirtayasa Tahun 2021-2022 dianalisis berdasarkan ketepatan penggunaan kata kerja operasional (KKO) yang digunakan guru dalam mendeskripsikan keterampilan 4-C (berpikir kritis dan pemecahan masalah, kreativitas dan inovasi, komunikasi, serta kolaborasi), dibandingkan dengan kata kerja/basis outcome pada Central Board of Secondary Educatio (CBSE). Penelitian ini menggunakan metode analisis konten, dengan tahapan: merumuskan masalah, memilih sampel/sumber data penelitian, membuat kategorisasi, membuat koding dan memperjelas isi ringkasan, menganalisis hasil koding, serta menyajikan dan menginterpretasikan data berdasarkan pada teori atau hipotesis pemikiran. Analisis data dilakukan dengan menggunakan analisis kualitatif, meliputi: reduksi data, penyajian data, serta penarikan kesimpulan dan verifikasi data. Hasil penelitian yang diperoleh adalah (1) dalam mentransformasikan keterampilan abad 21, tingkat pemahaman guru pada keterampilan komunikasi adalah paling baik dibandingkan dengan keterampilan*

*4-C lainnya, (2) guru memiliki pengetahuan pedagogis dan profesional yang masih rendah, hal ini diindikasikan dari kekeliruan yang dilakukan guru dalam memilih KKO yang tepat untuk mendeskripsikan keterampilan 4-C dalam merancang pembelajaran. Penelitian ini juga merekomendasikan tentang pentingnya upgrading untuk meningkatkan pemahaman guru terhadap keterampilan 4-C dalam mewujudkan pembelajaran abad 21, sesuai dengan capaian kurikulum maupun kebijakan yang ditargetkan.*



**How to cite:**

Sukirwan, Ratnaningsih, N., Patmawati, H., & Suhaya (2023). 4-Cs: Teachers' efforts in transforming 21st-century skills in teaching and learning. ***Journal of Authentic Research in Mathematics Education, 6***(1), 1-12. https://doi.org/10.37058/jarme.v6i1.9079

## 1. INTRODUCTION

As the world enters the 21st century, technology is dominant in life. Various technological devices have sprung up, both in the form of hardware And software, which humans use to solve problems. Currently, technological sophistication can solve various complex problems previously unreachable by conventional work activities. This situation then triggers a paradigm shift in human thinking, from understanding to problem-solving, from competitive to collaborative, from knowledge to skills, and from basic to Applied skills (Trilling & Fadel, 2009).

In education, a paradigm shift in thinking can be seen in learning outcomes that learners achieve through learning and innovation skills. According to Partnership for 21st Century Skills (2015), learning and innovation skills must be improved to face life and work environments that are increasingly complex in the 21st century. Four skills support learning and innovation skills: critical thinking and problem-solving, creativity and innovation, communication, and collaboration. These four skills, 4-Cs, are part of 21st-century skills (Fitri et al., 2020; Putri et al., 2022; Ramadhani & Napfiah, 2022).

Critical thinking and problem-solving skills refer to using knowledge, data, and facts to solve problems effectively. According to Marlina and Jayanti (2019), critical thinking skills are higher-order thinking skills in using and manipulating material according to the situation needed. This critical thinking skill is instrumental in dealing with problems. A person facing a problem does not have to find answers immediately, but it takes the ability to think independently, assess problems, and find and develop problem-solving. When his critical thinking skills are reliable, he immediately attempts to solve problems through the steps he masters. So, critical thinkers can be said to be excellent problem solvers who can provide innovative and new solutions to problems that arise, both at work and in one's personal life.

Creativity refers to a new way of seeing or doing things (CBSE, 2020), the unfamiliarity or uniqueness of the solution to a particular situation (Mazeh, 2020). Creativity is also the essence of innovation and novelty (Kaplan, 2019). Therefore, the term creativity cannot be separated from innovation. In this case, someone who develops

creativity continuously will transform into someone innovative. Creativity and innovation are some of the most critical 21st-century skills because these two skills are seen as able to increase the potential possessed by a person by bringing out positive aspects, as well as self-expression, healthily and productively.

Collaboration relates to the activity of working together with others to achieve specific goals. According to CBSE (2020), collaboration is a skill in working together with others effectively. The phrase clarifies the understanding of cooperation that is limited or only benefits one party. Collaboration allows one to develop interest and pleasure in learning processes that transcend environmental, social, and cultural boundaries. So, being an effective collaborator does not just mean being able to work with others but also being able to learn, share, and express yourself. It also signifies the importance of openness to collaboration and sharing creative ideas that can encourage people to communicate more with each other.

Communication is a skill to express ideas and express opinions, both verbally and non-verbally. According to the Ministry of Education and Culture (Kemendikbud, 2017), communication is transmitting information, ideas, and skills using symbols, images, numbers, words, etc. Communication is becoming one of the most critical 21st-century skills. Communication can be a crucial factor in career advancement, making a person highly valued and positively influencing others. In addition, good communication skills will support a person's ability to build collaboration, foster better relationships, and improve decision-making.

Based on the description of the critical role of 4-Cs in the 21st century, several policies and anticipatory actions have emerged from non-profit organizations, governments, and researchers. For example, international economic organizations, Organization for Economic Cooperation and Development (OECD), highlight how to prepare learners for the new global economy (Ananiadou & Claro, 2009). Similarly, government policy regarding the national literacy movement (Han et al., 2017), strengthening character education (Hendarman et al., 2019), minimum competence assessment (Wijaya & Dewayani, 2021), as well as a guide to implementing 21st-century skills in teaching and learning (Kemendikbud, 2017). In particular, Diana & Turmudi (2021) and Fitriah & Mirianda (2019) highlight the readiness of teachers in Indonesia to face the challenges of the 21st century, where teachers are faced with a variety of increasingly complex problems, in addition to increasingly sophisticated technology (cyber society), as well as the phenomenon of deviation of learners' characteristics and values. In addition, Musfah (Satria, 2022) revealed several problems teachers face, one of which is regarding teacher competence. Data obtained from the Ministry of Education and Culture between 2015 and 2016 (Agung et al., 2018) stated that the average results of the Teacher Competency Test (TCT) were still below the standard value set by the government. In 2015, TCT's national average score was 52.37, 3 points lower than the standard score of 55. Meanwhile, in 2016, TCT's national average score was 56.69. The average value is also still lower than the standard value set by the government, which is 65.

In the 2022 performance report of the Directorate General of Teachers and Education Personnel (GTK, 2022), it is stated that the problem of teacher competence is

related to the knowledge and mastery of technology, pedagogics, and professionals of some teachers who are still inadequate. This problem is inseparable from the demands of implementing 21st-century skills in teaching and learning. Some studies report that some teachers do not experience obstacles in 21st-century teaching and learning, but others still experience problems in mastering technology and integrating 21st-century skills in teaching and learning (Patta et al., 2022).

The integration of 21st-century skills in teaching and learning is closely related to teachers' pedagogic and professional knowledge. Daryanto and Karim (Tarihoran, 2019) revealed that two of the five categories of 21st-century teachers relate to pedagogic and professional knowledge in designing and developing student teaching and learning experiences and facilitating and inspiring students' learning and creativity. Both knowledges can be explicitly identified from lesson plans designed by teachers (Noviani & Astawa, 2019; Sarwantinah, 2021; Wibawa, 2019). The integration of 21st-century skills in this lesson plan can further provide an overview of (1) the level of teacher understanding of 21st-century skills in teaching and learning and (2) the level of pedagogic and professional knowledge of teachers to transform 21st-century skills in teaching and learning.

## 2. METHOD

This research uses a qualitative approach with content analysis methods. Krippendorff (2004) states that content analysis is a research method for making reproducible and valid conclusions from text (or other meaningful things) to the context in which it is used. Content analysis in this study is used to get a detailed picture of the context of 21st-century skills in teacher-made lesson plans as an implication of teachers' efforts in transforming 21st-century skills in teaching and learning. To achieve this target, as many as 30 lesson plans made by elementary school teachers participating in Teacher Professional Education of Sultan Ageng Tirtayasa University for 2021-2022 are used as the primary data source in this study. All teachers who make the lesson plans are confirmed to have received the Teacher Professional Education workshop on lesson plan design that integrates 21st-century skills in teaching and learning. In addition, the lesson plans analyzed have the same format as the 2013 curriculum document.

This research was carried out with procedures adapted from Fauzi & Pradipta (2018), Shava et al. (2021), Sukirwan et al. (2023), and Turmuzi et al. (2023) includes: (1) formulating problem questions, (2) selecting samples or sources of research data, (3) making categorization, (4) coding data and clarify the content of the summary, (5) analyze the results of coding, and (6) present data and interpret data based on theories or hypotheses of thought. Categorization is based on the 4-Cs that emerge from each stage of teaching and learning. Meanwhile, coding identifies the operational verb used on each 4-Cs, referring to the established indicators. The indicators of the 4-Cs used in this study refer to the 4-Cs indicators of CBSE (2020), as shown in Table 1.

**Table 1.** 4-Cs Indicators and Operational Verbs/Outcome Bases

| 4-Cs | Indicators | Operational Verbs/ Outcome Bases |
|---|---|---|
| Critical Thinking and Problem Solving Skills | • Use different types of reasoning to suit specific situations<br>• Analyze how parts of the whole interact with each other to produce a whole output in a complex system<br>• Analyze and evaluate evidence, arguments, claims, and beliefs effectively<br>• Analyze and evaluate various alternative main points of view<br>• Synthesize and make connections between information and argumentation<br>• Interpret various information and draw conclusions based on the best analysis<br>• Reflect critically on learning processes and experiences<br>• Solve various types of unknown problems in both conventional and innovative ways<br>• Identify and ask significant questions that clarify different points of view and lead to better solutions | Arguing, comparing and contrasting, analyzing, classifying, defining, describing, explaining, problem-solving, tracking cause and effect, evaluating |
| Creativity and Innovation skills | • Using a variety of idea-creation techniques (such as brainstorming)<br>• Creating new and valuable ideas (both critical and radical concepts)<br>• Elaborate, refine, analyze, and evaluate ideas to improve and maximize creative efforts<br>• Develop, implement, and communicate new ideas to others effectively<br>• Be open and responsive to new and diverse perspectives; Incorporate input and feedback into the work<br>• Demonstrate originality and inventiveness in working and understanding real-world limitations in adopting new ideas<br>• View failure as an opportunity to learn; Understand that creativity and innovation are long-term cyclical processes of small successes and repeated mistakes<br>• Act on creative ideas to make an accurate and valuable contribution in the field in which innovation will occur | Creating, imagining, entertaining, brainstorming, questioning, overturning, designing, improvising, problem-solving, accessing information, and using technology |
| Communication skills | • Articulate thoughts and ideas effectively using oral, written, and nonverbal communication skills in various forms and contexts.<br>• Listening effectively to decipher meaning, including knowledge, values, attitudes, and intentions<br>• Use communication for a variety of purposes (e.g., to inform, instruct, motivate, and persuade)<br>• Utilize various media and technologies, and know how to justify their effectiveness a priori and assess their impact.<br>• Communicate effectively in diverse environments (including multilingual) | Speaking, reading, writing, listening intently and patiently, use of technology, evaluating messages, analysis of the situation, turn-taking and initiation, choosing a medium of communication |
| Collaboration skills | • Demonstrate the ability to work effectively and respectfully with a diverse team. | Team building, evaluating, leading, |

| | | |
|---|---|---|
| | • Exercise flexibility and willingness to assist in doing the things necessary to achieve common goals<br>• Take shared responsibility for collaborative work and reward individual contributions made by each team member. | decision making, resolving conflicts, brainstorming, goal setting, managing time, allocating resources, delegating |

Operational verbs are used as coding by identifying 4-Cs that are more specific. Multiple teachers may use the same operational verb for several different 4-Cs. This will be a sign of the extent of teachers' understanding of 4-Cs and the teachers' pedagogic knowledge and professionalism towards 21st-century teaching and learning. The proper use of operational verbs (construct validity) is further validated using operational verb/primary outcome results of each of the 4-Cs (CBSE, 2020).

## 3. RESULTS AND DISCUSSION

In realizing teaching and learning that adopts 21st-century skills, teachers generally write one or more 4-Cs in the appropriate teaching and learning phases. The writing of 4-Cs indicates the teacher's efforts to implement 21st-century skills in teaching and learning. Of the 30 lesson plans analyzed, the following data on the emergence of 4-Cs is presented based on the number of skills that arise from each lesson plan.

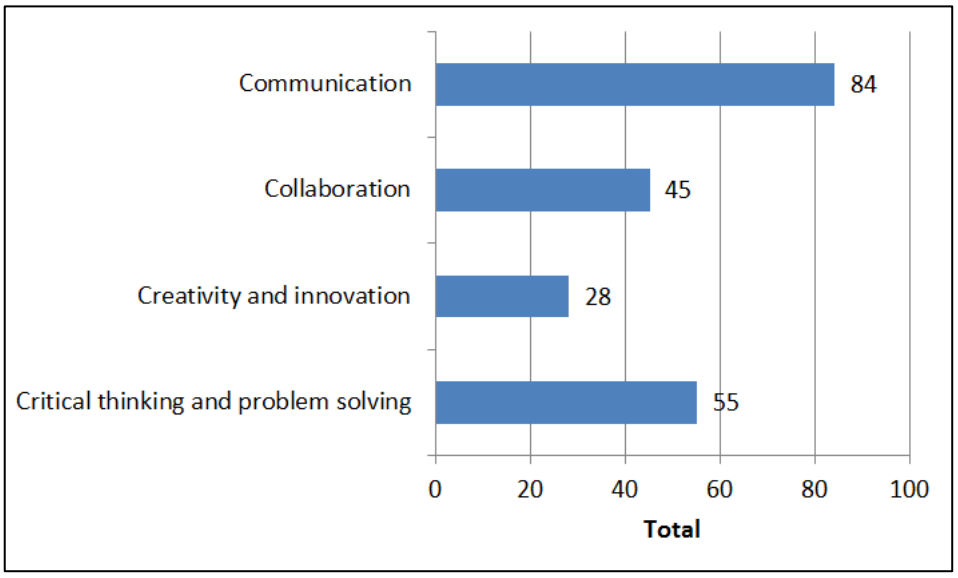


**Figure 1.** Total of 4-Cs Appearing in Teacher's Lesson Plans

In Figure 1, communication skills have the most frequency of occurrence compared to other 4-Cs. The percentage of communication skills was 39.62%, followed by critical thinking and problem-solving skills at 25.95%, creativity and collaboration skills at 13.21%, and the lowest collaboration skills at 21.23%. The frequency of occurrence of each of these 4-Cs does not consider the performance indicators' accuracy. However, applying the 4-Cs to teaching and learning steps signifies teachers' efforts to transform 21st-century skills in teaching and learning.

To see the accuracy of applying the 4-Cs in teaching and learning, an analysis of performance indicators is carried out using operational verbs from each 4-Cs. The following is data on using operational verbs from each 4-C in teachers' lesson plans.

**Table 2.** Use of Operational Verbs by Teachers in the Representation of 4-Cs

| 4-Cs | Operational Verbs |
|---|---|
| Critical thinking and problem-solving skills | Identify (3), conclude (1), observe (2), notice (5), design (1), ask (13), discuss (1), do (1), present (1), ask questions (6), practice (2), analyze (5), explore (2), respond (3), solve (1), interpret (1), create (1), discuss (1), compare (1), observe (2), suggest (1), |
| Creativity and innovation skills | Complete (2), discuss (1), observe (2), analyze (2), present (2), create (3), resume (1), compose (1), write (2), conclude (1), observe (1), conduct experiments (1), repeat (1), fill (3), report (1), guide (1), participate (1), observe (1), create (1) |
| Communication skills | Discuss (7), present (9), conclude (4), reveal (1), find (1), inform (4), remind (1), explain (4), respond (5), ask (10), listen (1), ask and answer (8), analyze (5), present (2), observe (2), check (1), read (1), answer (1), study (1), convey (4), reflect (1), remind (1), study (1), ponder (1), invite (1), mention (4), convey (1), experiment (1), discuss (1), |
| Collaboration skills | Discuss (8), explore (2), ask and answer (9), demonstrate (1), confirm (1), conclude (2), observe (2), analyze (4), explore (1), ask (1), give reinforcement (1), divide tasks (1), explain (1), deliver (1), respond (1), reflect (1), experimenting (1), discuss (1), identify (1), positively (1), mention (1) |

Table 2 shows that operational verbs for each 4-Cs are pretty varied. The verb "ask" is most used in critical thinking and problem-solving skills, while the verb "to present" is also "to ask" is most used in communication skills. Even if the verbs "ask" and "ask and answer" are identified, they are most widely used in communication skills. Meanwhile, the verb "discuss" is most used in collaboration skills, while the dominance of words in creativity and innovation skills is less pronounced, although the verbs "make" and "fill" are pretty noticeable compared to other verbs.

Some of the same verbs are used on different 4-Cs. Table 2 shows that the verb "discuss" is used for all 4-Cs, as well as for the verbs "observe," "analyze," and "conclude." The verb "discuss" is used in communication and collaboration skills, as well as for the verbs "experiment," "explain," "convey," and "ponder." The verb "present" is used for communication skills, critical thinking, and problem-solving, and for the verb "to ask". The verb "explore" is used for collaboration skills, critical thinking, and problem-solving, as well as for the verbs "to posit" and "to identify". The verb "discernment" is used for critical thinking and problem-solving skills, as well as creativity and innovation, as well as for the verbs "create" and "complete." The verb "present" is used for communication and creative skills and innovation, while the verb "ask and answer" is used on critical thinking and problem-solving, communication, and collaboration skills. The total distribution of verb use in each of the 4-Cs is shown in Table 3.

**Table 3.** Use of the Same Operational Verbs in 4-Cs

| Operational Verbs | Critical Thinking and Problem Solving | Creativity and innovation | Communica-tion | Collaboration |
|---|---|---|---|---|
| Discuss | | | * | * |
| Experimenting | | | * | * |
| Q&A | * | | * | * |
| Present | * | | * | |
| Respond | * | | * | * |
| Inquired | * | | * | |
| Discerning | * | * | | |
| Discuss | * | * | * | * |
| Observe | * | * | * | * |
| Analyze | * | * | * | * |
| Explore | * | | | * |
| Posting | * | | | * |
| Identify | * | | | * |
| Creating | * | * | | |
| Explain | | | * | * |
| Serves | | * | * | |
| Delivery | | | * | * |
| Mention | * | | * | * |
| Finish | * | * | | |
| Conclude | * | * | * | * |
| Conclude | * | * | | * |
| Contemplate | | | * | * |

Teachers use the operational verbs in Table 3 to describe sentences or work orders on 4-Cs. Some operational verbs match the outcome base in CBSE (2020), but others seem inappropriate, including using operational verbs for some 4-Cs. Although the matches mostly show no word similarity, some of the teacher's chosen verbs seem identical to the basis outcome of CBSE. For example, in critical thinking and problem-solving skills, using the verb "present" in teacher lesson plans is identical to "explaining" in CBSE. In collaboration skills, the verb "divide tasks" in teacher lesson plans is identical to "team building" in CBSE. Similarly, in communication skills, the verb "reflect" on a teacher's lesson plan is identical to "evaluate messages" in CBSE. Data on the relevance of verb use on 4-Cs chosen by teachers compared to the basis outcome on CBSEs for verbs used on some of the same 4-Cs are more presented in Figure 2.

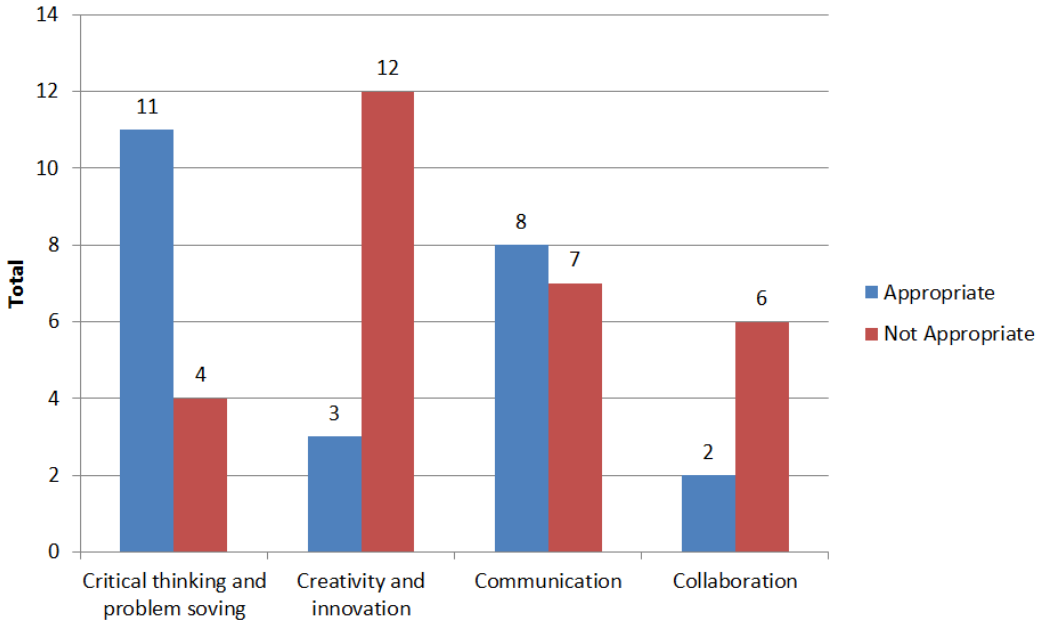


**Figure 2.** Relevance of the Same Operational Verbs of 4-Cs

Figure 2 shows that the relevance of using operational verbs in critical thinking, problem-solving, and communication skills is 73.33% and 53.33%, respectively. This suggests that teachers' critical thinking, problem-solving, and communication comprehension levels are significant, with relatively low fallacies. Meanwhile, the relevance of using operational verbs on creativity, innovation skills, and collaboration was 20% and 25%, respectively. This indicates that teachers' level of understanding of creativity, innovation skills, and collaboration is relatively low. Next, to see the use of operational verbs specifically used on only one 4-Cs it is presented in Figure 3.

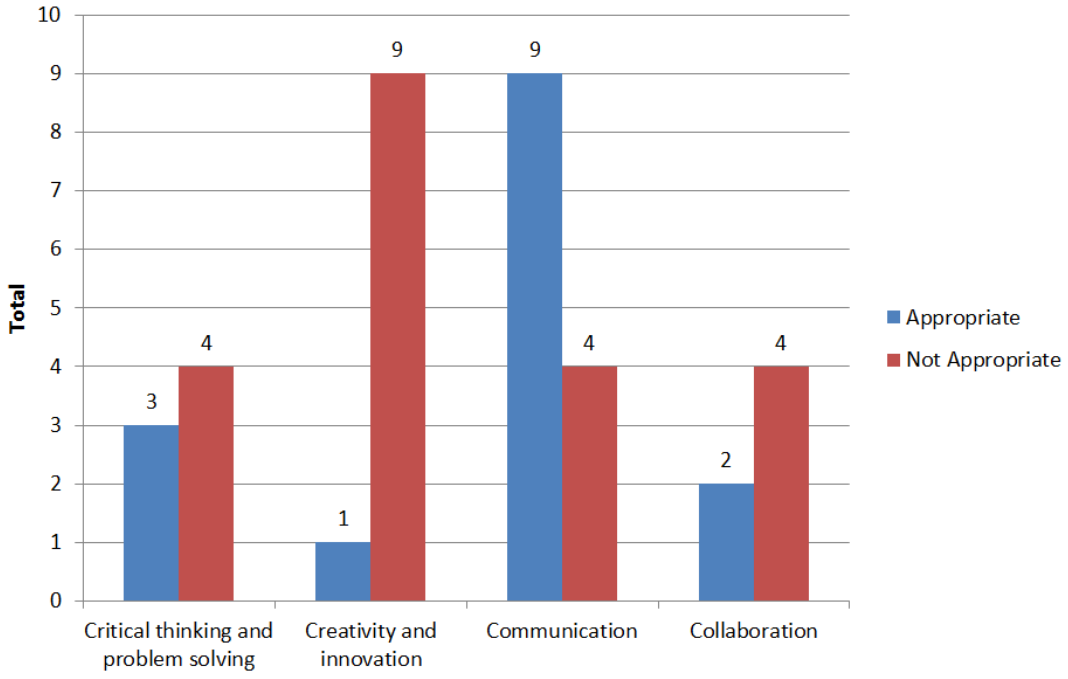


**Figure 3.** Relevance of Different Operational Vers of 4-Cs

Figure 3 shows that the level of teacher comprehension of 4-Cs is quite significant in communication skills. In these skills, 69.23% of teachers can use the proper operational verbs according to the basis outcome CBSE. Meanwhile, in other 4-Cs, the misuse of operational verbs is much more than basis outcome CBSE. This shows that teachers still have problems choosing the correct operational verbs to describe critical thinking and problem solving, creativity and innovation, and collaboration skills.

The error in choosing the correct operational verbs to describe 4-Cs is a phenomenon experienced by teachers in designing 21st-century teaching and learning. This phenomenon also illustrates that to carry out 21st-century teaching and learning, it is not enough to describe 4-Cs arbitrarily and simply in a pedagogical action; a deep understanding of the characteristics of each 4-C is needed. Teachers also need to think deeply about the proper use of verbs in describing the indicators of each 4-C. For example, on indicators of critical thinking and problem-solving skills, students are asked to analyze evidence obtained based on steps passed in previous experiments.

## 4. CONCLUSION

The conclusions obtained from the results of research and discussion in this study, among others: (1) the level of teacher's comprehension in transforming 21st-century skills in communication is best compared to other skills, although further analysis is still needed to describe the achievement of these skills based on the established indicators, (2) pedagogical and professional knowledge of teachers look still low, this can be seen from mistakes made by teachers in choosing the correct operational verbs to describe the 4-Cs in designing teaching and learning. The results of this study are further expected to be one of the references for activities such as upgrading teachers in implementing 21st-century teaching and learning, where the realization of 4-Cs in teaching and learning is not solely on ordinary pedagogical actions but requires deep understanding, including (1) choosing the correct operational verbs in describing 4-Cs, and (2) targeting 4-Cs according to indicators set.

## REFERENCES

Agung, I., Raharjo, S. B., Sabon, S. S., Supriyadi, T., Mustari, I., Juanita, F., & Utari, N. R. (2018). *Evaluasi pembinaan guru melalui program guru pembelajar guna menuju tingkat keterampilan bepikir tinggi (HOTS)* (I. Kintamani, Y. Jakaria, & L. H. Winingsih (eds.)). Kementerian Pendidikan dan Kebudayaan.

Ananiadou, K., & Claro, M. (2009). 21st century skills and competencies for new millennium learners in OECD countries. In *OECD Education Working Papers* (Issue 41). Organization for Economic Cooperation and Development. https://doi.org/10.1787/218525261154

CBSE. (2020). *21st century skills: A handbook* (J. Emmanuel (ed.); 1st ed.). Central Board of Secondary Education.

Diana, N., & Turmudi, T. (2021). Kesiapan Guru dalam mengembangkan modul berbasis STEM untuk mendukung pembelajaran di abad 21. *Edumatica: Jurnal Pendidikan Matematika*, *11*(2), 1–8.

https://doi.org/10.22437/edumatica.v11i02.11720

Fauzi, A., & Pradipta, I. W. (2018). Research methods and data analysis techniques in education articles published by Indonesian biology educational journals. *Indonesian Journal of Biology Education*, *4*(2), 123–134. https://doi.org/10.22219/jpbi.v4i2.5889

Fitri, M., Yuanita, P., & Maimunah. (2020). Pengembangan perangkat pembelajaran matematika terintegrasi keterampilan abad 21 melalui penerapan model Problem Based Learning (PBL). *Jurnal Gantang*, *5*(1), 77–85. https://doi.org/10.31629/jg.v5i1.1609

Fitriah, D., & Mirianda, M. U. (2019). Kesiapan guru dalam menghadapi tantangan pendidikan berbasis teknologi. *Seminar Nasional Pendidikan Program Pascasarjana Universitas PGRI Palembang*, 148–153.

GTK. (2022). *Laporan kinerja 2022*. Dirjen GTK, Kementerian Pendidikan, Kebudayaan, Riset, dan Teknologi.

Han, W., Susanto, D., Dewayani, S., Pandora, P., Hanifah, N., Miftahussururi, Nento, M. N., & Akbari, Q. S. (2017). *Materi pendukung literasi numerasi: Gerakan literasi nasional* (L. A. Mayani (ed.)). Kementerian Pendidikan dan Kebudayaan.

Hendarman, Saryono, D., Supriyono, Kamdi, W., Sunaryo, Latipun, Winarsunu, T., Chamisijatin, L., Koesoema, D., Indriyanto, B., Hidayati, S., Kurniawan, Sufyadi, S., Setyorini, N. P., Utomo, E., Hadinata, O., Wismayanti, E., Anggraini, L., Setiyorini, H. P. D., … Haura, T. (2019). *Konsep dan pedoman penguatan pendidikan karakter tingkat sekolah dasar dan sekolah menengah pertama* (L. Muliastuti (ed.)). Kementerian Pendidikan dan Kebudayaan.

Kaplan, D. E. (2019). Creativity in education: Teaching for creativity development. *Psychology*, *10*(2), 140–147. https://doi.org/10.4236/psych.2019.102012

Kemendikbud. (2017). *Panduan implementasi kecakapan abad 21 kurikulum 2013 di sekolah menengah atas*. Direktorat Pembinaan Sekolah Menengah Atas, Direktorat Jenderal Pendidikan Dasar dan Menengah, Kementerian Pendidikan dan Kebudayaan.

Krippendorff, K. (2004). *Content analysis: An introduction to its methodology* (M. H. Seawell, J. Meyers, C. A. Hoffman, & J. Selhorst (eds.); 2nd ed.). SAGE Publications, Inc. https://doi.org/10.1103/PhysRevB.31.3460

Marlina, W., & Jayanti, D. (2019). 4C dalam pembelajaran matematika untuk menghadapi era revolusi industri 4.0. *Seminar Pendidikan Matematika*, *5*(1), 392–396. https://doi.org/10.32722/epi.v16i1.1419

Mazeh, Y. (2020). What is creativity, and why is it so important? *Open Access Library Journal*, *7*(3), 1–11. https://doi.org/10.4236/oalib.1105562

Noviani, N. K., & Astawa, I. B. M. (2019). Profesionalisme guru dalam pengimplementasian Rencana Pelaksanaan Pembelajaran (RPP) pada mata pelajaran geografi SMA di Kota Singaraja. *Jurnal Pendidikan Geografi Undiksha*, *7*(2), 44–53. https://doi.org/10.23887/jjpg.v7i2.20688

Partnership for 21st Century Skills. (2015). *Core content integration*. Ohio

Department of Education. www.P21.org.

Patta, R., Basri, K. T. nanda, Kadir, A., & Asriadi. (2022). Persepsi guru kelas pada keterampilan pembelajaran abad ke 21 di SD Inpres 6/75 Ta Kecamatan Tanete Riattang Kabupaten Bone. *JPPSD:Jurnal Pendidikan dan Pembelajaran Sekolah Dasar*, *1*(4), 253. https://doi.org/10.26858/pjppsd.v2i2.32344

Putri, R. D. R., Ratnasari, T., Trimadani, D., Halimatussakdiah, Husna, E. N., & Yulianti, W. (2022). Pentingnya keterampilan abad 21 dalam pembelajaran matematika. *SICEDU: Science and Education Journal*, *1*(2), 449–459. https://doi.org/10.31004/sicedu.v1i2.64

Ramadhani, Z. L., & Napfiah, S. (2022). Pengembangan media pembelajaran matematika interaktif berbasis keterampilan abad 21 pada materi aritmatika sosial. *Jurnal Pendidikan dan Riset Matematika*, *5*(1), 2656–4181. http://ejurnal.budiutomomalang.ac.id/index.php/prismatika

Sarwantinah. (2021). Upaya meningkatkan kinerja guru dalam menyusun RPP melalui supervisi akademik secara periodik. *Jurnal Kewarganegaraan*, *5*(1), 107–112. https://doi.org/10.31316/jk.v5i1.1286

Satria, M. H. Y. (2022). *Kesiapan guru di Indonesia dalam menghadapi tantangan pembelajaran yang inovatif pada abad 21*. https://doi.org/10.31237/osf.io/d9ztc

Shava, G. N., Hleza, S., Tlou, F., Shonhiwa, S., & Mathonsi, E. (2021). Qualitative content analysis, utility, usability and processes in educational research. *International Journal of Research and Innovation in Social Science*, *5*(7), 553–558. www.rsisinternational.org

Sukirwan, Nindiasari, H., Warsito, & Saleh, H. (2023). Dialektika budaya dan matematika: Studi pada penelitian etnomatematika di Indonesia. *Journal of Authentic Research on Mathematics Education*, *5*(2), 177–190. https://doi.org/10.37058/jarme.v5i2.7155

Tarihoran, E. (2019). Guru dalam pengajaran abad 21. *SAPA - Jurnal Kateketik dan Pastoral*, *4*(1), 46–58. https://doi.org/10.53544/sapa.v4i1.68

Trilling, B., & Fadel, C. (2009). *21st-century skills: Learning for life in our times*. John Wiley & Sons, Inc.

Turmuzi, M., Suharta, I. G. P., & Suparta, I. N. (2023). Ethnomathematical research in mathematics education journals in Indonesia: A case study of data design and analysis. *Eurasia Journal of Mathematics, Science and Technology Education*, *19*(1), 1–13. https://doi.org/10.29333/ejmste/12836

Wibawa, I. M. D. (2019). Meningkatkan kinerja guru dalam menyusun silabus dan Rencana Pelaksanaan Pembelajaran (RPP) melalui supervisi kolegial. *Journal of Education Action Research*, *3*(1), 66. https://doi.org/10.23887/jear.v3i1.17092

Wijaya, A., & Dewayani, S. (2021). *Framework Asesmen Kompetensi Minimum (AKM)*. Pusat Asesmen dan Pembelajaran, Balitbangbuk, Kementerian Pendidikan dan Kebudayaan.