



Mathematics Teaching Tools for Implementing the Independent Curriculum Stage B Class 4

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ABSTRAK

Kurikulum Merdeka telah disusun untuk diterapkan sepenuhnya pada tahun 2024. Perubahan tersebut seringkali mempengaruhi instrumen pembelajaran yang digunakan di kelas. Dalam menghadapi perubahan tersebut, sekolah memerlukan pengembangan perangkat pembelajaran tambahan dalam penerapan Kurikulum Merdeka. Tujuan penelitian ini adalah untuk memberikan pengalaman belajar yang lebih menyeluruh, mendalam, dan kontekstual bagi siswa dalam memahami konsep-konsep dasar matematika. Penelitian ini merupakan penelitian pengembangan yang mengembangkan instrumen pembelajaran matematika untuk siswa kelas IV dalam penerapan Kurikulum Merdeka. Populasi penelitian ini berjumlah 168 siswa. Secara acak kelompok eksperimen hanya berjumlah 30 siswa, sedangkan siswa yang dipilih sebagai kelompok kontrol berjumlah 26 siswa. Produk ini dikembangkan dengan menggunakan model pengembangan Plomp yang terdiri dari 5 tahap; observasi awal, penyusunan desain produk, realisasi produk, pengujian, evaluasi, dan revisi, dan implementasi. Instrumen penelitian yang digunakan dalam penelitian ini adalah lembar observasi, angket, pretest dan posttest, dan pedoman wawancara. Produk akhir berisi tujuan pembelajaran, modul pembelajaran, dan instrumen penilaian. Teknik analisis data yang digunakan dalam penelitian ini adalah uji normalitas, uji homogenitas, uji t, dan n-gain score. Hasil n-gain menunjukkan produk berada pada kategori sedang. Hasil uji-t diperoleh peningkatan yang menunjukkan adanya peningkatan dari skor pre-test ke post-test. Artinya ada perubahan. bahwa dapat dikembangkan instrumen pembelajaran yang valid, praktis dan efektif dalam meningkatkan hasil belajar kognitif siswa. Implikasi penelitian ini dapat digunakan untuk memecahkan masalah praktis, memperbaiki sistem yang ada, atau mengembangkan teori baru.

ABSTRACT

The Merdeka Curriculum has been prepared to be fully implemented in 2024. These changes often affect the learning instruments used in class. In facing these changes, schools need to develop additional learning tools in implementing the Independent Curriculum. The aim of this research is to provide a more comprehensive, in-depth and contextual learning experience for students in understanding basic mathematical concepts. This research is development research that develops mathematics learning instruments for fourth grade students in implementing the Merdeka Curriculum. The population of this research was 168 students. Randomly, the experimental group only consisted of 30 students, while the students selected as the control group were 26 students. This product was developed using the Plomp development model which consists of 5 stages; initial observation, preparation of product design, product realization, testing, evaluation and revision, and implementation. The research instruments used in this research were observation sheets, questionnaires, pretest and posttest, and interview guidelines. The final product contains learning objectives, learning modules, and assessment instruments. The data analysis techniques used in this research are normality test, homogeneity test, t test, and n-gain score. The n-gain results show the product is in the medium category. The results of the t-test showed an increase which showed an increase from the pre-test to post-test scores. This means there is change. that valid, practical and effective learning instruments can be developed in improving students' cognitive learning outcomes. Implications of this research can be used to solve practical problems, improve existing systems, or develop new theories.

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1. INTRODUCTION

The curriculum is one of several aspects that cannot be separated in the implementation of education. The role of the curriculum starts from the conceptual aspect to its application in the field. The curriculum also plays a role as planning and preparation of content, teaching materials/materials and guidelines for procedures for implementing effective education, Since Indonesia proclaimed its independence in 1945, the education system in Indonesia, especially the curriculum implemented, has undergone at least 11 transformations (Hudaidah & Ananda, 2021; Salsabila et al., 2019). Explained that the curriculum in Indonesia has undergone several changes and developments. And the newest is the independent learning curriculum which will begin being tested in 2022. The Freedom to Learn The curriculum is targeted to be fully implemented in 2024. Concept of Freedom to Learn is one of the policy programs of the Ministry of Education and Culture, Research Technology and Higher Education of the Republic of Indonesia (Aura Diva et al., 2020; Muttaqien et al., 2019). The ministry formulated an independent learning policy based on the 2019 results International Student Assessment Program (PISA) study. The assessment results show that the assessment of Indonesian students, children in Indonesia in the field of literacy and numeracy is in sixth position from the bottom. 74th position out of 79 countries that took part in the assessment. In response to the PISA results, the Ministry developed innovative minimum skills assessments, including literacy, numeracy and character surveys (Bulu, 2021; Erlinda, 2020). Children's knowledge of mathematics when they enter school is very important for their future. Mathematics knowledge greatly determines later mathematics and reading abilities, which are very important for children's academic achievement. Numeracy skills are an important predictor of academic achievement, therefore a focus on improving numeracy skills is recommended from early childhood education. Numeracy skills are an important predictor of academic achievement, therefore a focus on improving numeracy skills is recommended from early childhood education (Erlinda, 2020; Fadhliah, 2020).

Numeracy skills have a significant influence on students' pedagogical development, one of which is students' critical thinking skills. A study states that there is a positive relationship between numeracy literacy and critical thinking skills, numeracy literacy and creative thinking skills, as well as critical thinking skills and creative thinking skills. Critical thinking is further explained in conceptual and operational categories. In the conceptual category, critical thinking is the ability to think at a high level, the ability to think rationally and reflectively, the ability to solve problems logically and make sense, the ability to metacognition and self-regulation, the ability to evaluate real world problems to obtain solutions and general cognitive abilities (Chambrier et al., 2020; Firdaus et al., 2022).. Examined further, schools as implementing units need supplemental development of learning tools in implementing the independent learning curriculum. Schools need supplementary learning tools for mathematics subjects in implementing the independent curriculum. This condition is related to the importance of numeracy skills for students. In this case the researcher tried to create additional teaching aids for implementing an independent curriculum for elementary school students, especially in mathematics subjects. The subject is related to students' numeracy skills, therefore there is a need for new learning methods so that students, especially at elementary school level, are able to understand mathematics well. A model is a form of accurate representation in an actual process that allows a person or group of people to try to act based on the object that is used as a guide. Meanwhile, learning is a learning process carried out by students, not made for students. Learning is an educator's effort to help students carry out learning activities. The aim is to obtain efficiency and effectiveness of learning activities carried out by students Cooperative learning is a form of learning where students learn and practice in small groups collaboratively. This group consists of four to six members with heterogeneous membership. Based on motivation theory, a form of reward or appreciation for achieving goals when students carry out learning activities is motivation in cooperative learning (Herwina, 2020; Hudaidah & Ananda, 2021).

Cooperative learning is learning that uses small groups so that optimal cooperation is built in the learning process. The main agenda of cooperative learning (Bulu, 2021; Hudaidah & Ananda, 2021). The aim of cooperative learning is to achieve three goals, namely improving academic learning outcomes, accepting individual differences and developing social skills. There are six characteristics of cooperative learning Group goals, Individual accountability, Equal opportunity to succeed, Team competition, Task specialization And adaptation to individual needs. Assessment, assessment and measurement in this cooperative model are explained by Slavin. Several forms of models such as competition evaluation models, individual evaluation models and cooperative evaluation models. The tools used are almost the same as in general, namely tests, student observation sheets (both individual and group), group communication questionnaires, and files of student work results in portfolios. Cooperative learning has several advantages, including:(Jaelani, 2020; Ke & Grabowski, 2020). The advantages include providing

students with the opportunity to explore questioning skills and dissect a problem. Providing opportunities for students to be more intensive in investigating a case and solving or finding solutions to the case study. Develop discussion skills. Provide space for teachers to understand students in more detail and pay attention to students' intelligence levels. A student-centered approach, learning focuses on student activities so that students are more active in the learning process. Providing opportunities for students to respect and appreciate their friends, as well as respecting other people's opinions. Cooperate with each other to achieve group goals (Jannah & Oktaviani, 2022; Standar & Kurikulum, 2020).

Previous research findings in Classroom Action Research (PTK) learning outcomes showed an increase of 60.99% from the average student learning outcomes before learning. Other similar further research is. The research results show that the Teams Games Tournament (TGT) cooperative learning model can improve students' numeracy skills. Further research related to the Team Games Tournament (TGT) showed an increase in the average numeracy competency of fifth grade students at SDN 3 Durian, Sambas Regency, West Kalimantan. Writing about Cooperative Techniques for Mathematics Learning in Middle Schools in Bangladesh, the results were that experimental group students showed a positive attitude towards learning mathematics with team play tournaments. Meanwhile, other research findings shows findings that the use of the TGT technique is beneficial in learning mathematics. Teamwork is more effective than interpersonal competition in facilitating positive attitudes toward mathematics (Ke & Grabowski, 2020; Standar & Kurikulum, 2020).

The novelty of this research lies in the development of learning tools that are in accordance with the Merdeka Curriculum philosophy, namely student-centered learning with a differentiation approach and linkages to real life contexts. Based on these conditions, the researcher tried to identify the problem in detail with the following results. Elementary schools require supplemental mathematics learning tools in the independent learning curriculum. Innovative and cooperative mathematics learning tools are needed for students. Independent learning tools are needed that are effective and efficient in achieving numeracy (mathematics) literacy learning outcomes. Based on the points in identifying this problem, the researcher organized this research into research and development research. Researchers develop complementary products for teaching tools for implementing an independent curriculum. Furthermore, the aim of this research is to produce a Team Games Tournament type cooperative learning design to improve mathematics learning outcomes. Furthermore, the Team Games Tournament type cooperative learning device implementing the Independent Curriculum was declared valid, practical and effective in improving mathematics learning outcomes.

2. METHOD

This type of research is development. The researcher outlined his ideas about learning tools. The idea is constructed through the stages of identifying problems or analyzing needs. This product was developed through the Plomp development model. Plomp (Pendidikan & Kebudayaan, 2021; Standar & Kurikulum, 2020). Plomp explains that design research is a systematic study of design, development, and evaluation. The Plomp model consists of five stages or 5 stages, namely: initial investigation stage, design stage, realization/construction stage, testing stage, evaluation and revision stage, and implementation stage. The stages in the Plomp model are presented in Figure 1. This research will take place from January 2023 to May 2023. The Validity Test, Practical Test and Effectiveness stages will take place from 10 to 28 April 2023. The stages begin with a validity test from experts on the products and instruments of this research. Next, the products and instruments that have been tested are continued to be tested on students/experimental classes (limited trials). The limited trial will last for 2 weeks to meet the minimum face-to-face product treatment. At meetings 1 and 8 students were given a pretest and posttest. Pretest and posttest are used as reference data in calculating N-Gain for the effectiveness test. Students and teachers were also given questionnaires which were used for practical tests after the posttest. The research was conducted in Cluster VII Sukasada District. The number of students in the population is 168 students. After random sampling. The experimental class is SD Negeri 3 Selat, with a total of 30 students. Meanwhile, the control class is SD Negeri 4 Selat with a total of 26 class 4 students. The data collection instruments in this research consisted of interviews, validation sheets, questionnaires, tests and observations. Interviews were conducted with teachers to collect information regarding obstacles in learning. Validation was carried out to obtain data regarding the validity and practicality of the product learning model being developed. This questionnaire targets students and teachers regarding learning that has been tested. The test is carried out to determine whether there are changes in learning outcomes related to the product being developed. Observations are made when the development product is being tested. This is also done to see the implementation of the product being developed.

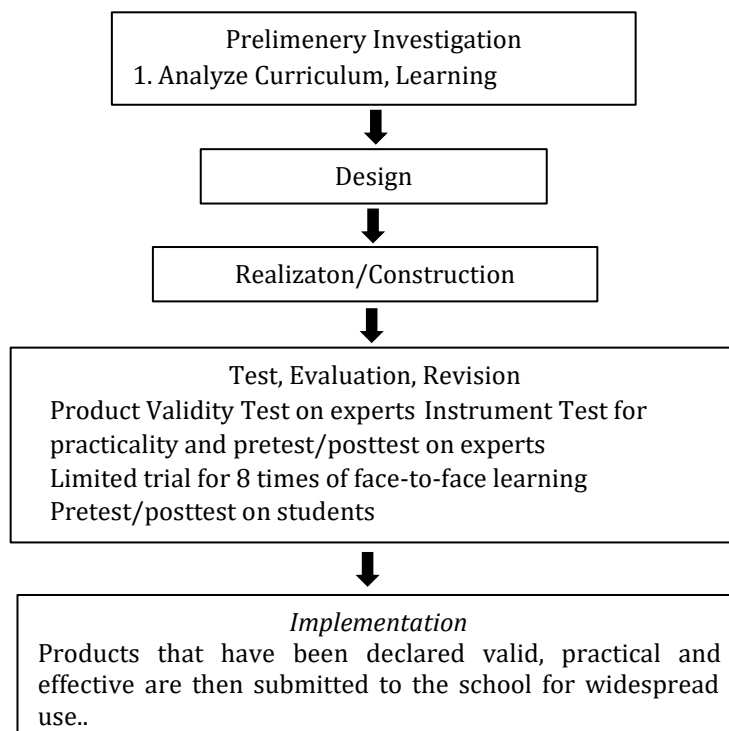


Figure 1. Product Development Flow Adopting the Plomp Development Model

After the data is obtained, the data is then analyzed to answer the problems that have been identified. In this research, the scope of data analysis includes analysis of the validity, practicality and effectiveness of the product being developed. The researcher refers to the instrument adapted (Kurniawan, 2020; Muttaqien et al., 2019). In validity analysis, researchers are assisted by experts to validate the products and instruments used in data collection in this research. In product validation, researchers used the lawhe formulation. Meanwhile, in instrument validation, researchers used the Gregory formula. For practicality, this product was tested using learning implementation observation sheets, student questionnaires and teacher questionnaires. The results of the questionnaire and observation sheet were then tabulated and interpreted. To test the effectiveness of the product, researchers used test data from experimental group students. Researchers compared pretest and posttest scores, also compared the experimental group with the control group. The flow is that researchers test the distribution of data through a normality test and then a homogeneity test. After fulfilling the requirements, the data is continued with the t test and n-gain test.

3. RESULT AND DISCUSSION

Result

Validity of the product developed in the form of teaching tools. The product is tested for validity by 5 judges. 2 lecturers and 3 more teachers. In testing the validity of the product, the Lawse formulation was used. Based on the calculation results of the assessment of 5 experts on the content validity of the product being developed, an average CVR of 0.96 was obtained. In the provisions of the Lawse formula, CVR is interpreted relatively in the range of -1.0 to +1.0. There are no CVR items that have negative values so there are no CVR items that must be removed. The average CVR shows a positive value and is included in the Essential level. This teaching tool can then be said to be practical after being assessed using a learning implementation observation sheet and questionnaires for students and teachers. The results of learning implementation observations are presented in Table 1.

Based on the table that has been presented, it can be seen that the assessment of the criteria for the practicality of implementing learning is based on the percentage of implementation of teaching tools whose products are developed which are classified as good practical and very good criteria. The effectiveness of the teaching tools developed was assessed using a learning outcomes test (posttest). The criteria set are that teaching tools are declared effective if they are able to improve student learning outcomes in the Medium or High N-Gain category. Next, the results of the N-Gain scores for each student in

each class were examined. Based on the diagram presentation, it can be seen that the percentage of N-Gain classified as High is 23%, Medium is 70% and Low is 7%. Thus, it can be said that the teaching tools which are the product of this development are effective. The N-Gain Score obtained for the Experimental Class is presented in Figure 2.

Table 1. Observation Results of Learning Implementation for Practicality Test

Observer	Implementation Percentage	
	Observation I	Observation II
1	80%	100%
2	80%	100%
3	80%	100%
4	80%	100%
Rate-rate category	80% Good	100% Very good

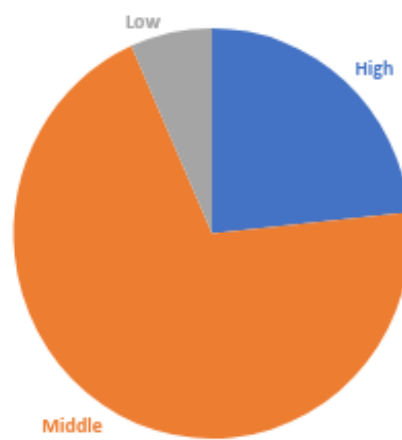


Figure 2. Diagram of obtaining the N-Gain Score for the Experimental Class

Discussion

The product developed is a Mathematics learning device for Stage B Class IV Elementary School. The content of the material used also adapts to the needs and time availability of the school where the research is conducted. The time availability in question is the educational calendar, syllabus and semester program. Adapting to these limitations, the teaching module was arranged in 8 face-to-face meetings. Stage B class IV was chosen because of an analysis of the needs of the research population in implementing the independent curriculum in the Independent Change category. In the independent change phase, the classes that implement the independent curriculum are class 1 phase A and class 4 phase B. The achievements stated in the teaching module in the learning device product being developed refer to the distribution of copies of the Decision Document. Decree of the Head of BSKAP Kemdikbudristek Number 008/H/KR/2022 concerning Learning Outcomes in Early Childhood Education, Basic Education and Secondary Education in the Independent Curriculum. Learning outcomes towards the end of the semester are in the elements of geometry, data analysis and opportunity. The learning device product developed consists of a learning objective flow which contains the reasons for preparing the learning flow and objectives as well as learning outcomes. Other content consists of teaching modules with attached material from each teaching module and assessment instruments. The assessment instrument consists of a grid of pretest-posttest questions, pretest-posttest questions, an attitude assessment sheet and a performance assessment sheet.

In the teaching module section, the researcher tries to create a teaching module that is practical in 1 sheet and complete in providing the required information. Based on this description, valid, practical and effective learning tools are obtained. The contents of the teaching aids consist of a flow of learning objectives, learning outcomes, teaching modules and assessment instruments based on the draft which is the final product. The characteristics of teaching tools are; Develop independent curriculum teaching tools systematically and sequentially, containing elements of teaching tools including title, time allocation, information on models used, development of Pancasila student profiles, learning objectives according to

learning outcomes, and information on assessment methods. The learning steps follow the syntax of the Teams Game Tournament learning model by displaying five learning steps. Learning tools use a cooperative approach. Learning resources in the form of text, videos and images are presented practically. Assessments include assessments of knowledge, attitudes and performance. Then the characteristics of the assessment instrument can be described as follows; The test is prepared based on the HOTS cognitive level. The preparation of the test has referred to Anderson's revised operational verbs. Adjusted to competency, indicators, objectives and material. Students can find out the score obtained.

Based on the assessment of 7 experts, namely 5 material experts and 2 instrument experts, the product expert assessment obtained an average percentage of 96% with a very feasible category, while the expert assessment for the instrument was in the form of pretest, posttest, interview guide, implementation observation sheet. learning, teacher and student response sheets show that all products are in the very feasible or reliable category. This is supported by research related to previous research that the Team Games Tournament model is effective in improving students' mathematical abilities. Based on the description above, it can be said that the Team Games Tournament cooperative learning tool for implementing the independent curriculum for stage B (grade 4) in mathematics learning developed by researchers describes a learning tool that is in accordance with student characteristics, namely a teaching tool that is packaged practically and is able to improve student learning outcomes. .

In developing this product, the researcher used 4 observers to observe the implementation of the learning. Observations were carried out in the experimental class 2 times simultaneously. Namely on May 16 and May 26 2023. On May 16, the average results of measuring and assessing the implementation of the designed program/learning have been implemented at 80%. On May 26, the average assessment results of all observers showed that the learning implementation had been carried out 100%. This means that all learning stages designed by researchers and carried out by the homeroom teacher in the experimental class can be carried out without skipping any stages. The second tool is a teacher and student response questionnaire. Teachers are given response questionnaires as facilitators in the learning process using the products developed. Meanwhile, students are given a response questionnaire to measure and assess the level of practicality of students in following the designed learning. The student response questionnaire was given once to students at the end of treatment of the product developed after taking the posttest. The percentage of student responses was 91.8% in the student response assessment criteria, which was included in the Very Positive category. The percentage of teacher responses of 80% on the teacher response assessment criteria is included in the Positive category. Based on these two measuring instruments and their measurement and assessment results, the product developed can be categorized as practical. This is supported by previous research that the development of the Team Games Tournament model provided a positive response for students and teachers and was able to improve students' abilities in learning Mathematics (Niklas & Scheneider, 2020; Nufitasari, 2019; Nuryadi, 2021).

The effectiveness of the teaching tools developed was assessed using a learning outcomes test (posttest). The criteria set are that teaching tools are declared effective if they are able to improve student learning outcomes in the Medium or High N-Gain category. Before the N-Gain test, the data was processed with SPSS version 17.0 to determine the normality of data distribution, data homogeneity test, t test and then the n-gain test. The t-test results can be seen in the posttest scores, there are differences in posttest scores between the experimental group and the control group. The average of the 26 students who obtained the control class posttest was 67.8. Meanwhile, the posttest average of 30 experimental class students was 80.5. There is a difference in the posttest average of the experimental class and the control class. The average posttest score for the experimental class is greater than the average posttest score for the control class. Based on the N-Gain score calculation, the high category is 23%, medium is 70% and low is 7%. The category is dominating n-gain so it can be said that the product teaching tools developed are effective. The results of the research stated that there was an increase in the learning outcomes of class V students at SDN No. 35 Maccinibaji after implementing the Team Games Tournament model in the learning process. Similar results also explain the increase in mathematics learning outcomes for fourth grade students at SDN No. 75 Malewang after implementing the Team Games Tournament model in that class. The results of product effectiveness tests developed in this research also support the explanations of experts and previous research. This research also supports the argument in the research results which states that the Team Games Tournament is able to increase student involvement/activity in learning activities. Student involvement also improves student understanding and skills (Offirstson & Muhammad Zaenal, 2021; Sakdiah & Ayni Putri Silalahi, 2020).

This learning device can provide improved learning outcomes for students because of the innovation presented in this product. These innovations are also supported by theories and expert statements. The innovation in question is differentiation, students are invited to watch a video before playing. Differentiation in learning refers to an approach designed to meet the needs of different

individuals in the learning process. This includes recognizing that each student has a different learning style, different level of understanding, and different interests. Differentiation allows teachers to teach more effectively by taking these differences into account. Differentiated learning strategies have a positive influence on mathematics learning outcomes. In addition to face-to-face learning, differential learning approaches facilitate motor learning through stochastic resonance processes (Salam et al., 2021; Salsabila et al., 2019; Septiani et al., 2023). The use of video media can also help students learn and improve their learning outcomes in online learning. The next thing that needs to be considered in this product is the implementation stage in the classroom. Teachers need time to prepare this learning tool. This learning requires video references that are appropriate to the learning. practice questions on the worksheet. In-game devices. The devices used include LCDs, projectors and electricity to display videos in learning. Apart from the use of videos, this device involves elements of play in learning. Playing can play an important role in improving learning outcomes, especially in children and even in some cases in adults. The best approach is to combine play with formal learning in a way that combines positive experiences with relevant knowledge and skills. There are many empirical studies that mention improving student learning outcomes, especially in mathematics subjects, through the involvement of play in learning, one of which is research that mentions increasing mathematics learning outcomes for elementary school students through the traditional engklek game (Sumarni & Yuanita, 2021; Watts et al., 2023). Another thing is practice questions through student worksheets. questions in the HOTS-based LKPD. Practicing questions is an effective method for improving student learning outcomes, especially in the context of formal education. Practice questions provide students with the opportunity to master the subject matter better. When working on practice questions, students are often faced with various scenarios and applications of the material studied. Especially in subjects like math and science, working on problems requires good communication skills to explain the problem solving or the process they use. HOTS questions are able to improve numeracy literacy competency to achieve the Drinking Competency Assessment for students (Widyastuti et al., 2020; Yulianto et al., 2022; Zippert & Johnson, 2023).

The implications of this study are to provide a real contribution to improving the quality of mathematics learning in grade 4 with open tools that support the principles of the Independent Curriculum. For teachers, the results of this study can be used as a guide to implement more flexible, differentiated, and activity-based learning that is relevant to the context of students' daily lives. With this teaching tool, teachers will find it easier to design student-centered learning and provide challenges according to their level of understanding and learning needs, so that it is expected to increase students' interest and learning outcomes in mathematics. Theoretically, this study enriches the literature on the development of innovative Independent Curriculum-based teaching tools, while practically, this study supports efforts to disseminate more adaptive and inclusive learning methods. Another implication is to provide a basis for further research that can explore the development of teaching tools in other fields of study or at different levels of education. The limitations of this study include several aspects. First, the teaching tools developed may not be fully applicable in all school contexts due to differences in resources, facilities, and student ability backgrounds in various regions. Second, this study may be limited to a relatively short-term trial, so that the long-term impact of this teaching tool on students' mathematics learning achievement cannot be fully measured. Third, limitations in teacher training to use this teaching tool can affect the effectiveness of its implementation, especially for teachers who are not yet familiar with the differentiated learning approach. Recommendations to overcome these limitations are first, to conduct further trials in various school contexts with different conditions, such as in rural areas or areas with limited facilities, to measure the feasibility and effectiveness of teaching tools in various settings. Second, to conduct further research over a longer period of time to understand the impact of this teaching tool on students' mathematics learning development in depth and sustainably. Third, it is recommended to hold intensive training for teachers so that they are more accustomed and confident in implementing this Independent Curriculum-based teaching tool, so that student-centered learning objectives can be achieved optimally.

4. CONCLUSION

The characteristics of the Mathematics team game tournament model teaching device Stage B are arranged systematically, sequentially and integrated, containing the flow of learning objectives, teaching modules, attachments of materials in the teaching module, attitude assessment sheets and performance assessment sheets. The assessment instrument has been arranged with operational verbs and HOTS, blueprints for pretest/posttest questions, pretest/posttest questions, answer keys for pretest/posttest questions. The teaching device product has been tested by experts and is interpreted as valid which shows a positive value and is included in the Essential level. The assessment of the criteria for the practicality of

the implementation of learning is based on the percentage of the implementation of the teaching device, the product developed is classified as practical with good and very good criteria. Reviewed from the student questionnaire, the assessment criteria for student responses are included in the Very Positive category. Reviewed from the assessment criteria, the teacher's response is included in the Positive category. The teaching device product is declared effective. Thus, it can be said that the teaching device is an effective development product.

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