International Journal of Education, Vocational and Social Science
https://e-journal.citakonsultindo.or.id/index.php/IJEVSS
E-ISSN : 2963 4954
IJEVSS

Interactive Video Based On Differentiated Learning To Improve Counting Skills Of A Student With Mathematics Learning Difficulties In Grade Vii

Baiti
Universitas Negeri Yogyakarta, Indonesia
Sukinah
Universitas Negeri Yogyakarta, Indonesia

Corresponding Author: baiti.2025@student.uny.ac.id

Abstract

Counting skills underpin mathematics learning, yet students with mathematics learning difficulties in inclusive classrooms often struggle with basic operations and tend to be passive when instruction is uniform. This classroom action research aimed to describe how interactive video based on differentiated learning was applied in mathematics instruction and to examine whether it improved the counting skills of a Grade VII student with mathematics learning difficulties. The study followed the Kemmis and McTaggart model in two cycles at SMP Negeri 02 Malinau during the even semester of the 2025/2026 academic year. The subject was CS, one of 15 students, who was identified through initial observation, diagnostic assessment, and teacher recommendations. The action differentiated content, process, and product through interactive video on integer operations, and scaffold cards were added in Cycle II. Data were collected through a counting skill test, observation sheets, and documentation, and were analysed descriptively. The score of CS rose from 74 before the action to 78 in Cycle I and 88 in Cycle II, and the observed engagement increased from 83.33% to 100%. The findings suggest that interactive video with differentiated support can help a student with mathematics learning difficulties count more accurately and participate more actively, although the evidence comes from a single subject.

Keywords: counting skills; differentiated learning; inclusive education; interactive video; learning difficulties

Copyright at authors some right reserved this work is licensed under a Creative Commons Attribution-ShareAlike 4.0 International License

INTRODUCTION

Counting skills are a foundation of mathematics learning because they support logical thinking and the solution of everyday problems (Van de Walle et al., 2019). In practice, however, this basic ability often does not develop optimally, particularly in inclusive classrooms where students differ in ability, learning style, and need for support. Students with mathematics learning difficulties commonly struggle to understand mathematical symbols, remember solution procedures, and apply concepts they have learned (Lerner & Johns, 2015). In junior high school, such difficulties are often reported for integer operations (Fitriani & Pratama, 2023).

Instruction that treats all students in the same way is therefore unlikely to help students with learning difficulties. These students may lose confidence, hesitate when choosing a solution step, and wait for the teacher's direction or copy their peers. Effective mathematics instruction should give every student the opportunity to understand concepts through meaningful experiences that match their needs (National Council of Teachers of Mathematics, 2020). Differentiated learning responds to this need by adjusting the content, process, and product of learning to students' readiness, interests, and learning profiles (Tomlinson, 2017). Studies in Indonesian schools have examined differentiated learning supported by digital resources such as interactive worksheets and animated video (Cahya et al., 2024; Damanik et al., 2025).

The choice of media is equally important. Interactive video can present material visually, aurally, and through simple activities at the same time. This is consistent with multimedia learning theory, which holds that people learn more effectively from words and pictures than from words alone (Mayer, 2009), and with dual coding theory, which explains that verbal and visual information are processed in two cognitive systems that reinforce memory (Paivio, 2014). The effect of instructional video on learning effectiveness has been studied since the early years of e-learning (Zhang et al., 2006), and more recent studies in Indonesia have examined interactive video in junior high school mathematics, for example on learning outcomes, problem solving, and counting skills (Hidayat, 2023; Hidayat, 2024; Putra et al., 2023; Rambe et al., 2024; Siswanti & Agustin, 2024).

Interactive video based on differentiated learning allows the teacher to adjust the difficulty of the material, the speed of presentation, and the form of activity to the needs of the student. Existing studies, however, mostly examine interactive video or differentiated learning separately, and few combine the two for students with mathematics learning difficulties in inclusive classrooms. A class that applies interactive video in project-based learning has also been

Copyright at authors some right reserved this work is licensed under a Creative Commons Attribution-ShareAlike 4.0 International License

reported (Muizah & Khatimah, 2024), but the support needed by a student with persistent counting difficulties has received less attention.

An initial assessment in Grade VII of SMP Negeri 02 Malinau showed that one of the 15 students, identified by the initials CS, had not reached the minimum mastery criterion and showed difficulty in understanding the concept of numbers, determining operation steps, and solving contextual problems. This study therefore aimed to (1) describe how interactive video based on differentiated learning was applied in mathematics instruction for a Grade VII student with mathematics learning difficulties and (2) examine whether the intervention improved the counting skills of the student.

RESEARCH METHODOLOGY

This study used classroom action research (CAR) to improve the learning process and outcomes directly in the classroom. The Kemmis and McTaggart (1988) model was followed, in which each cycle consists of planning, acting, observing, and reflecting. The cycles were repeated until the success indicators were reached (Arikunto, 2018).

The research was conducted at SMP Negeri 02 Malinau, an inclusive junior high school in Malinau Regency, North Kalimantan, during the even semester of the 2025/2026 academic year. The participants were the 15 students of Grade VII who attended mathematics lessons in the same classroom. Based on initial observation, diagnostic assessment, and the recommendations of the mathematics teacher and the special assistant teacher (*guru pendamping khusus*), one student with mathematics learning difficulties, referred to as CS, was determined as the main research subject. CS had mild intellectual barriers and needed more time to understand integer operations.

The action in each cycle comprised four stages. In planning, the researcher prepared a differentiated lesson plan, interactive video, pictorial worksheets, observation instruments, and an end-of-cycle test. In acting, the researcher taught mathematics using the interactive video. In observing, the activities of the teacher and the engagement of CS were recorded on observation sheets. In reflecting, the researcher analysed the test results and observations and decided the improvements for the next cycle. The video presented animated solution steps, visual illustrations, voice narration, and worked examples of integer operations in a graded sequence from easy to difficult. Differentiation was applied to content, process, and product. Cycle I was

Copyright at authors some right reserved this work is licensed under a Creative Commons Attribution-ShareAlike 4.0 International License

carried out on 4 May 2026, and Cycle II was carried out in several sessions after the reflection on Cycle I.

Data were collected through a test, observation, and documentation. The test measured the counting skill of CS in addition, subtraction, multiplication, and division of integers and was scored with a rubric covering fluency, accuracy, and flexibility (Rahman et al., 2024). The observation sheet contained six indicators of learning implementation and student engagement, each scored 1 when achieved and 0 when not yet optimal (Sugiyono, 2019). Documentation in the form of photographs, video, and learning documents complemented the data. The instruments were prepared by considering validity and reliability (Sugiyono, 2019).

The action was considered successful when CS reached the school's minimum mastery criterion (*Kriteria Ketuntasan Minimal*, KKM) of 75, the counting skills in terms of fluency, accuracy, and flexibility improved, and the activity of the student in learning increased (Mulyasa, 2013). Quantitative data were analysed descriptively by calculating the score and the percentage of achievement, which was obtained by dividing the score obtained by the maximum score and multiplying by 100 (Sudjana, 2016). Qualitative data from the observations and documentation were analysed through data reduction, data display, and conclusion drawing (Miles et al., 2014).

RESEARCH RESULTS

Results

Pre-action condition. The pre-action assessment on the concept of numbers, arithmetic operations, and contextual problems showed a class mean of 77.8. As shown in Table 1, 14 of the 15 students (93.33%) reached the KKM of 75, whereas one student (6.67%) did not. This student was CS, who scored 74. Although the gap to the KKM was only one point, observation and diagnostic assessment showed that CS had more complex difficulties than the other students. CS had difficulty understanding the concept of numbers, determining the correct steps of an operation, and solving contextual problems, needed more time to finish tasks, and tended to wait for the teacher's help. Interviews with the mathematics teacher and the special assistant teacher confirmed that these difficulties had appeared consistently in earlier lessons. CS was therefore determined as the main subject.

Copyright at authors some right reserved this work is licensed under a Creative Commons Attribution-ShareAlike 4.0 International License

Table 1. Mastery Result of the Pre-Action Assessment (N = 15)

Category	Number of students	Percentage
Completed (score ≥ 75)	14	93.33%
Not completed (score < 75)	1	6.67%
Total	15	100%

Cycle I. In the planning stage, interactive video on integer operations was prepared for sessions of 10–15 minutes, together with pictorial worksheets that supported the visual understanding of CS, an observation instrument, and an end-of-cycle test. Differentiation of content was applied by dividing the material into small, graded units; differentiation of process by giving flexible working time and the chance to replay the video; and differentiation of product by letting CS choose a set of problems that matched the student's readiness. In the acting stage, the teacher began with a brief apperception to connect the new material to the prior knowledge of CS, and CS then watched the video. While watching, CS was allowed to pause, replay, and slow down the video, and afterwards completed the worksheet and practice problems on addition, subtraction, multiplication, and division of integers.

The observation of Cycle I showed that learning implementation and engagement reached 83.33%, in the good category, with five of six indicators achieved (Table 2). CS was able to follow the video, showed interest in the visual display and narration, and understood the solution steps more easily than in conventional lessons. The indicator that was not yet optimal was active participation, because CS still needed time to adapt and rarely expressed opinions or answered questions.

Copyright at authors some right reserved this work is licensed under a Creative Commons Attribution-ShareAlike 4.0 International License

Table 2. Observation of Learning Implementation and Engagement of CS in Cycles I and II

No.	Indicator	Cycle I	Cycle II
1	The student with mild intellectual barriers can follow the interactive video	1	1
2	The interactive video suits the ability level of the student	1	1
3	The student understands the concept of integer operations through the video	1	1
4	The teacher gives differentiated guidance to the student	1	1
5	The student participates actively in learning	0	1
6	The interactive video helps improve the ability of the student	1	1
	Total score	5	6
	Percentage of achievement	83.33%	100%

The Cycle I test in Table 3 gave CS a score of 78, an increase of four points from the pre-action score of 74. CS correctly solved (−8) + 12 and was able to choose a set of problems that matched the student's readiness, which indicates that the visual representation of integers in the video supported understanding. The lowest score appeared in accuracy and independence (10 of 20), and CS still made computational errors in multiplication and division of integers and gave limited mathematical representations.

Table 3. Counting Skill Test Results of CS in Cycle I

No.	Indicator	Maximum score	Score obtained
1	Determining the result of addition of integers, (−8) + 12	20	20
2	Determining the final temperature after a temperature drop	20	15
3	Comparing two negative integers and giving a reason	20	18
4	Solving differentiated problems according to ability level	20	15
5	Accuracy and independence in doing the task	20	10
	Total	100	78

Copyright at authors some right reserved this work is licensed under a Creative Commons Attribution-ShareAlike 4.0 International License

The reflection of Cycle I identified that the visual presentation and the replay feature supported the pace of CS, but the participation of CS was low and computational errors remained. The analysis of the causes pointed to the internal condition of CS, namely the need for adaptation time and limited confidence, and to the action of the teacher, because the instruction was dominated by cognitive scaffolding for procedural solutions and gave little room for psychological support and independence.

Cycle II. Based on the reflection, the researcher simplified the animation to reduce cognitive load, added more varied examples, clarified the rules of positive and negative signs, and designed graded worksheets that matched the ability of CS. To increase participation, positive reinforcement in the form of instant visual rewards (*token economy*) was combined with interactive question pauses in the video, and scaffold cards were added as visual support for remembering the solution steps. In the acting stage, the teacher began with a structured apperception to activate the prior knowledge of CS about addition and subtraction, gave individualized scaffolding, and provided guided practice with special attention to multiplication and division. During independent work, positive reinforcement was given consistently.

The observation of Cycle II showed that the implementation of learning by the teacher reached 100% in the very good category, and the engagement of CS also reached 100% because all six indicators were achieved (Table 2). The most notable change was in the fifth indicator, active participation, which scored 0 in Cycle I. CS asked questions when facing obstacles, responded to the verbal stimulus of the teacher more confidently, and worked more independently, including using the replay feature to review material that had not yet been understood. The test result in Table 4 shows a score of 88, in the very good category. CS scored 25 of 25 on addition and subtraction, 22 on multiplication and division, 21 on comparison and reasoning, and 20 on independent differentiated problems. Computational errors in multiplication and division decreased, and CS could give reasons for the answers more systematically.

Copyright at authors some right reserved this work is licensed under a Creative Commons Attribution-ShareAlike 4.0 International License

Table 4. Counting Skill Test Results of CS in Cycle II

No.	Test component	Mathematical aspect	Maximum score	Score obtained
1	Addition and subtraction problems	Understanding of basic concepts	25	25
2	Multiplication and division problems	Computational accuracy with integers	25	22
3	Comparison analysis problems	Mathematical reasoning and representation	25	21
4	Independent differentiated problems	Independence and task commitment	25	20
	Total		100	88

Comparison across stages. Table 5 summarizes the learning outcomes of CS. The score increased by four points from the pre-action stage to Cycle I and by ten points from Cycle I to Cycle II, so the total increase was 14 points. The score of 88 was above the KKM of 75, the engagement reached 100%, and the success indicators were therefore met at the end of Cycle II.

Table 5. Comparison of the Learning Outcomes of CS Across Stages

Stage	Score	Category	Increase	Information
Pre-action	74	Fair	–	–
Cycle I	78	Good	+4	Increased
Cycle II	88	Very good	+10	Increased

DISCUSSIONS

The application of interactive video based on differentiated learning created a more flexible and engaging mathematics lesson for CS. Mathematics is abstract, and integer operations require logical thinking, understanding of symbols, and systematic calculation, which is a barrier for students with learning difficulties (Fitriani & Pratama, 2023; Lerner & Johns, 2015). In this study, differentiation was applied through the content (small graded units), the process (flexible time, pause, and replay), and the product (problems chosen by readiness), as proposed by Tomlinson (2017). The video presented animated steps, visual illustrations, and narration, which

Copyright at authors some right reserved this work is licensed under a Creative Commons Attribution-ShareAlike 4.0 International License

is consistent with multimedia learning theory (Mayer, 2009) and dual coding theory (Paivio, 2014). In Cycle I, 83.33% of the observation indicators were achieved and CS followed the video until the end. After the video was simplified and clarified in Cycle II, the implementation reached 100%, which shows that the cycle-based reflection helped the researcher adjust the action to the response of CS.

The counting skills of CS improved from 74 to 78 and then to 88. At the pre-action stage, CS made errors in integer operations that involved negative numbers, which is in line with the difficulties described by Lerner and Johns (2015) and Fitriani and Pratama (2023). In Cycle I, the visual representation helped CS solve (−8) + 12, but accuracy in multiplication and division remained low. In Cycle II, clearer sign rules, varied examples, graded worksheets, scaffold cards, and guided practice were associated with a higher score in all components. The improvement agrees with studies that examined interactive video in junior high school mathematics, including its effect on learning outcomes and on counting skills in terms of fluency, accuracy, and flexibility (Hidayat, 2023; Hidayat, 2024; Putra et al., 2023; Rahman et al., 2024), and with the report that differentiated learning supported by animated video was associated with better mathematics learning outcomes (Damanik et al., 2025).

The improvement of the score was accompanied by a change in the learning behaviour of CS. At the beginning, CS often waited for the help of the teacher, but in Cycle II, CS asked questions, responded confidently, and used the replay feature independently. Student engagement covers behavioural, emotional, and cognitive aspects (Fredricks et al., 2004), and all three appeared to develop in CS: participation in the activities, enthusiasm and confidence, and the effort to understand and reason about answers. Learning success is also influenced by internal factors such as motivation and readiness and by external factors such as media and support from the teacher (Slameto, 2015). In this study, the combination of the video, differentiated tasks, and positive reinforcement may therefore have contributed to the improvement through higher engagement, and not only through the media itself.

Several limitations should be considered. The study involved a single subject with mild intellectual barriers, so the findings cannot be generalized to all students with mathematics learning difficulties. The material was limited to integer operations, the study was conducted in two cycles with a limited number of sessions, and the sustainability of the improvement was not observed. Other factors, such as motivation, physical and psychological condition, family support, and learning outside school, could not be fully controlled. The learning also required devices such

Copyright at authors some right reserved this work is licensed under a Creative Commons Attribution-ShareAlike 4.0 International License

as a laptop, tablet, or projector and a stable power supply. The researcher acted as the implementer and observer, which allows subjectivity even though observation instruments were used. The measurement focused on the cognitive aspect and did not examine mathematical communication, problem solving, or social skills.

CONCLUSION

Conclusion

Interactive video based on differentiated learning was applied through differentiation of content, process, and product, with scaffold cards and positive reinforcement added in Cycle II. The action improved the counting skills of the Grade VII student with mathematics learning difficulties, as the score increased from 74 before the action to 78 in Cycle I and 88 in Cycle II, a total increase of 14 points that surpassed the KKM of 75. The observed engagement also increased from 83.33% to 100%, and the student showed more participation, confidence, and independence in learning.

The findings imply that teachers and special assistant teachers in inclusive schools can use interactive video that the student can pause, replay, and slow down, together with graded tasks and positive reinforcement, as an alternative strategy for students with mathematics learning difficulties. Schools may support this by providing adequate devices and by encouraging collaboration among subject teachers, special assistant teachers, and parents. Further research should involve more subjects, other mathematics topics, and a longer period so that the findings can be generalized, and may also examine affective aspects such as mathematics anxiety.

REFERENCES

Arikunto, S. (2018). *Prosedur penelitian: Suatu pendekatan praktik* (Edisi revisi). Rineka Cipta.

Cahya, I. C., Susanto, S., Safrida, L. N., Yudianto, E., & Wihardjo, E. (2024). Pengembangan E-LKPD interaktif berbasis Liveworksheets dalam pembelajaran berdiferensiasi pada materi limas fase D. *Jurnal Tadris Matematika, 7*(2), 251–268.

Damanik, H. C., Sitepu, A., Sari, D. W., Juliana, J., Dongoran, J., & Silaban, P. J. (2025). Pengaruh pembelajaran berdiferensiasi berbantuan media video animasi terhadap hasil belajar matematika kelas IV. *Pendas: Jurnal Ilmiah Pendidikan Dasar, 10*(3).

Copyright at authors some right reserved this work is licensed under a Creative Commons Attribution-ShareAlike 4.0 International License

Fitriani, A., & Pratama, Y. A. (2023). Analisis kesulitan belajar matematika pada siswa kelas VII SMP: Studi kasus operasi bilangan bulat dan pecahan. *Jurnal Pendidikan Matematika Indonesia, 8*(1), 45–56. https://doi.org/10.26737/jpmi.v8i1.3456

Fredricks, J. A., Blumenfeld, P. C., & Paris, A. H. (2004). School engagement: Potential of the concept, state of the evidence. *Review of Educational Research, 74*(1), 59–109.

Hidayat, A. (2023). Video interaktif dalam pembelajaran matematika: Efektivitas dan implementasinya di sekolah menengah. *Jurnal Inovasi Pembelajaran Matematika, 6*(1), 22–34.

Hidayat, R. (2024). Pengembangan video interaktif berbasis multimedia untuk meningkatkan kemampuan menghitung siswa kesulitan belajar matematika di sekolah inklusif. *Jurnal Inovasi Teknologi Pendidikan, 11*(2), 112–125. https://doi.org/10.21831/jitp.v11i2.58923

Kemmis, S., & McTaggart, R. (1988). *The action research planner* (3rd ed.). Deakin University Press.

Lerner, J. W., & Johns, B. (2015). *Learning disabilities and related disabilities: Strategies for success* (13th ed.). Cengage Learning.

Mayer, R. E. (2009). *Multimedia learning* (2nd ed.). Cambridge University Press.

Miles, M. B., Huberman, A. M., & Saldaña, J. (2014). *Qualitative data analysis: A methods sourcebook* (3rd ed.). Sage Publications.

Muizah, A., & Khatimah, H. (2024). Implementasi model pembelajaran project based learning berbantuan video interaktif pada pembelajaran matematika. *MES: Journal of Mathematics Education and Science, 9*(2).

Mulyasa, E. (2013). *Praktik penelitian tindakan kelas*. Remaja Rosdakarya.

National Council of Teachers of Mathematics. (2020). *Principles to actions: Ensuring mathematical success for all*. National Council of Teachers of Mathematics.

Paivio, A. (2014). *Mind and its evolution: A dual coding theoretical approach*. Psychology Press.

Putra, A., Rahman, M., & Fitriani, L. (2023). Pengaruh video interaktif terhadap hasil belajar matematika siswa SMP. *Jurnal Pendidikan Matematika Indonesia, 8*(1), 45–57.

Rahman, A., Wijaya, T., & Suryani, N. (2024). Efektivitas media video interaktif terhadap fluency, accuracy, dan flexibility dalam kemampuan menghitung matematika siswa SMP. *Journal of Mathematics Education Research, 6*(3), 234–248. https://doi.org/10.31537/jmer.v6i3.4521

Copyright at authors some right reserved this work is licensed under a Creative Commons Attribution-ShareAlike 4.0 International License

Rambe, W. A., Musdi, E., Suherman, S., & Asmar, A. (2024). Pengembangan video interaktif menggunakan model contextual teaching and learning untuk meningkatkan kemampuan pemecahan masalah matematis. *AKSIOMA: Jurnal Program Studi Pendidikan Matematika, 13*(2).

Siswanti, F. E., & Agustin, R. D. (2024). Pengembangan video interaktif pada pembelajaran matematika materi SPLDV. *Jurnal Ilmiah Matematika Realistik, 6*(1).

Slameto. (2015). *Belajar dan faktor-faktor yang mempengaruhinya*. Rineka Cipta.

Sudjana, N. (2016). *Metoda statistika*. Tarsito.

Sugiyono. (2019). *Metode penelitian pendidikan: Pendekatan kuantitatif, kualitatif, dan R&D*. Alfabeta.

Tomlinson, C. A. (2017). *How to differentiate instruction in academically diverse classrooms* (3rd ed.). ASCD.

Van de Walle, J. A., Karp, K. S., & Bay-Williams, J. M. (2019). *Elementary and middle school mathematics: Teaching developmentally* (10th ed.). Pearson.

Zhang, D., Zhou, L., Briggs, R. O., & Nunamaker, J. F. (2006). Instructional video in e-learning: Assessing the impact of interactive video on learning effectiveness. *Information & Management, 43*(1), 15–27.

Copyright at authors some right reserved this work is licensed under a Creative Commons Attribution-ShareAlike 4.0 International License