ASEAN Journal of Community and Special Needs Education

Journal homepage: https://ejournal.bumipublikasinusantara.id/index.php/ajcsne

# Gamification-Based Learning for Student Engagement in Vocational Education: Preliminary Evidence and Implications for Inclusive Education

*Alviana Mahbubah[1], Abdilla Althaaf[1], Insyah Ratna Sulistyorini[2], Setia Rahmawan[1,*]*

[1]Universitas Islam Negeri Sunan Kalijaga, Indonesia
[2]SMK Perindustrian Yogyakarta, Indonesia
Correspondence: E-mail: setia.rahmawan@uin-suka.ac.id

**ABSTRACT**

This study examined the implementation of gamification in learning grinding and sizing at an industrial vocational high school and explored its implications for inclusive education. A quantitative descriptive approach was employed with eleventh-grade students. Data were collected using observation sheets and questionnaires and analyzed using percentages and averages. The findings showed changes in student engagement across the learning cycles, particularly in attention, participation, interaction, collaboration, and interest. However, students' willingness to ask questions varied across the cycles, and questionnaire responses did not show the same pattern as observational engagement. Gamification can provide an interactive structure for vocational learning, although different dimensions of student engagement may respond differently to its implementation. From an inclusive-education perspective, the approach provides preliminary evidence that can inform future development of accessible gamification for learners with diverse educational needs. Further studies involving students with disabilities and appropriate accessibility adaptations are required before its effectiveness in special needs education can be established.

**ARTICLE INFO**

***Article History:***
*Submitted/Received 02 June 2026*
*First Revised 29 Jul 2026*
*Accepted 22 Aug 2026*
*First Available online 23 Aug 2026*
*Publication Date 01 Mar 2027*

***Keywords:***
*Gamification;*
*Inclusive education;*
*Special needs education;*
*Student engagement;*
*Vocational education.*

## 1. INTRODUCTION

Vocational education prepares students to acquire knowledge and practical competencies relevant to specific occupations and industrial environments [1]. Effective vocational learning therefore requires students not only to receive theoretical information but also to participate actively in demonstrations, discussions, and practical activities. Student engagement is particularly important because vocational learning frequently combines conceptual understanding with the performance of practical tasks. Student engagement can be reflected through attention, participation, interaction, questioning, collaboration, and involvement in learning activities. Active participation has been associated with the learning process and learning outcomes [2, 3]. However, conventional teacher-centered instruction can provide limited opportunities for students to interact and participate actively [4]. This challenge is particularly relevant when students are expected to understand technical processes through both classroom explanation and practical activities.

Grinding and sizing are technical topics taught in industrial vocational education. Their learning involves understanding processes while following demonstrations and participating in practical activities. Therefore, an instructional approach that encourages students to maintain attention, interact, participate, and collaborate may support engagement with this technical content. Gamification provides one possible approach. In educational settings, gamification incorporates game-related elements and activities into learning to encourage participation and motivation. Previous studies in vocational education have reported the use of gamification to support learning activity and motivation [5, 6]. Gamification can provide challenges, interactive activities, and structured participation that differ from conventional teacher-centered learning [7-10]. An additional consideration is that students do not necessarily engage with the same instructional approach in the same way. Differences in attention, confidence, communication, participation, and interaction may result in different engagement patterns. This variation is particularly relevant to inclusive and special needs education, where instructional activities should provide multiple ways for learners to access information, participate in learning, and demonstrate engagement.

Accessibility becomes an additional consideration when gamification is extended to students with special educational needs. This is particularly relevant for students with visual impairment because gamified activities may rely on visual instructions, icons, colors, screen-based information, or visual indicators of progress. Such dependence may create barriers unless equivalent information and interaction are provided through accessible alternatives. Thus, the potential use of gamification in special needs education requires consideration of how its instructional and game-related components can be adapted for non-visual access. However, gamification cannot be assumed to be equally accessible to learners with different educational needs. Identifying responsive and challenging dimensions of engagement can provide a preliminary basis for developing and evaluating accessible gamification in special needs education.

This study aimed to examine student engagement during the implementation of gamification in grinding and sizing learning at an industrial vocational high school. The study analyzed engagement patterns across successive learning cycles and student responses to the gamified learning process. The study further discusses implications for accessible gamification in inclusive and special needs vocational education, particularly potential adaptations for students with visual impairment. Because the participants were not identified as students

with disabilities, these adaptations are presented as conceptual directions for future research.

## 2. LITERATURE REVIEW

### 2.1. Student Engagement in Vocational Education

Student engagement involves cognitive and behavioral participation in classroom and practical activities. Observable engagement can include attention, answering and asking questions, participation, interaction, collaboration, and involvement in practical learning. In vocational education, engagement is particularly relevant because students are expected to connect theoretical understanding with occupational and practical competencies [1]. Previous studies have associated learning activity with student learning processes and outcomes [2, 3]. Conversely, learning dominated by teacher-centered instruction may restrict opportunities for students to participate [4]. This provides a rationale for exploring instructional approaches that can increase opportunities for active involvement.

### 2.2. Gamification and Student Engagement

Gamification introduces game-related features into educational activities to support engagement and participation [8]. Previous research has also examined students' awareness and adoption of gamification for learning [7]. In learning, its purpose is not simply to turn lessons into games but to structure activities in ways that encourage attention, motivation, participation, and interaction. Gamification has been applied in vocational educational contexts. Gamification-assisted learning has been reported as an approach for supporting learning activity, motivation, and learning outcomes [5]. More recent implementation in vocational-school learning has similarly examined gamification as a means of improving motivation and learning outcomes [6]. Gamification can restructure student participation by providing challenges and interactive opportunities for engagement. Because engagement is multidimensional, improvement in one indicator does not necessarily imply improvement in others. Therefore, the effects of the learning process should be interpreted from the pattern across indicators rather than from a single generalized statement that students became "more active."

### 2.3. Gamification and Diverse Learning Needs

Learners may respond differently to the same instructional strategy because of variations in interest, confidence, communication, understanding, and adaptation; inclusive education should accommodate these differences. From this perspective, gamification has potential relevance to inclusive learning because it can provide different forms of participation and interaction. Nevertheless, the presence of game elements alone does not make an instructional activity inclusive. Accessibility depends on how information, instructions, challenges, feedback, and interaction mechanisms are presented. This consideration becomes particularly important for students with sensory disabilities. For example, a gamification activity that communicates essential information exclusively through visual elements could create barriers for students with visual impairment. Future adaptation could therefore consider non-visual modes of interaction, such as accessible verbal instructions, audio feedback, tactile learning materials, and other mechanisms appropriate to the needs of the target learners. These adaptations represent future design considerations and were not evaluated with students with disabilities in the present study.

### 2.4. Grinding and Sizing as a Context for Interactive Vocational Learning

Grinding and sizing provide a relevant context for examining engagement because learning involves technical content together with demonstrations and practical activities. The research observed students during learning and practical sessions and evaluated their attention, questioning, participation, interaction, collaboration, and related engagement behaviors. Gamification in this context can therefore be examined not merely in terms of students' enjoyment but through observable participation during vocational learning. This is important because an instructional approach intended for vocational education should support engagement with the learning process rather than operate as an activity detached from the technical content. The study connects gamification, student engagement, and vocational learning while considering special needs education as a future extension.

## 3. METHOD

This study employed a quantitative descriptive approach to examine student engagement during gamification-based learning. The collected data consisted of numerical scores obtained through observations and questionnaires and were subsequently analyzed using percentages and averages. The implementation was examined across successive learning cycles. Student engagement was observed during each cycle to identify changes in engagement indicators throughout the learning process. The participants were seven Grade 11 students at an industrial vocational high school who participated in learning activities on grinding and sizing. Two instruments were used: observation sheets and questionnaires. The observation sheets were used to assess student engagement during the learning process, including learning activity, willingness to ask questions, participation, and engagement during demonstrations and practical activities. The questionnaire was used to obtain students' responses to the implementation of gamification in grinding and sizing learning. Using these two sources of information made it possible to distinguish between observed engagement during learning activities and students' questionnaire responses. These measures were not treated as interchangeable because they represent different dimensions of students' responses to the learning process. Data were collected through observation and questionnaire administration during the learning process. Observations were conducted to document student engagement during grinding and sizing activities, while questionnaires were administered to determine student responses to gamification-based learning. Observations were conducted across the learning cycles. The resulting data were used to examine changes in engagement indicators from one cycle to another. The observation and questionnaire data were analyzed descriptively using percentages and averages with Microsoft Excel. The percentage was calculated using $P = \frac{f}{N} \times 100$, where $P$ is the percentage, $f$ is the total score obtained, and $N$ is the maximum possible score. The average was calculated using $\bar{x} = \frac{\sum x}{N}$, where (\bar{x}) is the average, (\sum x) is the total score, and (N) is the number of students. The results were then organized according to questionnaire responses and student-engagement indicators across the learning cycles.

## 4. RESULTS AND DISCUSSION

### 4.1. Student Responses before and after Gamification

The questionnaire data provide information about students' responses to the learning process before and after the implementation of gamification. The questionnaire results are summarized in **Table 1** to allow more direct comparison. The questionnaire response rate

decreased after gamification was implemented. The response value declined from 85.43% before implementation to 72.76% afterward.

**Table 1.** Student questionnaire responses before and after gamification.

| ASSESSMENT CONDITION | STUDENT RESPONSE (%) |
|---|---|
| Before gamification | 85.43 |
| After gamification | 72.76 |

This result is important because it prevents the findings from being interpreted too simplistically. Gamification did not produce improvement across every measured outcome. The questionnaire responses declined, whereas classroom observations showed stronger engagement in several dimensions across the learning cycles. Therefore, questionnaire responses and observed engagement should be treated as different measures rather than combined into one general conclusion. Differences in learning interest, understanding, and adaptation to a new instructional approach may have contributed to the questionnaire pattern. Some students may require more time to become familiar with the rules and activities introduced through gamification. However, because these explanations were not independently tested, they should be interpreted as possible explanations rather than demonstrated causal factors. This distinction is also relevant to inclusive education. Students may respond differently to the same instructional design, and an approach that increases observable participation may not necessarily produce uniformly positive subjective responses. Inclusive instructional design should therefore consider variation in student preferences, confidence, familiarity, and interaction with learning activities.

### 4.2. Student Engagement in Cycle I

Student engagement during Cycle I was evaluated using several observable indicators (**Table 2**). Student attention and interest obtained the highest values in Cycle I, both reaching 85%. Enthusiasm reached 80%, while learning focus, participation, discipline, and collaboration each reached 75%. Answering questions and interaction were slightly lower at 70%. The most prominent weakness was asking questions, which reached only 45%. Students were able to remain attentive and interested during gamification-based learning, but this did not automatically translate into confidence in asking questions. This is an important distinction because student engagement consists of several behaviors that may develop differently.

**Table 2.** Student engagement indicators in Cycle I.

| NO | ENGAGEMENT INDICATOR | PERCENTAGE (%) |
|---|---|---|
| 1 | Student attention | 85 |
| 2 | Learning focus | 75 |
| 3 | Answering questions | 70 |
| 4 | Asking questions | 45 |
| 5 | Participation | 75 |
| 6 | Interaction | 70 |
| 7 | Enthusiasm | 80 |
| 8 | Discipline | 75 |
| 9 | Collaboration | 75 |
| 10 | Interest | 85 |

The relatively high levels of attention, interest, participation, and enthusiasm are consistent with previous studies. Gamification can support learning activity and motivation [5, 6]. However, the low questioning value suggests that game-related activities alone may not remove communication barriers. Students can be interested in an activity while still feeling reluctant to formulate or express questions.

For vocational education, this distinction is particularly relevant because engagement should involve both participation in activities and communication about technical understanding. In grinding and sizing learning, students may need to ask for clarification during demonstrations or practical work. Therefore, improving questioning behavior should remain an instructional priority even when other engagement indicators are already relatively strong.

### 4.3. Student Engagement in Cycle II

**Table 3** shows that student interest reached the highest value in Cycle II at 90%. Student attention and enthusiasm each reached 85%, while several other indicators remained between 70 and 75%. In contrast, asking questions decreased from 45% in Cycle I to 35% in Cycle II. Gamification continued to attract students' attention to the learning activities. Nevertheless, the further decline in asking questions demonstrates that increased interest should not be interpreted as improvement in every form of engagement. This is one of the more useful findings of the study. A single overall engagement score could conceal substantial differences among indicators. Students may display enthusiasm, attention, and participation while remaining reluctant to initiate verbal interaction through questions. Thus, evaluation of gamification should examine individual engagement dimensions rather than rely only on a total score. The findings also illustrate why instructional adaptation across learning cycles can be important. If questioning remains weak, teachers can modify learning activities to provide explicit opportunities for questions, use smaller discussion groups, or integrate structured prompts. Such strategies were not independently evaluated in the present study, but the pattern in **Table 3** indicates an area requiring further instructional attention.

**Table 3.** Student engagement indicators in Cycle II.

| NO | ENGAGEMENT INDICATOR | PERCENTAGE (%) |
|---|---|---|
| 1 | Student attention | 85 |
| 2 | Learning focus | 75 |
| 3 | Answering questions | 70 |
| 4 | Asking questions | 35 |
| 5 | Participation | 75 |
| 6 | Interaction | 70 |
| 7 | Enthusiasm | 85 |
| 8 | Discipline | 75 |
| 9 | Interest | 90 |
| 10 | Accuracy | 75 |

From an inclusive-learning perspective, the variability among indicators is also important. Learners may participate through different modes. Some may demonstrate engagement through attention and practical participation rather than verbal questioning. Consequently, future inclusive gamification should provide multiple ways for learners to participate rather than requiring a single form of response.

### 4.4. Student Engagement in Cycle III

Cycle III displayed stronger engagement in several dimensions (**Table 4**). Interaction, interest, and enthusiasm each reached 90%, while attention, practical participation, and group collaboration reached 85%. Asking questions increased to 60%, representing an improvement compared with the corresponding values in the preceding cycles.

**Table 4.** Student engagement indicators in Cycle III.

| NO | ENGAGEMENT INDICATOR | PERCENTAGE (%) |
|---|---|---|
| 1 | Attention | 85 |
| 2 | Practical readiness | 75 |
| 3 | Asking questions | 60 |
| 4 | Practical participation | 85 |
| 5 | Accuracy | 75 |
| 6 | Group collaboration | 85 |
| 7 | Interaction | 90 |
| 8 | Discipline | 75 |
| 9 | Interest | 90 |
| 10 | Enthusiasm | 90 |

The increase in asking questions is particularly notable because this indicator had been the weakest area in Cycles I and II. The progression from 45% in Cycle I to 35% in Cycle II and then 60% in Cycle III demonstrates that engagement did not improve in a simple linear pattern. Instead, this indicator initially declined before increasing substantially in the final cycle. The strong values for interaction and collaboration suggest that students became increasingly involved in the social aspects of learning. In vocational education, such involvement is relevant because practical tasks frequently require students to observe demonstrations, coordinate activities, communicate, and work with peers. The results also support a more cautious interpretation of gamification. Rather than claiming that gamification immediately improved every aspect of engagement, student responses evolved over repeated learning cycles. Student engagement developed differently across the observed dimensions and learning cycles. Gamification can contribute to learning activity and motivation [5, 6]. The present findings add a more detailed perspective by showing that different components of engagement may respond at different rates.

### 4.5. Comparison across Learning Cycles

**Table 5** summarizes the principal patterns of student engagement across the three learning cycles. Engagement did not increase uniformly across all indicators. Cycle I showed relatively high attention and interest but limited questioning; Cycle II showed increased interest accompanied by lower questioning; and Cycle III demonstrated stronger interaction, interest, enthusiasm, and questioning. The three cycles show a changing engagement pattern rather than a uniform increase across all indicators. Cycle I demonstrated high attention and interest but limited questioning. Cycle II showed the highest interest observed at that point, while questioning declined further. Cycle III showed stronger interaction, interest, and enthusiasm, together with an improvement in asking questions.

**Table 5.** Comparison of the principal student engagement findings across learning cycles.

| CYCLE | STRONGEST OBSERVED ENGAGEMENT | ASKING QUESTIONS | MAIN INTERPRETATION |
|---|---|---|---|
| Cycle I | Attention and interest (85%) | 45% | Students showed relatively strong attention and interest, but questioning remained limited. |
| Cycle II | Interest (90%) | 35% | Interest increased, but willingness to ask questions declined. |
| Cycle III | Interaction, interest, and enthusiasm (90%) | 60% | Engagement became stronger across several indicators and questioning improved. |

The effectiveness of gamification should not be judged from a single engagement dimension. The strongest result appears in the later cycle, where several forms of engagement were simultaneously high. Nevertheless, the questionnaire results in **Table 1** remain lower after gamification than before it. Thus, observational and questionnaire data provide different perspectives on student responses. This discrepancy does not necessarily mean that one instrument is incorrect. Observation captures visible behavior during learning activities, whereas questionnaires capture students' reported responses. A learner may participate actively during an activity while still reporting reservations about the instructional approach. Therefore, the two forms of data should be interpreted as complementary rather than interchangeable.

### 4.6. Implications for Special Needs and Accessible Vocational Education

An important implication of the present findings is that student engagement did not develop uniformly across all dimensions. Attention, interaction, questioning, collaboration, and subjective responses showed different patterns across the learning cycles. This variation is relevant to inclusive and special needs education because learners may require different modes of participation, communication, and access to instructional activities. Gamification can support participation through challenges, interaction, feedback, and structured learning activities. However, gamification cannot automatically be considered inclusive when access depends predominantly on visual interfaces, written instructions, color coding, icons, or screen-based progress indicators. Such features may create barriers for students with visual impairment and other learners who require alternative modes of accessing instructional information. For students with visual impairment, future gamification-based vocational learning could be adapted through spoken instructions, auditory feedback, tactile learning supports, keyboard-compatible interaction, and non-visual representations of progress. In practical vocational activities, instructions and game-related tasks could also be provided through multiple formats. Thus, participation does not depend exclusively on visual information. These adaptations may be particularly relevant to learning grinding and sizing because vocational instruction combines conceptual explanation, demonstration, communication, and practical participation.

To clarify the potential direction for inclusive development, the proposed adaptations are summarized in **Table 6**. The participants in the present study were not identified as students with visual impairment or other disabilities. Therefore, the findings demonstrate engagement patterns only within the original vocational-school participants and do not establish the accessibility or effectiveness of the proposed adaptations for students with special educational needs.

**Table 6.** Potential adaptations of gamification for students with visual impairment in vocational education.

| POTENTIAL BARRIER | POSSIBLE ACCESSIBLE ADAPTATION | INTENDED LEARNING SUPPORT |
|---|---|---|
| Visual instructions | Spoken or audio instructions | Access to task directions without relying on visual information |
| Visual feedback | Auditory feedback | Immediate recognition of progress and task completion |
| Screen-based game indicators | Screen-reader-compatible or non-visual progress indicators | Independent monitoring of game progress |
| Visual diagrams or demonstrations | Verbal description and tactile learning materials | Support for understanding technical processes |
| Mouse-dependent interaction | Keyboard-compatible navigation | More accessible interaction with digital activities |
| Visually presented group tasks | Verbal and collaborative task formats | Participation in teamwork and discussion |
| Visual scoring or rewards | Audio or text-to-speech feedback | Accessible recognition and motivation |

Future research should directly involve students with visual impairment and other learners with special educational needs. Such studies should evaluate not only student engagement but also accessibility, usability, learning performance, independence, and participation in practical vocational activities. This progression would allow the preliminary findings from the present study to support the development of gamification that is not only interactive but also genuinely accessible within special needs and inclusive vocational education.

### 4.7. Limitations

Several limitations should be considered:

(i) The study involved only seven students. The findings therefore describe a small vocational-learning context and should not be generalized broadly.

(ii) The research used a quantitative descriptive approach without a comparison group. Changes across learning cycles therefore cannot be attributed exclusively to gamification.

(iii) Questionnaire responses decreased after gamification even though several observational engagement indicators improved. These two forms of evidence should therefore be interpreted as complementary rather than as uniformly positive outcomes.

(iv) The participants were not identified as students with disabilities. Consequently, the special-needs implications and accessibility adaptations proposed in **Table 6** remain conceptual directions for future research and require direct evaluation with the intended learners.

## 5. CONCLUSION

This study examined gamification-based learning for student engagement in grinding and sizing within vocational education. Observational results showed relatively strong attention, participation, interaction, collaboration, and interest, particularly during the final learning cycle, although willingness to ask questions varied across cycles. Questionnaire responses decreased after gamification. Observed engagement and student-reported responses did not

follow identical patterns. Gamification therefore offers a potentially useful structure for interactive vocational learning, but its effects should be interpreted across multiple engagement dimensions. Future research should adapt and directly evaluate accessible gamification with students with disabilities before its effectiveness in special needs education is established.

## 6. AUTHORS' NOTE

The authors declare that there is no conflict of interest regarding the publication of this article. The authors confirmed that the paper was free of plagiarism.

## 7. REFERENCES

[1] Hanafi, I. (2012). Re-orientasi keterampilan kerja lulusan pendidikan kejuruan. *Jurnal Pendidikan Vokasi, 2*(1), 107-116.

[2] Muryani, D. (2021). Hubungan keaktifan belajar dengan konsep diri siswa Madrasah Ibtidaiyah. *JENIUS (Journal of Education Policy and Elementary Education Issues), 2*(2), 80-88.

[3] Rohmah, N. W., & Hermawan, D. (2025). Pengaruh keaktifan belajar terhadap hasil belajar siswa Madrasah Tsanawiyah. *Inspirasi Dunia: Jurnal Riset Pendidikan Dan Bahasa*, *4*(1), 159-173.

[4] Nurbani, N., and Sofyan, H. (2015). Efektivitas metode pembelajaran quiz team pada matakuliah logika komputer ditinjau dari motivasi belajar mahasiswa. *Jurnal Pendidikan Vokasi, 5*(2), 261-272.

[5] Wardana, S., and Sagoro, E. M. (2019). Implementasi gamifikasi berbantu media Kahoot untuk meningkatkan aktivitas belajar, motivasi belajar, dan hasil belajar jurnal penyesuaian siswa kelas X Akuntansi 3 di SMK Koperasi Yogyakarta tahun ajaran 2018/2019. *Jurnal Pendidikan Akuntansi Indonesia, 17*(2), 46-57.

[6] Fitrianingrum, D., and Kholis, N. (2025). Implementasi gamifikasi untuk meningkatkan motivasi dan hasil belajar pada mata pelajaran dasar program keahlian ketenagalistrikan di SMK Negeri 2 Yogyakarta. *Journal of Electrical Engineering and Education (JEEE), 1*(1), 116-130.

[7] Ekunola, G. T., Babalola, E. O., Omolafe, E. V., and Ibrahim, A. T. (2022). Undergraduate students' awareness to adopt gamification for learning in University of Ilorin, Nigeria. *ASEAN Journal for Science Education*, *1*(1), 17-22.

[8] Toshmuradovna, S. I. (2026). Developing students' English language competence through gamification: Definition, digital tools, and a literature review from a community service perspective. *ASEAN Journal of Community Service and Education*, *5*(2), 143-152.

[9] Ayustyaningtias, R., Alinurdin, E., and Wahyudin, A. (2025). Improving students' critical thinking through blended learning media learning game word wall. *ASEAN Journal of Educational Research and Technology*, *4*(1), 51-58.

[10] Abdulmuhsin, I., Bolaji, H. O., and Bello, A. S. (2026). Chemistry educators' readiness and intentions to integrate game-based software: A survey. *ASEAN Journal for Science Education, 5*(1), 1-12.