



AGRICULTURAL AWARENESS EDUCATION FOR STUDENTS WITH MILD INTELLECTUAL DISABILITIES: AN ACTIVITY-BASED APPROACH

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Abstract

This study aimed to examine the effects of an activity-based agricultural awareness education program on the agricultural awareness of middle school students with mild intellectual disabilities (MID). The study was conducted using a convergent mixed-methods design embedded within a design-based research framework. Ten agricultural activities were developed and implemented over 25 teaching hours with 12 students aged 11 to 15. The program integrated direct teaching, video-based modeling, hands-on tasks, systematic reinforcement, and peer interaction to support conceptual learning and social participation. Data were collected through the MID Agricultural Awareness Test and semi-structured interviews with students and teachers. Quantitative results showed a statistically significant increase in students' agricultural awareness from pretest ($M = 15.75$, $SD = 2.86$) to posttest ($M = 18.41$, $SD = 1.56$), $t(11) = 4.804$, $p = .003$. Qualitative results indicated that students developed practical knowledge about soil, plants, harvesting, and food preparation, while teachers reported increased engagement, cooperation, environmental awareness, and peer interaction during the program. These results should be interpreted cautiously because the study used a small sample and a single-group pretest–posttest design. The results provide preliminary evidence that activity-based agricultural awareness education may help connect science-related content with real-life experiences for students with MID.

Keywords: agricultural awareness; activity-based learning; special education; experiential learning; mild intellectual disability.

Introduction

According to data from the European Commission (EC), between 1 percent and 3 percent of the world's population is affected by intellectual disability. More recent global estimates indicate that approximately 107.6 million people, corresponding to 1.74 percent of the world population, live with intellectual disability according to the Global Burden of Disease (GBD) study (GBD, 2020; Nair et al., 2022; Yang et al., 2024). Intellectual disability is classified into different levels of severity, one of which is mild intellectual disability (MID) (Maulik et al., 2011; Schalock and Luckasson, 2015).

MID is characterized by significant limitations in both intellectual functioning, including reasoning and problem solving, and adaptive behavior, including daily living and social skills, as defined by the American Psychiatric Association (APA) (APA, 2013). For this reason, individuals with MID require systematic support not only for cognitive development but also for social participation and social development (Wang et al., 2024).

Academic knowledge that is closely connected to everyday life plays a crucial role in supporting social development (Durlak et al., 2011). Social skills refer to behaviors that individuals frequently encounter in their environment and that enable meaningful participation in social life when acquired (Christ et al., 2017). Being informed about work-related skills and everyday activities in one's immediate environment enhances individuals' opportunities for social inclusion and community participation (Khoronzhevych et al., 2021). Accordingly, well-designed instructional activities can increase both the social acceptance and social participation of students with MID.

The region in which this study was conducted is well known in Türkiye for its agricultural production. Increasing students' awareness of agricultural production and agricultural products can therefore provide meaningful opportunities for students with MID to engage with their social environment and to acquire practical life knowledge that supports independent living, as emphasized by the American Association on Intellectual and Developmental Disabilities (AAIDD) (AAIDD, 2016). Moreover, agricultural awareness can create opportunities for career exploration among individuals with MID (Norris et al., 2025). Previous research emphasizes the importance of introducing agricultural education from the primary school level onward (Knobloch and Martin, 2002). However, lower-secondary textbooks contain only limited information about agricultural topics (Haşlıoğlu et al., 2011), and they rarely provide detailed explanations of how region-specific crops are grown, harvested, and used as products. Given this gap, it is important to examine the effects of specially designed agricultural activities on the agricultural awareness of students with MID.

Literature Review

Although research on science education for students with disabilities has increased, studies focusing specifically on science education for students with MID remain limited (Villanueva et al., 2012; Özgüç & Cavkaytar, 2015). Contemporary science education is typically book-centered and teacher-led, relying heavily on verbal explanations and visual representations of scientific concepts (Kızılaslan et al., 2020). However, there is still insufficient empirical evidence regarding which instructional approaches are most effective for teaching science content to students with MID (Apanasionok et al., 2019).

Existing research suggests that students with MID benefit most from structured, explicit, and multimodal instructional approaches. Peer-mediated interventions have been shown to improve both social and behavioral outcomes for learners with intellectual disabilities (Bowman-Perrott et al., 2021). Direct instruction has also been identified as a highly effective method for this population, particularly for acquiring functional and academic skills (Dessemontet et al., 2019; Eratay, 2020). In addition, video-based education has been found to be especially beneficial for students with MID, as it provides visual modeling, repetition, and opportunities for independent practice (Schroeder, 2023). Reinforcement strategies further enhance learning, with multiple studies demonstrating their positive effects on engagement, skill acquisition, and task persistence among students with MID (Matson & Boisjoli, 2009; Mirzamani et al., 2011; Johnson, 2018). Collectively, these results indicate that combining direct instruction, video modeling, reinforcement, and peer support creates an optimal learning environment for students with MID.

Agricultural sciences, as a subfield of science education, offer particularly rich opportunities for experiential and functional learning. A growing body of research indicates that agricultural and horticultural activities can support not only skill development but also emotional and social functioning in individuals with MID. For example, Joy et al. (2020) demonstrated that an eight-week succulent cultivation program led to significant improvements in emotional behavior, fine motor skills, and social skills among participants with MID. Similarly, Ulugöl

and Eratay (2020) showed that video modeling was highly effective in teaching seedling cultivation skills to students with MID, highlighting the value of visual and procedural support in agricultural instruction.

Evidence from broader farming-based interventions further supports the social and psychological benefits of agricultural activities for individuals with intellectual disabilities. A systematic review by Iancu et al. (2014) found that team-based agricultural practices had a meaningful positive impact on mental well-being, although the authors emphasized the need for additional research to clarify their social and vocational outcomes. More recently, Son et al. (2022) reported that horticultural programs improved work behaviors, adaptive functioning, and fine motor skills, while also strengthening social relationships among participants with intellectual disabilities.

Despite these promising results, most existing studies focus on upper-secondary or adult populations, leaving middle school students with MID largely underrepresented in the literature. This gap is particularly important given that, according to Piaget (1954), the transition toward formal operational thinking provides a critical window for introducing abstract concepts such as germination and plant growth. Therefore, there is a clear need for developmentally appropriate, activity-based agricultural instruction designed specifically for middle school students with MID.

Based on this gap, the problem addressed in the present study is the limited availability of developmentally appropriate, activity-based agricultural awareness education programs designed specifically for middle school students with mild intellectual disabilities. Therefore, this study aimed to examine the effect of an activity-based agricultural awareness education program on the agricultural awareness of middle school students with mild intellectual disabilities and to explore students' experiences during the implementation process. Accordingly, the study was guided by the following research questions:

1. Does the activity-based agricultural awareness education program significantly improve the agricultural awareness levels of middle school students with mild intellectual disabilities?
2. How do students with mild intellectual disabilities experience the activity-based agricultural awareness education program?
3. What changes are observed in students' engagement, cooperation, social communication, and environmental awareness during the implementation process?

Research Methodology

Design

This study employed a convergent mixed-methods design embedded within a design-based research (DBR) framework. This methodological combination was selected because the study involved both the development and the evaluation of an educational program for a specific learner group. A DBR framework was appropriate because the study did not test a previously standardized program; instead, it developed agricultural awareness activities through expert collaboration, literature-based planning, and classroom-based implementation. The convergent mixed-methods design was used because changes in students' agricultural awareness could not be fully understood through test scores alone. Quantitative data were used to examine whether students' awareness scores changed after the program, whereas qualitative data were used to explain how students experienced the activities and how teachers observed changes in participation, communication, and engagement.

The purpose of this approach was to develop, implement, and evaluate an educational intervention grounded in both theory and classroom practice. DBR was used to guide the systematic development of the agricultural awareness activities through expert collaboration and iterative refinement, while an evaluative case study design was used to examine how the intervention functioned in practice and what outcomes it produced (Merriam, 1998).

Figure 1
Steps of the Study



Quantitatively, a single-group pretest–posttest quasi-experimental design was used to examine changes in students’ agricultural awareness. Qualitatively, semi-structured interviews with students and teachers were conducted to capture experiences, social interaction, and perceived changes during the intervention. Quantitative and qualitative data were collected concurrently and integrated during interpretation to provide a comprehensive understanding of the intervention’s effects.

Setting and Participants

The study was conducted with 12 lower-secondary students diagnosed with mild intellectual disability (MID), aged between 11 and 15 years. Participants were enrolled in six different middle schools, and two students also received additional services from private special education and rehabilitation centers. Participation was based on voluntary consent, and purposive sampling was used to select students who met the study criteria and matched the goals of the intervention (Nikolopoulou, 2023).

The instructional activities were implemented in a structured school-based learning environment designed to minimize distractions and allow hands-on engagement with agricultural materials. This setting enabled students to interact with concrete tools, plants, and food materials while working individually and collaboratively.

Ethical Approval

Ethical approval for the study was obtained from the Çanakkale Onsekiz Mart University Social and Humanities Research Ethics Committee before data collection began (Approval date: 22 August 2025; Decision no: 49/72). Written informed consent was obtained from the students’ parents or legal guardians, and student assent was also sought before participation. Participation was voluntary, and students were informed that they could withdraw from the study at any stage without any negative consequences. To protect confidentiality, student and teacher identities were anonymized using codes such as S1–S12 and E1–E6. All activities were conducted in a structured school-based environment under teacher supervision, and the content of the activities was designed to be developmentally appropriate for students with mild intellectual disabilities.

Development of the Agricultural Awareness Program

The program development began with an analysis of middle school science textbooks focusing on plant growth and agricultural production. Although these materials covered basic concepts such as germination and plant growth, they lacked experiential, student-centered activities appropriate for learners with MID.

To address this gap, five structured online meetings were held between a special education specialist and an agricultural engineer. These expert consultations were combined with a review of literature on effective instructional strategies for students with MID. Both sources emphasized the importance of selecting activities that support functional life skills, social participation, and concrete learning.

Based on this process, ten agricultural activities were developed to represent the full agricultural cycle, from soil and plant care to harvesting and food preparation (Appendices 2). The activities were reviewed by three special education experts and three science education experts for content accuracy, developmental appropriateness, and instructional clarity. Revisions were made accordingly, and the finalized program was scheduled for 25 instructional hours.

Clarification of Key Social Constructs

Because this study examined several social outcomes during the activities, the terms social communication, social participation, and social skills were used with distinct meanings. Social communication refers to students' verbal and non-verbal interactions with peers and teachers during the activities. Social participation refers to students' active involvement in shared tasks and group-based learning processes. Social skills refers more broadly to observable behaviors such as sharing, helping, cooperation, turn-taking, and joint decision-making. These distinctions guided the interpretation of the interview data.

Data Collection Instruments

Three main instruments were used to collect quantitative and qualitative data: the MID Agricultural Awareness Test, student semi-structured interviews, and teacher semi-structured interviews.

The MID Agricultural Awareness Test was developed to measure students' knowledge and awareness of agricultural concepts and practices targeted in the intervention. The test consisted of 10 items rated on a three-point Likert-type scale, suitable for students with MID. Content validity was established through expert review by three special education specialists and three science education experts. Content validity ratios (CVR) ranged between 0.71 and 1.00, indicating strong content relevance. No items were removed following expert review. The instrument was piloted with two students, and no comprehension problems were identified. Test-retest reliability was examined using a two-week interval, yielding a Pearson correlation coefficient of $r = .78$, which indicates acceptable temporal stability.

Student interview protocols were designed to examine changes in agricultural awareness, social interaction, emotional responses, and engagement during the activities. Questions focused on what students learned, how they interacted with peers, which activities they found enjoyable or difficult, and how their feelings toward nature and farming changed. Instructor interviews focused on student motivation, attention, cooperation, communication, and behavioral changes observed throughout the program. All interview protocols were reviewed by three special education experts, one science education expert, and three curriculum specialists to ensure clarity, developmental appropriateness, and alignment with the study goals.

Data Collection Procedures

The agricultural awareness program was implemented across 25 teaching hours using evidence-based teaching strategies for students with MID, including direct teaching, video-based modeling, structured practice, and systematic reinforcement. To maximize engagement, students completed a reinforcement preference form, and their individually selected social reinforcers were used consistently throughout the teaching process (Table 1).

Table 1
Social Reinforcers Chosen by the Students

Student Number	Social Reinforcer	Student Number	Social Reinforcer
S1	Well done	S7	High-five
S2	Great job	S8	Very good
S3	Congrats	S9	Excellent
S4	Very good	S10	Congrats
S5	Well done	S11	Congrats
S6	Very good	S12	Great job

One representative activity was the Kitchen Workshop, in which students learned how agricultural products are transformed into food through hands-on preparation tasks (Appendices 1).

Before the intervention, the MID Agricultural Awareness Test was administered as a pretest. Throughout the implementation, daily semi-structured student interviews were conducted to monitor changes in learning, social interaction, and engagement. After the completion of the program, the test was re-administered as a posttest, and follow-up interviews were conducted with both students and teachers to capture perceived changes in agricultural awareness and social development.

Data Analysis

Quantitative data from the MID Agricultural Awareness Test were analyzed using paired-samples t-tests to examine changes between pretest and posttest scores. Descriptive statistics (means and standard deviations) were calculated to summarize students' agricultural awareness before and after the intervention. These analyses allowed the researchers to determine whether the activity-based program produced statistically significant improvements in agricultural knowledge.

Qualitative interview data were analyzed using thematic coding. Two researchers independently coded all transcripts, and inter-coder reliability was calculated using the Miles and Huberman (1994) formula, yielding 82% agreement, which indicates acceptable reliability. Disagreements were resolved through discussion to reach consensus. To enhance trustworthiness, multiple strategies were used, including method triangulation (quantitative tests, student interviews, and instructor interviews), source triangulation (students and teachers), and the use of direct quotations to support analytic interpretations. This combination of quantitative and qualitative evidence strengthened the credibility and confirmability of the results.

Research Results

Quantitative Results: MID Agricultural Awareness Test

As shown in Table 2, pretest–posttest scores on the MID Agricultural Awareness Test indicated an increase in students’ agricultural awareness after the intervention. Participants’ mean pretest score was 15.75 (SD = 2.86, $n = 12$), which increased to 18.41 on the posttest (SD = 1.56, $n = 12$). The difference between pretest and posttest scores was statistically significant, $t(11) = 4.804$, $p = .003$, suggesting that the activity-based program contributed to a meaningful improvement in agricultural awareness among students with MID.

Table 2

Pretest and Posttest Scores on the MID Agricultural Awareness Test ($n=12$).

Variable	<i>n</i>	<i>M</i>	<i>SD</i>	<i>df</i>	<i>t</i>	<i>p</i>
Pretest	12	15.75	2.86	11	4.804	.003
Posttest	12	18.41	1.56			

Results from Student Interview

Agricultural Awareness

To examine students’ agricultural awareness and social communication during the implementation, semi-structured interviews were conducted at the end of each day. To elicit changes in agricultural awareness, students were first asked: “Did you do anything for the first time today? Can you explain something you learned thanks to this activity? What did you learn that you did not know before?” Students were also asked: “After the activities, what changed in your thoughts about nature, soil, and plants? What did you realize you had misunderstood or known incompletely?” The codes developed from students’ responses are presented in Table 3.

Table 3
Student Views Related to the Agricultural Awareness Category

Question	Code	Students
1- What was something you did for the first time in today's activities? Can you describe something you learned through this activity? What did you learn that you had not known before?	Making a salad	S1, S7
	Harvesting vegetables	S2, S3, S8, S12
	Smart irrigation	S10
	Adequate irrigation	S2
	Drama/role-play	S1
	Animals	S1
	Sowing seeds	S6, S7
	Painting pots	S4
	Soil components and soil knowledge	S1, S5, S6, S10
	Insects	S9, S10, S11
	Local agricultural products	S11
	Catching butterflies	S12
	Using a tablet-based mobile app	S3
2- What changed in your thoughts about nature, soil, and plants after the activity? Can you explain what you had known incorrectly or incompletely before?	Realizing misconceptions	S1, S7, S10
	Misunderstood growing conditions	S9
	Valuing/appreciation	S3
	Strengthened love for nature	S10
	Feeling good	S5
	Loving nature more	S9
	Helping others	S1
	Protecting nature	S3

Students' responses indicated that several agricultural concepts and practices were learned for the first time. For example, after the second day, S2 stated, "Something I did for the first time... I learned about sand, I learned about soil," reflecting a new understanding of soils.

Similarly, S10 reported, “I didn’t know what soil was like,” again pointing to first-time learning related to soil. After the fifth day, S8 noted, “Picking fruits and vegetables from the garden,” indicating that harvesting was a new experience. S3 emphasized first-time technology-mediated plant identification, stating, “Yes, I used those tablets to take a picture of a plant for the first time,” suggesting an initial experience with a tablet-supported plant identification application. In addition, after the fifth day, S1 reported, “I guess the first thing you did was making a salad,” indicating first-time participation in food preparation linked to agricultural products.

Students also described changes in awareness that extended beyond factual knowledge to include social and environmental values. After the fourth day, S1 stated, “Being respectful to others. Helping someone when they fall,” suggesting that the activities also supported prosocial awareness. After the third day, S3 explained, “When I see nature, I think about not having fires and protecting nature. I don’t want fires to happen,” indicating increased environmental responsibility. Practical agricultural knowledge also appeared in students’ accounts. After the fifth day, S10 described learning a more accurate harvesting technique: “Normally I pulled it, but the teacher explained... When you lift it up and twist it like this, it comes off anyway,” reflecting a shift from pulling to twisting during eggplant harvesting. Similarly, S9 stated, “It was the first time I learned that watermelons come out of the soil,” indicating new understanding about crop growth. Some students also described increased positive affect toward nature, such as S10 saying, “My love increased,” and S9 stating, “It made me love nature more,” after the third day.

Social Communication and Collaboration

To examine social communication, students were asked: “Did you work together with your friends today? What did you do? Was it easy to make decisions together?” Codes derived from these responses are presented in Table 4.

Table 4
Student Views Related to the Social Communication Category

Question	Code	Students
1- Did you work together with your friends today? What did you do? Was it easy to make decisions together?	Task distribution was easy	S7, S3
	Being together was nice	S4
	Working together was enjoyable	S3
	Social bonding/closeness	S2

Overall, students’ responses suggested that collaboration was feasible and often enjoyable. For example, after the fifth day, S3 stated: “*While making salad, we decided who would chop and who would do what. It was easy,*” highlighting task distribution and decision-making. After the third day, S4 noted: “*What made me happy was hanging out together at the greengrocer’s, sharing,*” emphasizing social interaction and sharing. S3 also described enjoyment in shared creative work: “*Putting the flowers in the container and decorating it was nice; I liked it,*” which reflected positive peer interaction during joint activities. In a similar vein, S2 expressed shared identity and bonding: “*We proudly painted it. Since we are both Beşiktaş fans, we made it Beşiktaş,*” indicating that collaboration facilitated social closeness through common interests.

Experiences and Emotions During the Activities

To explore students' experiences, they were asked: "What made you happiest during the activities?" followed by: "Were there things that were difficult for you? Why do you think you had difficulty?" They were also asked: "What interested you most today?" and "What emotions did you experience during the activity?" The codes developed from responses are shown in Table 5.

Table 5
Student Views Related to the activity process

Question	Code	Students
1- What made you the happiest during the activities? Can you explain?	Drawing/painting pictures	S1, S12
	Making a salad	S12
	Harvesting vegetables	S1, S4
	Planting flowers	S12
	Decorating pots	S5
	Socializing	S7
	Coloring/painting	S3, S8, S12
2- Were there any things that were difficult for you during the activity? Why do you think you had difficulty?	Catching animals	S1, S4
	Mathematical calculations	S12
	None (no difficulties)	S1, S2, S3, S7
3- What attracted your attention the most during today's activities? Can you explain?	Harvesting vegetables	S10
	Harvesting peppers	S7
	Drama/role-play	S12
	Selling	S10
	Being a vendor/market seller	S1, S2
	Smart irrigation	S4
	Planting seedlings	S5
	Painting pots	S2
	Working together	S4
	Flower types	S12
	Walking in nature/outdoor exploration	S1
4- What emotions did you experience during the activity?	Surprised	S2, S5, S12
	Excited	S12
	Happy	S1, S7, S10
	Cheerful	S4
	Fun/enjoyable	S12

Students frequently reported enjoyment from hands-on and role-based tasks. For example, S4 described: “We did drama... We drew fruits like figs and grapes, and we did a marketplace role-play,” suggesting that role-play and drawing were highly engaging. On the fifth day, S12 stated simply, “Making salad,” and S1 reported being happy “because we picked fruits and vegetables.” On the third day, S8 stated: “Seeing seeds, planting seeds in a pot, painting,” reflecting enjoyment of sensory and craft-based components. Another student, S4, also reported enjoyment “when catching animals,” pointing to interest in activity elements involving observation and interaction with living organisms.

In terms of difficulties, students’ responses indicated that challenges were not widespread but emerged in tasks requiring calculation. After the fifth day, S12 stated: “I got confused when calculating the money,” suggesting difficulty with mathematical operations. In contrast, S5 reported: “There wasn’t anything I struggled with,” and S1 similarly reported no difficulties after the first and second days.

Students’ interests were strongly oriented toward harvesting and real-life tasks. For instance, S10 stated: “I picked tomatoes and peppers, and I also made a salad,” indicating that collecting produce and preparing food were particularly interesting. On the fifth day, S2 noted interest in “being a vendor,” and S1 stated: “I walked around; I liked it a lot,” suggesting that exploring outdoor environments was motivating. Some students also expressed surprise and joy related to first-time experiences. For example, S5 stated: “Because I never picked anything before... that surprised me,” indicating novelty and emotional engagement. S4 reported happiness from shared time at the greengrocer’s and from eating what they prepared together: “Because we ate the food we collected and made together. I felt cheerful.” Similarly, S12 stated: “I had fun with my friends during the activities,” highlighting the emotional value of peer interaction.

Results From Instructor Interview

After the implementation, semi-structured interviews were conducted with teachers to capture observations regarding students’ motivation, participation, social communication, collaboration, and attention. Teachers were asked: (1) how they observed students’ motivation and participation, (2) whether they observed changes in students’ social communication, (3) how they evaluated group work and collaboration skills, and (4) whether students’ attention and focus differed during the program. The codes derived from teachers’ responses are presented in Table 6.

Table 6
Teacher Views During the Project on Students' Social Communication

Question	Code	Teacher
1- How did you observe the students' motivation and participation levels during the activities? Please explain in detail.	High motivation and active participation	E1, E3, E5, E6
	Improvement over time	E4, E6
	Social learning effect	E1, E5
2- Did you observe any change in the students' social communication skills during the project process? If yes, can you explain this change with examples?	Increased social communication	E1, E2, E3
	Sharing	E1, E2
	Reduced shyness	E4, E6
	Social cohesion among students from different schools	E2, E3
3- How did you observe the students' group work and cooperation skills? Please explain in detail.	Cooperation/helping each other	E2, E3
	Adaptation and inclusion	E1, E5
	Enjoyment	E5, E6
4- Did you observe any differences in the students' attention span or focusing skills? Please explain in detail.	Difference between theoretical vs. practical sessions	E2, E3
	Increased attention over time	E4, E5
	Effect of visual and concrete materials	E4
	Interest-based activities	E5
	Ability to recall/restate information	E1

Overall, teachers emphasized high motivation and participation. For example, E1 stated: "Students participated voluntarily in all activities," and E3 noted: "Each student was looking for an opportunity to show themselves," which reflected strong engagement. Teachers also described improvement over time. E4 stated that students' focus was high and that they could recall and express information from the previous day more clearly on the next day. E6 similarly reported: "Students were very interested in the activities. Their motivation was high, and they actively participated in every stage," indicating sustained engagement. Teachers further suggested that participation increased when students were directly included and when activities were experiential and visually supported. For example, E5 described a student who initially only observed on the first day but later became an active volunteer, which was interpreted as increased motivation over time.

Regarding social communication, teachers consistently reported positive change. E1 stated that students learned to communicate strongly with both teachers and peers, while E2 noted that communication was strong during shared tasks. E3 emphasized that students engaged in more dialogue, respected turn-taking, and attended to peers' speaking rights. Teachers also highlighted specific social behaviors such as sharing materials, mutual help, and reduced shyness. For example, E2 described how students exchanged colors and helped one another during a pot painting activity, while E4 observed that students who initially hesitated to speak became more communicative as activities progressed. E6 similarly noted that students were anxious and shy on the first day but became more comfortable and participatory by the final day.

Teachers also reported that students from different schools successfully socialized and formed positive peer relations.

In terms of collaboration, teachers reported frequent cooperation and mutual assistance. For example, E3 observed that during planting tasks, students helped one another in sequence by adding soil, holding the plant, and watering it. Teachers also noted that students adapted easily to group work, completed tasks collaboratively, and appeared to enjoy working together.

Finally, teachers described differences in attention depending on activity format. E2 reported that students' attention during theoretical explanations was brief, whereas attention and persistence were notably higher during practical tasks. Similarly, E3 emphasized that students sustained attention longer during direct, hands-on activities. Several teachers reported that attention increased over time, and that visual and concrete materials supported focus. Teachers also noted that interest-based activity design facilitated attention, and that students were able to recall and repeat learning from previous sessions, indicating retention.

Discussion

The students' posttest scores on the MID Agricultural Awareness Test were higher than their pretest scores after the activity-based agricultural awareness education program. This result indicates a positive within-group change in agricultural awareness. However, because the study did not include a control group, the increase should not be interpreted as definitive evidence that the program alone caused the improvement. It is more appropriate to state that the students showed measurable progress after participating in the program.

A possible reason for this progress is the concrete and repeated nature of the activities. Students with mild intellectual disabilities often need visible materials, guided practice, repetition, and immediate feedback when learning new concepts. In this study, agricultural concepts such as soil, irrigation, planting, harvesting, and food preparation were not presented only through verbal explanation. They were supported through hands-on tasks, video-based modeling, direct teaching, structured practice, and reinforcement. This may have helped students connect abstract agricultural concepts with observable actions and real objects.

This interpretation is compatible with previous research on teaching students with intellectual disabilities. Studies have shown that direct teaching, video modeling, reinforcement, and peer-supported activities can support learning, engagement, and skill acquisition among students with intellectual and developmental disabilities. The present results also align with agricultural and horticultural studies reporting that cultivation, planting, and garden-based activities may contribute to functional skills, social interaction, and emotional engagement in individuals with intellectual disabilities. However, most of these studies have focused on adults, vocational contexts, or older students. The present study adds a school-based middle school perspective to this literature.

The qualitative data help explain what changed beyond the test scores. Students reported first-time experiences such as learning about soil, planting seeds, harvesting vegetables, using a tablet-based plant identification application, and preparing salad from agricultural products. These responses suggest that the program created learning opportunities that are difficult to obtain through textbook-based science teaching alone. For students with MID, this type of learning may be especially useful because it links school knowledge with daily life, food, local production, and environmental observation.

Social communication was another area in which positive change was observed. Students described working together, sharing tasks, making decisions with peers, and enjoying group activities. Teachers also reported increased participation, reduced shyness, stronger peer interaction, and more cooperative behavior. These results are consistent with studies indicating that structured peer interaction and activity-based learning can support social and behavioral

outcomes for students with intellectual disabilities. In the present study, the social effects may have emerged because the activities required students to produce something together, such as decorating pots, planting, harvesting, preparing food, or role-playing a marketplace.

The results related to environmental awareness should be interpreted carefully. Some students stated that they began to think more about nature, plants, and environmental protection. These statements do not prove a stable or long-term change in environmental attitudes. Still, they show that the activities encouraged students to talk about nature and agricultural production in a more reflective way. This is important because environmental and agricultural topics can remain abstract when taught only through written or visual materials. Hands-on agricultural activities may make these topics easier for students with MID to understand and discuss.

The results also showed that not all parts of the program were equally easy for students. One student reported difficulty with money-related calculations during the marketplace activity. This difficulty is not surprising, as students with MID may experience challenges in abstract reasoning and numerical processing. The finding suggests that agricultural awareness activities involving calculation, pricing, or market simulation should include additional supports such as visual price cards, step-by-step prompts, simplified numbers, teacher modeling, and peer assistance.

The study has several limitations that affect the interpretation of the results. The sample was small and included only 12 students. The design was a single-group pretest–posttest design, so maturation, repeated testing, teacher effect, or other uncontrolled factors may have contributed to the observed change. The intervention was also short-term, and no follow-up measurement was conducted. Therefore, it is not possible to determine whether the gains were maintained over time. In addition, the MID Agricultural Awareness Test was developed for this study, which limits comparison with other studies using standardized measures.

Despite these limitations, the study provides preliminary evidence that activity-based agricultural awareness education may support agricultural knowledge, participation, and peer interaction among middle school students with MID. The main value of the program appears to lie in its use of concrete materials, repeated practice, social interaction, and real-life agricultural tasks. Future studies should test similar programs with larger samples, comparison groups, longer implementation periods, and follow-up assessments. Research comparing different types of agricultural activities would also help clarify which components are most useful for students with MID. Another limitation concerns the MID Agricultural Awareness Test. Although the test was reviewed by experts and showed acceptable test–retest reliability, it was a researcher-developed instrument with only 10 items. Therefore, it may not cover the full breadth of agricultural awareness, and the results are not directly comparable with studies using standardized instruments. The local context should also be considered. Although the program was based on general principles of special education and experiential learning, its content was shaped by the agricultural characteristics of the region in Türkiye. Therefore, direct replication in other contexts may require adaptation to local crops, school resources, cultural practices, and available agricultural learning environments.

Conclusions and Implications

This study suggests that an activity-based agricultural awareness education program may support agricultural knowledge and social participation among middle school students with mild intellectual disabilities (MID). Students' posttest scores were higher than their pretest scores, and interview data indicated that they participated actively in hands-on activities such as planting, harvesting, irrigation, and food preparation. Teachers also reported increased participation, cooperation, peer interaction, and reduced shyness during the program. These results should be interpreted within the methodological limits of the study. The research was conducted with

a small and relatively homogeneous group of students and used a single-group pretest–posttest design without a control group. Therefore, the results do not allow strong causal claims. The intervention was also limited in duration, and no follow-up measurement was conducted to examine whether the observed gains were maintained over time. Another limitation concerns the MID Agricultural Awareness Test. Although the test was reviewed by experts and showed acceptable test–retest reliability, it was a researcher-developed instrument with only 10 items. Therefore, it may not cover the full breadth of agricultural awareness, and the results are not directly comparable with studies using standardized instruments. The local context should also be considered. Although the program was based on general principles of special education and experiential learning, its content was shaped by the agricultural characteristics of the region in Türkiye. Direct replication in other contexts may therefore require adaptation to local crops, school resources, cultural practices, and available agricultural learning environments.

Despite these limitations, the study provides preliminary evidence that agricultural awareness activities may be useful in connecting science-related content with everyday life for students with MID. Such activities may help teachers use concrete materials, visual support, structured practice, peer interaction, and reinforcement in ways that support both learning and participation. For schools, small-scale agricultural learning spaces such as gardens or classroom-based planting areas may offer practical opportunities for experiential learning, provided that the activities are adapted to students' developmental needs and local conditions.

Future studies should examine similar programs with larger and more diverse samples, comparison or control groups, longer implementation periods, and follow-up assessments. Further research may also compare different types of agricultural activities to identify which components are most useful for supporting agricultural awareness, social communication, and participation among students with MID.

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CRedit Author Contributions

TK: Conceptualization, Methodology, Investigation, Data Curation, Formal Analysis, Writing – Original Draft, Visualization. İS: Supervision, Methodology, Validation, Resources, Writing – Review & Editing, Project Administration.

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Conflict of interest

The authors declare no conflict of interest.

Data Availability Statement

The datasets generated and analyzed during the current study are not publicly available because individual participant consent for data sharing was not obtained but are available from the corresponding author on reasonable request and in accordance with ethical approval.

Ethics Approval

Ethical approval for this study was obtained from the Çanakkale Onsekiz Mart University Social and Humanities Research Ethics Committee (Approval date: 22 August 2025; Decision no: 49/72).

Generative AI Tool Use

OpenAI's ChatGPT (version 5.2) was used to assist with language editing, proofreading, and improving the clarity and academic tone of the manuscript. The authors reviewed, verified, and take full responsibility for the final content of the manuscript.

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Appendices

Appendices 1. Kitchen Workshop Activities

1. Target Behavior

The student will be able to prepare a salad using tomato, cucumber, and pepper by following verbal instructions.

2. Preparation Phase

Materials:

1 tomato, 1 cucumber, 1 pepper, cutting board, plastic knife, bowl, napkin, apron

Environment:

A quiet school kitchen workshop free from distracting stimuli

Student readiness:

Prerequisite skills such as hand washing and safe cutting with a knife are assessed.

3. Explanation of the Goal

“Today we are going to make a salad together. We will use tomato, cucumber, and pepper. We will do each step together. When you do it correctly, I will give you a reward right away.”

4. Modeling (Demonstration)

The entire process is demonstrated step by step. The instructor only models; the student observes.

Modeling Steps

1. I wash my hands.
2. I take the tomato, pepper, and cucumber and wash them.
3. I place the tomato on the cutting board.
4. I carefully chop the tomato.
5. I carefully chop the cucumber.
6. I carefully chop the pepper.
7. I put all the ingredients into the bowl.
8. I cut the lemon in half and squeeze it over the salad.
9. I add salt and olive oil if desired.
10. I mix the salad.
11. I make it ready to serve.

5. Guided Practice (We Do It Together)

Each step is performed together with verbal instruction. The student receives assistance when needed, and immediate verbal reinforcement is given for correct responses.

Step	Teacher Behavior	Student Behavior	Reinforcement
1	“Now we wash our hands.”	Washes hands	Selected appropriate reinforcer
2	“Take the vegetables and wash them.”	Washes the tomato	Selected appropriate reinforcer
3	“Put it on the cutting board and carefully chop.”	Chops the tomato	Selected appropriate reinforcer
4	“Put it on the cutting board and carefully chop.”	Chops the cucumber	Selected appropriate reinforcer
5	“Put it on the cutting board and carefully chop.”	Chops the pepper	Selected appropriate reinforcer
6	“Put everything into the bowl.”	Puts the ingredients in	Selected appropriate reinforcer
7	“Cut the lemon in half and squeeze it into the bowl.”	Cuts and squeezes lemon	Selected appropriate reinforcer

8	“Add oil and salt to the bowl.”	Adds oil and salt	Selected appropriate reinforcer
9	“Mix the ingredients in the bowl.”	Mixes the ingredients	Selected appropriate reinforcer

Physical prompts are provided when necessary and gradually faded.

6. Independent Practice

The student performs the process independently while being observed. Reinforcement is provided.

Step	Student Behavior	Reinforcement
Performs all steps in sequence	Completes successfully	“You are now a salad master! Let’s enjoy eating it together.” (social reinforcer + activity reinforcer)

7. Evaluation

Checklist

Student Name:

Date:

Instructor:

Step	Correct	Incorrect
1. Washes hands	☐	☐
2. Washes vegetables (tomato, cucumber, pepper)	☐	☐
3. Chops the tomato	☐	☐
4. Chops the cucumber	☐	☐
5. Chops the pepper	☐	☐
6. Adds ingredients	☐	☐
7. Squeezes the lemon	☐	☐
8. Adds oil and salt	☐	☐
9. Mixes all ingredients	☐	☐

Total:

Appendices 2. Kitchen Workshop Activities

Activity No.	Activity Title
1	Getting to Know Agriculture
2	Our Soils
3	Let’s Get to Know Plants
4	I Am Not Afraid of Insects
5	Water Is Life
6	Let’s Organize the Garden and Decorate Our Pots

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7	Smart Irrigation
8	Selling Fruits and Vegetables
9	Let's Harvest
10	Kitchen Workshop

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