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Identification of Performance, Motivation, and Support Needs in Coding Education Provided for the Students with Mild Intellectual Disabilities

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ABSTRACT

Coding education, which enhances the computational thinking skills of K-12 students, is increasingly integrated into the curricula of various countries. However, such education is often excluded from the curricula designed for students with special needs. A review of the literature indicates a significant scarcity of studies dedicated to the coding instruction process for this population. To effectively integrate coding and computational thinking into the curricula for students with special needs, it is essential for educators to understand the appropriate materials and instructional supports that can enhance student motivation and participation during coding lessons. This study aims to evaluate the performance of a secondary school student with mild intellectual disabilities in coding education, with a focus on the materials used, student motivation, challenges encountered during the instruction, and the specific support needs of the student. Employing a holistic single case design, the research incorporates the perspectives of a secondary school special education student regarding their coding education, alongside observations made by the researcher. The findings indicate that the participant actively engaged in the coding education, with block-based coding activities being the most motivating among the various coding activities offered. Furthermore, the study identifies the essential individual supports required by the participant, which include concretization, verbal clarification of the tasks to be performed during each session, and access to the block-based coding platform.

Keywords: Special education, mild intellectual disability, coding, motivation, computational thinking.

Introduction

Since computational thinking is related to useful and applicable competences in individuals' daily lives, it is adopted worldwide as one of the 21st century skills that individuals should develop (Nordby et al., 2022; Wing, 2011; Zhang & Nouri, 2019). Although different nomenclatures such as computational thinking, computer thinking, computational thinking are used in the national literature for Computation Thinking, it is mostly referred to as computational thinking (Demir & Seferoğlu, 2017; Ilic et al., 2016; Şahiner & Kert, 2016; Yecan et al., 2017). Aho (2012) defined computational thinking as 'the thought process that involves formulating problems so that their solutions can be represented as computational steps and algorithms'. Computational thinking can help students think through unstructured problems, interpret data, and learn to communicate using computers (Lee et al., 2014). Coding teaching is frequently used in the acquisition of computational thinking skills (Akçay & Çoklar, 2016). In fact, coding has been included in the K-12 education curriculum in many countries (Lamprou & Repennig, 2018). While computational thinking is integrated into the K-12 curriculum, the access of special students to this education is excluded from the discussions (Bouck & Yadav, 2020). According to Kafai and Burke (2015), for these inclusions to truly make sense, a broad range of students must receive effective coding instruction that engages them in personally meaningful ways. Therefore, it is thought that this goal can be achieved by including coding education in the individual education programmes of not only students in regular classes but also students with special needs.

According to the report published by MEB (2022), there are 453 thousand 29 students with special education needs in our country (MEB, 2022). In 2017, with the curriculum change made in our country, coding education was included in the information technologies and software course curriculum of secondary school 5th and 6th grade students. Since this date, coding education has been given in regular classes with information technologies teachers who are experts in the field, with computer-free, block-based and robotic coding activities. However, the special education regulation does not include information technologies or coding courses at any grade level (MEB, 2018). It is thought that the fact that these special students, who are prepared for adult life with individualised curricula, do not receive information technologies and coding education causes them to become more disadvantaged compared to students receiving regular education. While the International Society for Technologies in Education (ISTE) provides standards for the interdisciplinary integration of coding, it also discusses what educators should do to ensure that students develop computational thinking skills to solve the problems they face (ISTE, 2018). However, it is seen that students with special needs are not included in these discussions and there is not enough research in the literature on how coding instruction can be applied to these students (Israel et al., 2015).

Snodgrass et al. (2016), in their study with two students with mild intellectual disabilities attending the 5th grade of primary school, observed the supports that students needed in acquiring computer use skills and stated that students with disabilities should participate in computer classes and receive the supports they need as in all other areas.

Ladner and Israel (2016) categorised the difficulties experienced by special education students in their educational life into three categories: accessible materials, teacher attitudes and pedagogical approaches (See Figure 1) and stated that the category of teacher attitudes is the biggest category of difficulty experienced by special education students in their education. In this category, it was emphasised that the biggest obstacle in the education of special education students is the prejudice towards special education students and their being considered inadequate in learning computer science or the teachers' setting the goals for these students lower than they should be. For the other two difficulty categories, it was stated that materials and activities should be designed by taking universal design principles into consideration and the curriculum, including programming tools, should be accessible to all students.

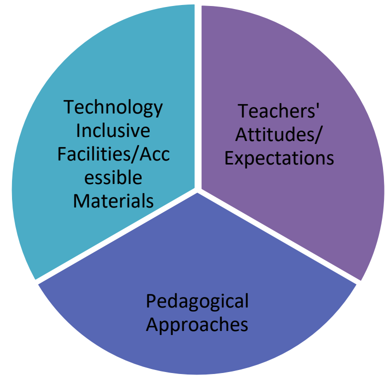

Figure 1.
Difficulties Experienced by Special Education Students in Educational Life (Thompson et al., 2009)

Based on these studies, it is thought that the problems experienced in the education of special education students can be overcome by ensuring that the activities to be organised with the materials to be used in individual education to be given to them are appropriate to their cognitive levels and at a level that will attract their interest and also by ensuring their motivation. In addition, for an effective learning environment, along with the teacher's attitude, supports that eliminate the incompatibility between the personal competence of the special education student and the educator's expectations should also be put into practice (Thompson et al., 2009). The individual experiences a feeling of inadequacy in the absence of the needed supports. For this reason, it is important to determine the support requirements that students will need while coding education is given to special education students.

From this point of view, in this study, the selection of materials and activities to be used in coding education to be given to special education students, the motivation of the student and the determination of the support needs of the student were seen as important variables for the effectiveness of the education.

Among special education student groups, students with mild intellectual disability are a group of students who can gain academic skills with the support and guidance provided during the education process (Snodgrass et al., 2016). Students with mild intellectual disabilities are prone to solving simple and structured problems and learning concepts and have significant potential in gaining new skills. In addition, it is thought that effective coding education to be developed for these students will also provide a basis for students with more severe disabilities. Therefore, it is important to work with students with mild intellectual disabilities in the study in order to determine effective methods in the coding education process by developing activities and materials suitable for the cognitive levels of these students.

In this context, the effectiveness of materials and activities in the coding education of secondary school students with mild intellectual disability, the effect of these materials and activities on the motivation of the student and the support needs of the student constitute the problem of this research.

Purpose and Importance of the Research

Individuals with intellectual disabilities are diagnosed as having functional deficits in both cognitive and adaptation to the environment in conceptual, social and practical areas, starting before the age of eighteen (MEB, 2018). Although there are different classifications of the subcomponents of computational thinking in the literature, the most frequently emphasised skills can be summarised as sorting, abstract thinking, attention, pattern recognition, algorithmic thinking, generalisation and problem solving (See Figure 2).

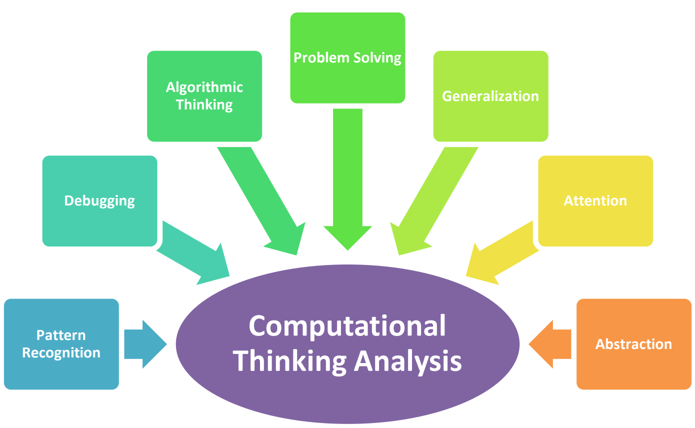

Figure 2.
Sub-Concepts of Computational Thinking

Some studies suggest that the sub-concepts of problem solving, algorithmic thinking, decomposition, generalisation, abstraction and debugging are directly related to coding education given at the K-12 level (Grover & Pea, 2013; Wing, 2006; Yadav et al., 2016). Individuals with intellectual disabilities have problems with skills such as problem solving, reasoning, generalisation, algorithmic thinking, attention, abstract thinking, etc. (See Figure 3), which can be developed by acquiring computational thinking skills in learning processes (MEB, 2021).

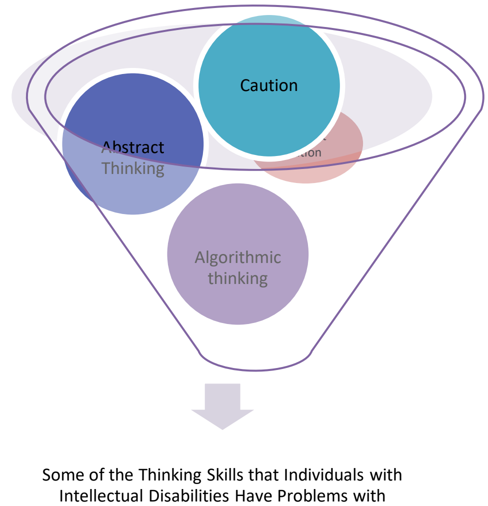

Figure 3.
Some of the Thinking Skills that Individuals with Intellectual Disabilities Have Problems with (MEB, 2021)

For this reason, it is thought that the inclusion of computational thinking skill training, which is one of the high-level thinking skills, in the learning processes of these students will be effective in developing their thinking skills. In addition, Assainova et al. (2018) stated that developing computational thinking skills in students with intellectual disabilities enables them to quickly adapt to the modern world, identify problems and produce complex solutions.

However, there are also studies showing that students with special needs can develop computational thinking skills when they are provided with appropriate support and environment (Lander & Israel, 2016; Stefik & Lander, 2015). As coding and computational thinking are more integrated into the curriculum of students with special needs, information technology teachers and special education teachers need to know which materials to use and how to provide instructional supports to ensure students' motivation and participation during coding education for students with special needs.

In addition, according to Stake (1975), the effectiveness of an instruction can be determined not only by whether its objectives are achieved or not, but also by the evaluations made by the stakeholders. In this context, in this study, practitioner observations and student opinions were included.

In the light of this information, the aim of this study is to examine the student reactions to the activities used during the coding education given to a student with mild disability by direct instruction method according to the materials used, motivation and support needs, and to reveal the evaluations of the student and the researcher about the process. In line with this purpose; the problem of the research is; ‘How is the student's performance, motivation and support needs in the implementation of the materials and activities used in coding instruction given to a secondary school student with mild intellectual disability?’. In line with this problem, answers to the following sub-problems will be sought:

In the coding instruction given to a secondary school student with mild intellectual disability

- Which materials and activities stand out?
- What is the effect of the materials and activities used on student motivation?
- What are the support requirements that the student needs?

Methods

Research Model

This study was conducted with a holistic single case design, one of the case study models (Yıldırım & Şimşek, 2013). The holistic single case design is applied when data are collected from a single unit of analysis (individual, institution, a programme, etc.). In the study, single case design was used to examine the effect of the activities used in coding instruction given to a student with mild intellectual disability on the student's performance, motivation and support needs. The study was limited to a student with mild intellectual disability and the coding learning process was considered as a holistic situation.

Participant and Setting

The participant of the study was a 13-year-old female student who was diagnosed with ‘mild intellectual disability’ in her medical evaluation report. The student attends the sixth grade in the special education class of a public secondary school. She also attends a rehabilitation centre after school and receives four hours of education per week. The student, who does not have any physical disability, can perform large and small muscle skills independently and initiate communication. The student can also greet acquaintances and respond to questions about himself, his immediate surroundings and the events happening around him in accordance with the context. In addition, he/she can determine what the problem is in the difficulties he/she encounters and can determine that the directions of the objects are different. On the other hand, he can understand and fulfil consecutive instructions of at least three words.

The participant student had not received any training on coding before. He has his own tablet computer at home and can switch on and off information technology devices independently. The student, who can enter the Internet browser and search on these devices, has an interest in information technology devices.

In line with the opinions of special education teachers, the participant was selected because he was interested in information technology devices, had high communication skills and good cognitive performance level. The prerequisite skills of the participant such as ‘not having received coding training before, having directional knowledge, being able to read and write, being able to pay attention to the activities for an average of 5 minutes, being able to perform simple operations such as clicking, opening, etc. on information technology devices’ were taken into consideration in the evaluation.

Prior to the study, the necessary permissions were obtained from the student, his/her teacher and parents for participation in the study and video filming. In addition, Ethics committee approval was received from Hacettepe University Non-Interventional Clinical Research Ethics Committee (Date: 11.07.2023, Number: 2023-12/44). Before starting the study, the school administration was informed about the subject. The applications related to the study were carried out in the school's information technologies classroom. During the research, paper and pencil activities, coding mat and game with obstacles, code.org block-based coding platform were used. The environment was prepared by the researcher before the application. The whole study was video recorded to determine inter-observer reliability and implementation reliability. Before starting the study, the researcher and the participant were present in the application environment, and the researcher made the evaluation of the prerequisite skills by observing the student in the classroom environment. While presenting the findings, the code name ‘Buse’ was used instead of the student's real name.

Coding Materials Used in Practice

Paper and pencil activities: These are linear coding activities developed by the practitioner. Two paper and pencil activities were carried out during the study.

Game: It is a game in which the coding mat is laid on the floor and the participant is expected to reach the target without tripping over obstacles (stools). It was used twice during the study.

Code.org: It is a platform that is highly preferred for block-based coding and preferred by the researchers due to the absence of distracting elements for individuals with intellectual disabilities. The lesson planning suitable for the level of the student on the platform was selected by the researchers. The selected sections include only linear programming blocks.

After the materials to be used by the researcher were determined, their suitability was determined by submitting them to the opinion of a field expert, necessary arrangements were made and then they were used in the study.

Data Collection

The data of the study consisted of observation reports, participant opinions, checklist and semi-structured interviews with the teacher. The data obtained from these data sources are listed in Table 1.

Since the research is in the case study model, which is one of the qualitative research methods, the data were collected through semi-structured interviews with the student and unstructured observations made by the researcher in order to collect in-depth information. In order to determine whether the interview questions consisted of questions that the student could answer, the opinions of two experts from the field were consulted, and after the necessary corrections were made in line with the opinions of the experts, it was made ready for application. In line with the expert opinions, all of the questions were taken into consideration. The interview was conducted in the information technologies classroom at the end of the research sessions.

Table 1.

Research Data

Purpose	Data Collection Method	Data Source
Assessing the student's prerequisite skills	Classroom observation Semi-structured interview with a special education teacher	Checklist Audio recording
Obtaining detailed information about the student	Semi-structured interview with a special education teacher	Audio recording
Teaching process	Observation Interview with the student	Video recording Audio recording

The interviews lasted approximately 15 minutes and were based on the volunteerism of the participant. During the interviews, voice recordings were taken in line with the participant's knowledge and permission. During the interviews, the researcher asked the questions in a conversational style and did not give directions about the answers given in order to maintain objectivity. The teaching sessions were videotaped in order to ensure the validity and reliability of the data, to observe the student's verbal as well as non-verbal behaviours, and to have the opportunity to monitor the data in detail. In addition, observation notes were kept by the researcher during the sessions. Each session lasted approximately 10 minutes. While the observation notes were reported by the researcher, the session videos were also used.

Researchers

This research was conducted by two researchers. The role of the first author consisted of instructional planning, observing the implementation, and conducting the research. The role of the second author was instructional planning, planning and providing the necessary materials for the implementation, implementing the implementation, data collection and analysis, and reporting. In addition, the fact that the implementing researcher is an expert in the field of information technologies has benefited the study in the correct execution of coding instruction. An expert from the field of special education and information technologies provided the control of the measurement tools.

Research Process

The research process was carried out in two stages as pre-implementation and implementation process. Before the implementation, detailed data about the student were obtained (evaluation of prerequisite skills and teacher opinions) and coding instruction was planned; during the implementation process, coding instruction was given (paper-pencil activities, block-based coding activities and coding games). During the implementation, the researcher collected data on student performance, motivation and support needs related to the activities carried out by the researcher. In addition, the student was interviewed about the coding activities after the application.

A total of eight sessions were worked with the participant for two weeks, two sessions on Mondays and Thursdays. Attention was paid to take a break of two lesson hours between the sessions. Each session lasted approximately ten minutes. The researcher worked one-to-one with the participant. It was observed that the participant was very eager and enthusiastic before the coding instruction started. In the first session, a video about the fairy tales to be used in the activity was shown for the introduction, and then the coding activity prepared on paper was introduced (two sessions). On the second day, coding was taught by creating obstacles with stools through repetitive dance movements and coding mat (two sessions). In the following sessions, block-based coding activities on code.org were included.

Analysing the Data

The interview data were analysed by descriptive analysis. According to Yıldırım and Şimşek (2013), the data obtained in descriptive analysis are summarised and interpreted according to predetermined themes. Direct quotations were frequently used where necessary. The findings obtained through interview and observation techniques were defined and interpreted. In addition, attention was paid to reporting the data in an easy-to-understand and readable way. Cause-effect relationships were tried to be established between the findings and where necessary, comparisons with different studies were made and discussed.

In qualitative studies, validity means that the measurement tool measures accurately and presents it unbiasedly as it is. In order to increase the internal validity of the study, while developing the interview form, the interview questions were finalised by taking expert opinion as a result of the review of the relevant literature. During the interviews, the participant's views were not interfered with or guided, and information about the real situation was tried to be reflected in the observations. The participant was selected among the volunteers and it was stated that no information about his/her identity would be shared with the participant. In addition, the research process and what was done in this process were explained in detail. While presenting the interview findings, the situation was given with direct quotations. In order to ensure the reliability of the research, another information technologies expert was asked to listen to the audio recording and to code a certain part of the data. For this purpose, the percentage of agreement suggested by Miles and Huberman (1994) [Reliability = Agreement/(Agreement + Disagreement)] was used and as a result of the calculation, it was determined that the percentage of agreement was above 85%.

Results

The findings of this qualitative research are presented under themes created according to the research purpose and research questions. These themes are provided as views and observations related to instructional materials, motivation, and support needs. The findings are explained within the framework of descriptive analysis as suggested by Yıldırım and Şimşek (2013).

Prominent Materials and Activities in Coding Instruction

During coding education, paper-pencil activities, coding with games, and block-based coding activities were presented to the student. It was determined that the student preferred block-based coding activities the most. The views of the student and the researcher on this matter are presented below under relevant subheadings.

Student Views

The participant stated that all the instructional materials used in coding education were fun. The participant's views on this are as follows:

> **Buse:** *"It was really fun. At first, I couldn't tell if we were doing a lesson or playing a game (laughs)."*
> **Buse:** *"I love using the computer. When my teacher first told me (at the beginning of the lesson week), I said I wouldn't like learning with the computer, but I liked this Angry Bird game (block-based coding activity). (See Figure 4) Is this a lesson?"*

Figure 4.
Programming Activity with Angry Bird on the Code.org Platform

When the participant was asked about her opinions on the paper-pencil activity, the game, and the block-based coding activities used during the coding instruction, she stated that she liked block-based coding the most, followed by the paper-pencil activity (See Figure 5), and she liked the game the least. When asked about the reason for this preference, she explained that they usually do coloring, cutting activities, and play board games in class, so she preferred to do activities on the computer.

Figure 5.
Paper-Pencil Activity with Coding Through Stories

Instructor: Which one did you like more? (the paper-pencil storytelling activity or the storytelling game activity).

> **Buse:** This one was better (the paper-pencil storytelling activity)
> **Teacher:** Did you like the stories (paper-pencil activity)?
> **Buse:** Well... (with an expression of slight dissatisfaction)

Researcher's Observation

The student appeared not to perceive activities involving computer use as actual lessons. This seems to stem from her previous learning experiences. For example, there is no course specifically focused on information technologies in the special education middle school curriculum. Additionally, students may lack an understanding of how lessons are conducted using information technology devices (such as computers, tablets, VR goggles, etc.). Moreover, their parents may restrict their use of devices like tablets and phones at home, leading them to develop the belief that these technologies are only harmful.

> Buse: I have a phone, teacher, but when school started, my mom banned it. I'll use it during the summer.
> Buse: I love using the computer, but I don't think I'll enjoy computer lessons (approaching it with prejudice because she dislikes lessons in general).

Among the activities implemented during coding instruction, it was observed that in the corridor game created with a coding mat and stools (See Figure 6), the participant found it easier to imagine herself as the character and thus had no difficulty selecting the directional blocks. She also selected the blocks more quickly.

Figure 6.
Corridor Game

Additionally, the use of colorful designs in the paper-pencil activities prepared for the participant, as well as the inclusion of characters she liked, increased her engagement in the activities. Observations revealed that the participant wanted to converse about the activities, which facilitated more comfortable communication. It was also noted that the participant confidently answered the questions posed to her and successfully adapted to the learning process by listening attentively.

The Effect of Materials and Activities Used in Coding Instruction on Student Motivation

It was determined that among the materials and activities presented during coding instruction, block-based coding activities had the most significant impact on increasing the student's motivation. The student's and researcher's views on this finding are presented below under relevant subheadings.

Student Views

When the participant was asked which activity or activities she would most like to repeat during coding instruction, it was observed that she chose block-based coding. The student's related statements are as follows:

> Buse: *"I think we should always do this in front of the computer from now on, it's so much fun..."*
> Buse: *"I love playing games on the computer, we're always doing photocopies and coloring in class anyway."*

Researcher's Observations

It was observed that the participant was very excited to start coding instruction. Observations indicated that Buse also focused on the activities, responded to the instructor's questions, and tried to complete the coding activities while murmuring to herself during independent activities. The student did not abandon any activity, instead focusing on the problem at hand and attempting to find a solution. Moreover, it was noted that before the sessions began, Buse expected verbal explanations about the activity to be conducted. When no information was given about the activities for that session, she became anxious and asked the instructor what they would be doing that day.

Although all of the activities attracted the participant's interest, it was observed that the computer-based coding activities were the ones that most motivated her. The participant expressed a desire to continue block-based coding activities. Despite her short attention span, she followed the character's movements based on her commands with great satisfaction. Some of Buse's reactions to this situation are as follows:

> Buse: *"Can I continue with this a little longer?"* (Ice Age block-based coding activity)
> Buse: *"Is the lesson over already? That was quick!"* (Code.org activities)

In coding activities, the participant was motivated to learn and paid close attention to each activity. The use of a computer during the lessons captured the participant's attention and led to more active participation. It was observed that block-based coding provided more motivation compared to coding with games or paper-pencil activities, and the participant wanted to use block-based coding as a reward during other activities. Some of the participant's reactions to this situation are as follows:

> Buse: *"When are we going to use the computer?"*
> Buse: *"After I finish this, can I play Angry Bird (block-based coding)?"*
> Buse: *"I didn't even notice when the lesson ended, I wish we could do all lessons like this."*
> Buse: *"This is really fun..."*

Student Support Needs in Coding Instruction

It was determined that during coding instruction, the student needed support in areas such as receiving approval, basic information technology proficiency, and concretization. The student's and researcher's views on this finding are presented below under relevant subheadings.

Student Views

When asked what she struggled with the most while using the computer, it was understood that Buse had difficulty logging into the Code.org website. Her reactions to this are as follows:

> Buse: *"...when I got home, I immediately opened my tablet and wanted to play the game we played, but I couldn't log in."*
> Buse: *"...I didn't like the smiley face coloring sheet. It takes too long to read, and coloring takes forever..."*

Researcher's Observations

As required by the individual education program implemented in her special education class, it was observed that Buse needed support to meet her educational needs. Although she was confident in the activities she completed, there were times when she looked up, waiting for approval from the researcher. This caused issues during the implementation of independent activities in the first session. However, in subsequent computer-based sessions, the participant pressed the finish button without needing the researcher's approval after completing the algorithm independently and had the program check whether her algorithm was correct. In the first session, she expected the researcher to perform basic tasks requiring information technology proficiency, such as turning on the computer and connecting to the internet browser. However, in later sessions, she independently performed tasks such as turning on the computer and connecting to the internet.

Nevertheless, despite the use of picture passwords for kindergarten and primary school students, the Code.org site requires a username and password for login. The student consistently needed support with this. The Code.org platform was chosen by the researchers due to the simplicity and clarity of its block-based coding interface. However, it was found that the login interface was confusing for the participant. The participant was unable to find the login section (located at the top right corner) during the sessions (See Figure 7). The other colorful sections on the page distracted her, and she chatted about them. In other words, it was determined that she needed support for logging into the system.

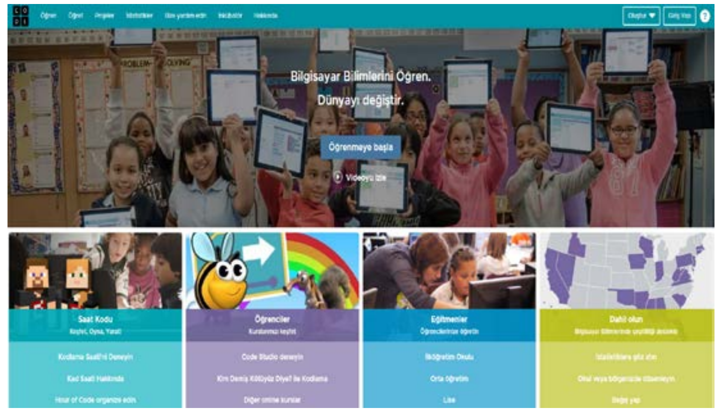

Figure 7.
Code.org Login Page Interface

Additionally, information technology devices or internet connections sometimes encounter technical issues, which can lead to time loss during lessons. Although the participant did not feel the need for help while using the computer during activities, she panicked and did not touch anything when the internet connection was lost, waiting for the instructor to assist her. The participant openly expressed her need for help when necessary. In short, the participant needed to be supported and encouraged by the researcher throughout the application process regarding the use of information technology devices. Some of the participant's reactions to this situation are as follows:

> Buse: "The connection is lost, teacher."
> Buse: "Can I turn on the computer today?"
> Buse: "I have a tablet at home; I can use this too. I can do it."

During these processes, a self-observation chart was prepared to assist the student in remembering the steps of algorithmic thinking during the sessions, using modeling and guided practices. However, it was observed that the student struggled to read this support material, and coloring the smiley face symbols took a long time, leading to boredom and reluctance to use it. A statement reflecting this situation is as follows:

> Buse: "...don't give me this paper; I don't need it. Coloring takes too long."

The participant was observed to be more successful in placing herself in the character's position during game activities. It was noted that she needed more concretization in activities on paper. During these activities, the researcher helped the participant to determine the direction in which the character would turn by using either a toy or the participant's own body to provide concretization (See Figure 8).

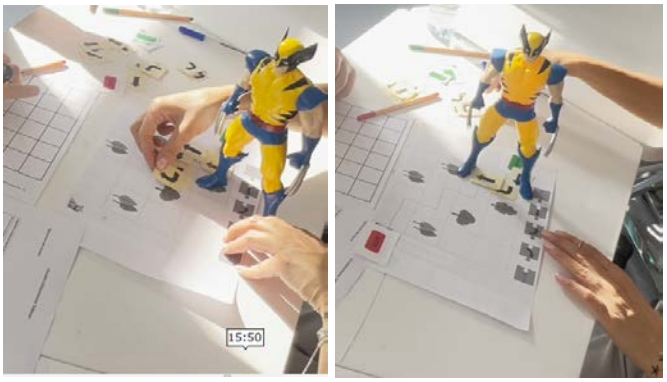

Figure 8.
Concretization Support

Conclusion, Discussion and Recommendations

This study concluded that a student with mild intellectual disabilities reported positive views regarding the coding education provided and actively participated in the sessions. Additionally, it was found that block-based coding materials should be emphasized in coding education for special needs students. In this context, if paper-pencil activities are to be used, preparing them with solid materials will enhance the student's ability to concretize. The materials used should also be designed with more vibrant colors to capture the student's interest.

When examining the student's performance based on the materials used in the coding education provided to the student with mild intellectual disabilities, it was observed that the student was most motivated by block-based coding activities, followed by paper-pencil and game activities.

Finally, this study identified individual supports that could be used in teaching coding to middle school students with mild intellectual disabilities. The participant needed validation from the instructor and support during the game and paper-pencil activities. However, during the block-based coding activity on the Code.org platform, she did not require validation or support. On the other hand, the participant needed help logging into the Code.org site. Therefore, it is essential to ensure that the coding environment selected in research involving special needs students is simple and that the login interface is not complex. Additionally, it was found that the self-observation chart created to help the student remember the steps of algorithmic thinking was not suitable for the special needs student. For future research to effectively serve its purpose, it is suggested that the sentences be shortened, the font size increased, and that the participant be allowed to place marks in her desired color instead of coloring smiley face symbols. In this direction, it can be said that further research is needed on these supports that can help assist special needs students during coding instruction.

In this study, the participant needed support for concretization, verbal expression of the activities before each session, and assistance accessing the block-based coding platform to ensure her active participation in coding activities. While two of these supports are not specifically related to coding, it is essential to conduct single-subject research to investigate the impact of these individual supports on learning. Providing excessive support when assisting a special needs student can lead to learned helplessness in the individual (Causton-Theoharis, 2009; Giangreco et al., 2005; Snodgrass et al., 2016; Stoner et al., 2006). Therefore, as applied in this research, support should only be provided at the moment the individual needs it, with the amount of support gradually increased according to the student's needs.

This study focused on only one student. Therefore, the results cannot be generalized to other contexts. Repeating this study will further support whether the results can be generalized among students and contexts. It is observed that there are many different diagnoses in special needs individuals, such as autism spectrum disorder, Down syndrome, and mild intellectual disability. Considering that this study was conducted with only a student classified as having mild intellectual disabilities, further research is needed on how to teach coding to special needs students.

Additionally, it is believed that information technology education should be included in the curriculum for special needs students. In this study, the participant with mild intellectual disabilities was motivated to learn coding with materials and supports tailored to her special needs. In summary, it has been concluded that special needs students require technology-specific supports and motivating activities to achieve success and actively participate in coding education. If these needs are not met, it is believed that special needs students will not be able to participate meaningfully in coding activities. Currently, special needs students are deprived of the technology lesson experiences that students in regular classes receive at the K-12 level. Therefore, it is suggested that individual supports tailored for special needs students should be identified, with the goal of increasing the student's active participation in technology lessons.

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Informed Consent: Written consent was obtained from the student and his/her parents who participated in this study.
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