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DEVELOPMENT OF "INTELLIGENT RULER" TO ENHANCE MEASUREMENT SKILLS OF SPECIAL EDUCATION NEEDS (SEN) STUDENTS IN THE SUBJECT OF SPECIFIC VOCATIONAL SKILLS: BASIC CLOTHING SEWING

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ABSTRACT

Skills in TVET (Technical and Vocational Education and Training) are an important aspect that needs to be instilled among students, especially for Special Education Needs (SEN) students. This skill requirement serves as an early preparation for SEN students to be involved actively and effectively in the industry upon completing their education. Therefore, one of the subjects that apply hands-on skills for SEN students is the subject of Basic Clothing Sewing, which involves fundamental technical tasks such as accurate measurement. Therefore, this study aims to identify the level of measurement skills among SEN students and the need for the development of Teaching Aids, namely "Intelligent Ruler". The study population was centered at Sekolah Menengah Kebangsaan Bandar Seri Putra. The sample of this study was focused on 20 SEN students who took the subject of Basic Clothing Sewing and 10 teachers who were directly involved in teaching SEN students. The data obtained from the teacher's feedback found that the skill level of the SEN students face serious challenges in measurement related skills. A total of 34% of students were categorized as "Very Weak", while 33% were at the "Weak" level. Meanwhile, the assessment of students' assignments is according to the range of the Sijil Pelajaran Malaysia (SPM) examination which is at grade G which is the lowest. Therefore, 100% of teachers also agree if this "Intelligent Ruler" is developed. In conclusion, the development of the "Intelligent Ruler" is very much needed and seen as a practical solution to help improve the level of measurement skills among SEN students, thereby increasing their mastery, confidence, and future employability in TVET-related fields.

Keywords: Level of measuring skills, Teaching Aids and Special Education Needs.

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INTRODUCTION

In an era of rapid globalization, every individual, regardless of ability, deserves an equal opportunity to build a brighter future. However, for Special Education Needs (SEN) students the challenge of achieving an independent life requires more holistic and structured support. Therefore, these SEN students need to instill skills in them to prepare for the future. One of the skills applied in learning is the skill of measuring and marking for the subject of Specific Vocational Skills (SVS) Basic Clothing Sewing. Measurement skills are one of the important aspects of the academic and functional development of special education students (Jones & Lee, 2022).

Programs such as the Integrated Special Education Program (PPKI) that was created to provide an inclusive education approach in Malaysia aimed at ensuring that SEN students have access to the same educational opportunities as other students in the mainstream education system. They may have learning disabilities, physical disabilities, developmental disorders, or cognitive impairments that affect the way they learn and master basic skills but are not the main problems to learn in the field of education and to delve into advances in technology in education.

Teaching aids are very important in education. It can include a variety of equipment, technology, and special materials that assist teachers in teaching students with needs such as autism, physical disability, dyslexia, and hearing impairments. This tool is designed to overcome the difficulties students face in understanding and absorbing lessons better. With appropriate use, teaching aids can enhance learning, engage students, and help them achieve their best academic achievement.

The use of the Internet of Things (IoT) in teaching aids for SEN students can improve their skills through more interactive, accessible, and individual-focused learning. SEN can overcome learning challenges and improve the quality of their education. According to a study by Mustaffar Abd Majid and Nor 'Azah Ahmad Safran (2023), the use of assistive technology in special education teaching and learning can improve the learning effectiveness of SEN students by providing an approach tailored to their needs.

The development of teaching aids using IoT has great potential to improve students' achievement and more active learning abilities in daily learning activities (Ali et al., 2024). This IoT technology has the potential to improve the ability of students to self-learn and be able to understand learning more effectively.

For students with special needs, the use of adapted aids not only helps in providing clearer explanations but also gives them the opportunity to interact with the teaching materials more actively. For example, visual aids, such as pictures or symbols, are very helpful for students with communication or language problems (Kim & Park, 2021). Assistive technologies, such as voice- based software equipped with learning applications, are also growing in popularity due to their ability to be tailored to the individual needs of students (Huang et al., 2022). Without appropriate support, they may find it difficult to keep up with mainstream learning in subjects that involve technical skills such as sewing (Brown, 2020).

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Therefore, teaching aids are not only beneficial to students but also help teachers to communicate information more effectively. Teachers can use a variety of methods tailored to the abilities of students with special needs, either through visual, audio, or a combination of both. This is in line with the differentiated instruction approach, where teachers need to adapt their teaching techniques to be more inclusive and responsive to the diverse needs of students (Jones et al., 2020).

Students need to be exposed to the Internet of Things (IoT) learning to enable them to master technological skills that are relevant to today's needs. Through IoT learning, SEN students can build self-confidence, communication, and problem-solving skills in a more interactive manner. In addition, this technology also helps to improve their abilities in operating smart devices, thus providing them with wider opportunities for them to be independent and participate in technology- based jobs. Therefore, the integration of IoT in special education not only enriches SEN student's learning experience but also builds a more inclusive and sustainable future.

Other than that, SEN students need significant exposure to Internet of Things (IoT) learning as a foundation to master the technological skills that are increasingly dominating the 21st century work and life landscape (Hussain et al., 2023). Mastering these skills is not only relevant to the development of the industry but also important in preparing SEN students for a future that is increasingly dependent on smart technology (Wong & Lee, 2024). The IoT learning approach in special education is not just to introduce new technologies, but it enriches the SEN students' learning experience by making it more relevant, engaging, and tailored to individual needs (Ng & Tan, 2022). This inclusive approach builds a more sustainable future by preparing SEN students to be more active in society and ensuring that they are not left behind in the current of global development (Lee et al., 2023).

PROBLEM STATEMENT

According to Zalizan (2009), among other characteristics of students with learning disabilities are difficulty learning skills, difficulty following instructions and poor concentration. Students with learning disabilities are also among the students who are at risk in terms of comprehension, and information retention due to their poor concentration (Manisah & Norizza, 2016). In addition, this problem also affects learning skills including the teaching and learning process and frequent mistakes in schoolwork and homework (Dogru, 2014). Among the categories of students with learning problems are Dyslexia, Attention Deficit Hyperactivity Disorder (ADHD), Slow Learner, Autism, Down Syndrome, Mild Intellectual Retardation.
According to Zalizan (2009) children with learning disabilities are those who have neurological problems that affect comprehension, language use, speech, writing, thinking, reading, writing, spelling and arithmetic. Therefore, these SEN students often face challenges in their measurement skills due to their difficulty in understanding abstract concepts such as units of measurement and marking straight. Studies show that deficiencies in cognitive abilities and spatial visualization make it difficult for them to make accurate measurements (Smith & Jones, 2021). This is supported by Gomez and Parker (2020) weaknesses in visual processing and spatial perception also contribute to their inability to measure correctly, especially in practical tasks such as measurements in vocational skills.

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Although students are often taught the same thing, SEN students often forget. This is because SEN has short-term memory problems that can also affect the ability of students to perform measurement tasks consistently and accurately (Clark & Wilson, 2020). Furthermore, SEN often suffer from weaknesses in measurement skills and lack of numerical mastery, which are important basic skills in various areas of learning. Studies show that this problem stems from cognitive difficulties that prevent them from understanding basic concepts of measurement and mathematical operations in depth (Williams & Douglas, 2021). These pupils also tend to experience confusion in associating number symbols with actual quantities, making it difficult for them to make accurate comparisons or calculations (Chen et al., 2020).

Measuring skills are fundamental in the field of clothing sewing, specifically in vocational skills courses. However, many SEN students face difficulties in obtaining accurate measurements which can affect the final result of the clothes sewn. Based on the Education Act 1996 in Malaysia, special education pupils refer to children who need learning that suits their special needs.

The lack of a deep conceptual understanding of the measurement unit, scale, and measurement process itself is often the main reason why SEN students are not proficient in measuring accurately (Rahman & Yusoff, 2022). In addition, the lack of opportunities to apply measurement skills in a practical and relevant context in daily life also contributes to the difficulty in mastering these skills (Hassan et al., 2023).

In addition, there is also a lack of knowledge and skills to improve technological skills in teaching and learning sessions. There are also teachers who are not skilled in using appropriate educational technology to assist SEN (Kim & Park, 2021) in learning and teaching sessions. Therefore, the application of technology in education for SEN students is limited. Despite the growing recognition of IoT concepts, there are still shortcomings in the development of IoT-based learning aids specifically designed to meet the needs of various Pupils with Special Education Needs (Rahman et al., 2022). In addition, studies on the effectiveness of IoT in improving SEN students' learning, independence, and participation are still limited. Therefore, more research is needed to validate the potential of this technology in special education (Smith & Jones, 2023).

In the context of skills, special education pupils often need special help to master basic skills such as reading, writing, arithmetic, and social skills. Weaknesses in these skills can include an inability to understand basic mathematical concepts, recognizing letters, or difficulty mastering manipulative and technical skills such as the use of technological equipment. Emphasis is placed on interventions tailored to their level of understanding, such as the use of teaching aids, structured activities, and interactive technology. Therefore, these SEN students may require additional interventions such as special teaching aids, assistive technology, and flexible curriculum to help them overcome constraints in mastering basic skills, such as reading, writing, and arithmetic.

OBJECTIVES

1. To identify the level of measurement skills among SEN students for the subject of Specific Vocational Skills (SVS) Basic Clothing Sewing.
2. Development of an "Intelligent of Ruler" for SEN students using an IoT approach.

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POPULATION AND SAMPLE

The population of this study was focused on students with special educational needs of the Integration Special Education Program at Sekolah Menengah Kebangsaan Bandar Seri Putra. The study sample consisted of 20 SEN students to identify the level of measurement skills and 10 SEN teachers for the development of “Intelligent of Ruler".

METHODOLOGY

Research methodology refers to the systematic process or approach used by researchers in conducting research. It involves various measures, techniques, and procedures used to collect, analyze, and interpret data to achieve the objectives of the study. Accurate methodology helps researchers ensure that studies are conducted scientifically and reliably. Creswell (2020) states that methodology is a framework that guides researchers in selecting data collection tools, study design, and data analysis procedures, ensuring that the study process is logical and coherent to answer research questions. In this study, the research used the ADDIE Model for the development needs. Therefore, this study was carried out using a quantitative approach by giving questionnaire instruments to teachers as respondents and while students were given assignment papers. In the context of this study, the researchers used the even number Likert Scale which is a scale of 1 to 4 scale.

1. Analysis

The following is an analysis of SEN students’ skill levels based on the teacher’s instrument as shown in table 1.

Table1: *Analysis of Measurement Skill Levels Among SEN Students*

ITEM	Very weak		Weak		Moderate		Good		VeryGood	
	F	%	F	%	F	%	F	%	F	%
Students can draw straight lines using a ruler	2	20	3	30	3	30	1	10	1	10
Students can correctly master the sequence of numbers	4	40	3	30	3	30	0	0	0	0
Students can recognize each number	4	40	4	40	1	10	0	0	1	10
Students are confused about the value of numbers given	4	40	4	40	1	10	0	0	1	10
Students easily forget numbers	3	30	4	30	1	10	1	10	0	0
Students can sketch the initial point of a line correctly	3	30	3	30	4	40	0	0	0	0
Students can sketch lines accurately	3	50	4	40	0	0	2	10	0	0
Students can hold a pencil and ruler correctly	2	20	2	20	4	40	0	0	2	20
TOTAL PERCENTAGE		34		33		21		4		6

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Table 1 shows that a significant portion of SEN students face serious challenges in measurement- related skills. A total of 34% of students were categorized as “Very Weak”, while 33% were at the “Weak” level. The item *“Students can sketch lines accurately”* recorded the highest percentage in the “Very Weak” category at 50%, reflecting difficulties with line accuracy and spatial coordination. These findings are supported by Mitchell and Sutherland (2020), who noted that SEN students commonly struggle with measurement and line-marking tasks, which can negatively impact their performance in practical or technical subjects.

The table also highlights that SEN students encounter substantial difficulties in basic numeracy. Items such as mastering number sequences, recognizing numbers, and understanding numerical values each recorded 40% of students at the "Very Weak" level and another 40% at the "Weak" level. These consistent weaknesses indicate serious gaps in foundational math skills. According to Wasterlid (2020), SEN students often struggle with basic numeracy concepts, including number arrangement and value recognition. This poor understanding of numbers limits their ability to perform measurement-related tasks and affects their progress across various learning areas.

Furthermore, only a small number of students demonstrated higher-level proficiency: just 4% were categorized as “Good”, and 6% as “Very Good”. For example, only one student (10%) showed very good ability in recognizing numbers and drawing straight lines. No students reached the “Very Good” level in mastering number sequences. These results reinforce the conclusion that most SEN students lack competency in essential measurement and numeracy skills. Therefore, there is a pressing need to provide suitable learning aids and interventions that incorporate technology and personalized support. This approach will help students overcome barriers, build self-confidence, and participate more actively in the learning process.

2. Design

In the initial design stage, the researchers chose an idea to address the main problem of SEN students who are not able to mark and measure accurately. Collect a variety of new ideas through internal resources such as company research and development, as well as external sources such as customer feedback and competitor analysis. Selection of Ideas- the acquired ideas will be integrated in this product. Next, the researchers produced a conceptual sketch of an innovative measuring device product called "Intelligent Ruler." This sketch integrates elements of the Internet of Things (IoT) with the aim of improving the functionality and efficiency of traditional measuring instruments.

The application of IoT elements at this design stage is intended to enable more accurate measurements and be able to apply learning digitally. In this phase, researchers have managed to sketch a visual prototype that illustrates an innovative idea that integrates sensors, communication commands, buzzers, LED lights and motorized tracks into a sketch of a measuring device. This approach is in line with current technological advancements in smart product design that leverage interconnected capabilities and data exchange (Gubbi et al., 2013). Indirectly, this sketch shows how IoT technology can be implemented to overcome the limitations of conventional measuring devices, such as improper measurements and the potential for human error (Want, 2010).

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3. Development

In today's digital era, the use of automation technology is becoming more widespread. Arduino is one of the open-source platforms that allows users to develop electronic systems easily and at a low cost. Therefore, the development of the "Intelligent Ruler" using the Arduino platform was chosen for its open, flexible, and relatively affordable nature, making it an ideal platform for creating customizable learning aids for special education students (Khan et al., 2020). The use of technology-based can help special education students become more confident and confident in using technology

DISCUSSIONS

The purpose of the requirements study is to obtain information on the development needs of the "Intelligent Ruler" product. Based on the research data obtained, the assessment of assignments was based on measuring skills in units of inches given to students. The assessment of assignments is based on the scoring range and grades of the Malaysian Examination Certificate (SPM). Therefore, the results obtained that 60% of the students obtained a G grade, which is the lowest grade. This proves that the level of students' skills in measuring activities is very weak.

In the field of clothing sewing, measurement accuracy is a major factor in producing comfortable and neat garments. Students who are new to learning this skill often make mistakes in measurements, leading to wastage of fabric and messy work. The use of conventional measuring instruments such as rulers and tape measures can sometimes be difficult for students with special needs or who lack experience in sewing. Therefore, smart ruler-based technology capable of providing interactive guidance and instant feedback is needed.

Teaching aids play an important role in the education of students with special needs by helping them understand learning concepts and overcome difficulties in the learning process. The use of appropriate assistive technology can increase the effectiveness of teaching and learning, as well as help students reach their full potential.

Based on the analysis obtained, most SEN students have a poor level of measurement skills. They lack the full mastery of these skills to increase excellence among SEN students. Therefore, SEN needs to be given appropriate tools that follow the current trends involving the latest technology to reach its full potential to integrate with society. Indirectly provides self-confidence and increases active involvement in the learning environment.

CONCLUSION

In conclusion, the development of "Intelligent Ruler." is an innovation that has the potential to increase the level of mastery of measurement skills among SEN students. With the integration of IoT technology, these tools can not only facilitate learning but also assist SEN students in developing better self-skills for their preparation towards a more independent industry and life. Therefore, the use of technology in special education should continue to be developed to ensure the effectiveness of teaching and learning that is more inclusive and responsive to the needs of students.

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