

Impact of AI Tools on the Development of Expressive Language Skills of Children with Intellectual Disability at the Primary Level

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Abstract

Expressive language skills are important for everyone for an independent life. Human interaction is being forced to be replaced by technology. The impact of language skills of children is limited due to attention towards technology and artificial intelligence (AI) tools. This study aims to connect AI tools like ChatGPT and Google AI Studio to develop the expressive language skills of children with mild to moderate intellectual disability. A quasi-experimental study design was employed, consisting of an intervention group (n=10) and a control group (n=10), which included both a pre-test and a post-test. The Madras Developmental Programming System was used before and after the intervention. The study results were significant with $p < 0.05$. The skills, like learning object names, narrating simple stories and jokes, and developing conversations, were developed. The limitations and future work are also discussed.

Keywords: AI tools, expressive language, intellectual disability, language skills, MDPS, technology

INTRODUCTION

AI tools play a vital role in enhancing expressive language by offering personalized, real-time feedback and adaptive learning. They support users in improving their vocabulary, grammar, sentence structure, and clarity, making communication more effective. In educational and therapeutic contexts, AI-powered apps help individuals, including those with language delays or disabilities, develop expressive skills through consistent, tailored practice. These tools also assist non-native speakers in learning to use natural language and enable creative expression through writing prompts and language games. Overall, AI fosters greater confidence, accessibility, and fluency in communication across diverse learning requirements.

The greatest aid for those with impairments to live independent lives in the twenty-first century is technology and digital media. The use of computers and mobile devices in classrooms to teach mathematics to students has significantly increased over the past several decades (Min Wook). As numerous studies have demonstrated the benefits of adopting digital tools for mathematics learning, students need user-friendly software and apps to improve their comprehension and increase their active learning. Digital resources are more easily available, engaging, and useful for comprehending material [1–30].

The most promising development pathways for children with ID seem to be through digital media [31]. The primary components of the current study are the development of expressive language skills for independent living. One of the study's

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distinctive features is the use of an AI tool to help children with ID improve their skills by having them complete easy online activities. The need for digital assistance, expressive language abilities, and an independent life must be explored to maximize the use of these devices for the well-being of children.

Related Studies

Related studies, including AI tools for developing expressive language skills in intellectual disabilities, are limited. Few studies have been conducted on this topic. Drljić conducted a thorough analysis of mathematical challenges and digital technologies. It divided the material into six main headings, including math challenges, cognitive and psychological processes, impediments, and various forms of digital technologies and frameworks that address these issues. Resources, both digital and non-digital, mathematics education and learning, and mathematical aptitude and openness to learning.

Klingenberg compiled reviews of digital arithmetic instruction for visually impaired students. He concluded that interactive online learning combined with tactile and aural learning can help children improve their math abilities. He also concluded that there is insufficient data to support the idea that digital tools can help visually impaired people learn math.

Kumaş investigated the effectiveness of digital stories as a cutting-edge method of teaching mathematics to young students with intellectual disabilities. To improve the educational process, he combined text, audio, and graphics using a multimedia approach. This study showed a promising strategy for enhancing young math proficiency in children with minor learning impairments. Additionally, the results indicate that incorporating digital storytelling into special education courses can enhance students' mathematical proficiency.

In a pilot study, Lindau documented the impact of a brief digital intervention on the perception of intellectual disability. When used as an intervention, film-based teaching had a slight positive impact on the attitudes of individuals with intellectual disabilities. For a discernible effect, the study also recommended a web-based intervention. Maed-Math investigated how mathematics instructional videos mediate the relationship between students' academic motivation and teaching tactics. A strong correlation was found between math tutorial videos, academic motivation, and teaching methods.

Faragher engaged in research concerning numeracy tailored for a digital environment, specifically for learners with Down syndrome, centering on the notion of functional mathematics. This study investigates impediments through the theoretical framework of educational quality of life and the advancement of numeracy, while emphasizing the creation of a suitable mathematical curriculum designed to foster enduring numeracy skills.

Ryan used an augmented reality-based training package to examine the efficacy of video-based arithmetic instruction on seven middle school students with distinct learning disabilities. To answer complex multistep arithmetic tasks, such as adding, subtracting, multiplying, and dividing integers, converting measurements using ratio reasoning, and calculating the rate of change through multiplication and division, the study employed a video model. The trial's findings showed that every stage of math issues was fixed following the intervention.

According to Min Wook's review of the impact of computer-assisted instruction on the mathematical performance of students with learning disabilities, well-designed computer-assisted instruction with effective instructional variables should be regarded as a promising intervention to support mathematics instruction. Park examined the results of a synchronous online intervention for children with learning difficulties that employed virtual manipulatives to teach them about equivalent fractions. Fifteen fraction lessons were taught using interactive whiteboards and one-on-one video conferences. Improvements were observed as a result of the intervention, even though the degree and sustainability of the improvement varied.

Sheila Lestari Giza researched how individuals with disabilities access information through digital applications. The results showed that deaf and blind people benefit from having access to information via digital applications. This technology is making life more accessible and independent. Min Wook investigated how students with learning difficulties perform in math after receiving computer-assisted instruction. The findings showed that learning mathematics was impacted by both a significant maintenance effect and a medium intervention effect. Rafiquddin thoroughly examined early literacy intervention digital training for special education teachers (Table 1).

With an intervention and a control group, Vereenoghe sought to co-develop a digital psychoeducational intervention to enhance the mental health of individuals with intellectual disabilities. This study showed that developing innovative digital treatments can involve individuals with ID. Children with ID and sensory impairments may now carry out everyday tasks independently via Lancioni's smartphone intervention. All participants in this trial received smartphones along with instructions at a predetermined time. The intervention helped improve performance in daily tasks.

Benavides-Varela examined the effectiveness of a digital-based intervention. When a digital-based intervention was used, math skills improved. However, there is no evidence that video games provide any further benefits over digitally based coaching and drilling methods. Considering the above studies, the researcher planned an intervention to help children with intellectual disabilities improve their expressive language. This study aimed to integrate an AI tool to develop and advance expressive language skills.

AI Tools for Developing Language Skills

AI tools are helping to develop language by making learning easier, faster, and more accessible. They offer personalized lessons, correct grammar and pronunciation, and allow users to practice speaking through virtual conversations. AI is also used to translate languages, support endangered languages, and create learning content for schools. Speech recognition, text-to-speech, and chatbots make language practice interactive and available at any time. These tools are especially helpful in areas with limited access to teachers and resources. Overall, AI supports learning and preserving languages worldwide (Figure 1). AI tools have a greater impact on the development of language skills in children with disabilities. The relationship between language skills, independent life skills, and AI tools is shown in Figure 1. The integration of AI tools in language development is a more important area in today's world [32–47] (Figure 2).

METHODOLOGY

The study employed a quasi-experimental design [48] with a pre-test and a post-test, involving 10 students in the intervention group and 10 in the control group.

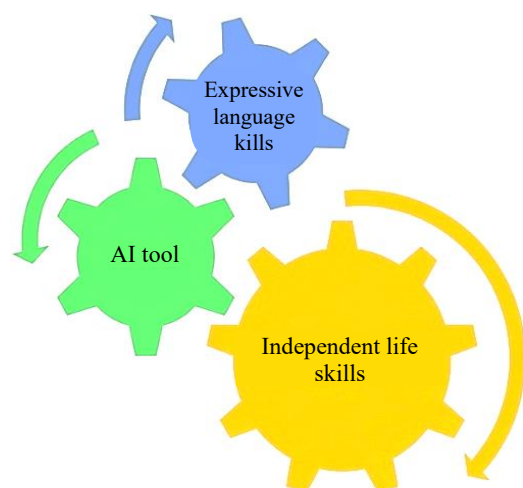


Figure 1. The relationship between language skills, independent life skills, and the AI tool.

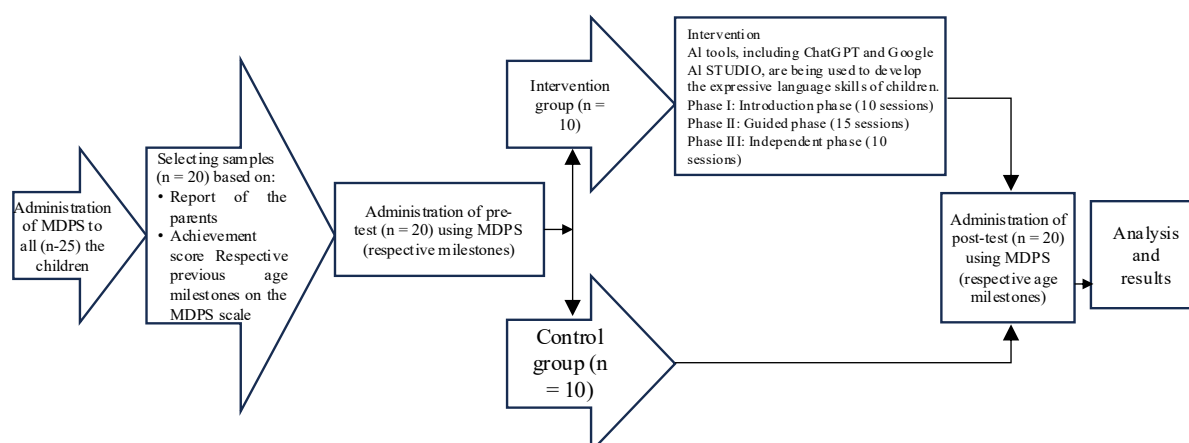


Figure 2. Impact of an AI tool on the development of expressive language skills of children with intellectual disability at the primary level.

Participants

Twenty primary school children from a special school for children with intellectual disabilities participated in the study. Mild and moderate children [11, 12, 14, 25, 26, 34, 37] were included in the study, considering the educational [32] ground of the severe and profound ID children renders them unable to acquire skills [32]. Though the prevalence of ID is greater in males [32], the present study aimed to include both genders to promote equality. Less research is done on the expressive language abilities of ID at the primary level, for students aged 6 to 14, because a solid foundation for language can be established at the primary level. The participants' demographic data are displayed in Table 1. These kids are enrolled in a special education program that uses the state board curriculum. English serves as the students' primary language of education.

Materials

The Madras Developmental Programming System (MDPS) is a tool developed to assess the functional skills of intellectually disabled children in India. It consists of 18 domains. Domain III (Table 2) focuses on numbers, which are highly related to the expressive language skills of intellectually disabled children. The data were sequenced based on the years. Prerequisites for learning age-appropriate functional math skills are considered. For example, if the child is in the 4th grade, the previous skills are considered prerequisites (Table 2).

Intervention Design

The intervention consisted of 30 sessions divided into three phases, continuously over two months. Phase 1 consisted of an introduction with 10 sessions, the second phase was the guided phase with 10 sessions, and the third phase was the independent phase with 10 sessions. Each session lasted 40 min. The planned activities are student-centered. They were allowed to rest and take breaks between the sessions. All the students were given an orientation about the study and the materials, such as a mobile phone and a computer. A few activities were also shown to students during the orientation sessions. For each student, an Individualized Education Plan (IEP) was prepared by the teacher according to the needs and levels of the student. Word problems, which are highly related to independent and vocational skills, are taken from their regular textbooks. The selected problem will undergo the following steps. Students will be assessed every 5th class of the study as an informal test.

Phase 1 is an essential rapport-building stage between the student and teacher. The teacher-to-student ratio was 1:2 in both groups. Prompts such as "Did you find the number?", "What operation to be done?", "Any difficult words?" were asked. Errors were corrected after each step (Sarah, 2020). Verbal and nonverbal reinforcement is provided when needed.

During the initial guided phase, a few steps were demonstrated. Each step was guided by the teacher using task analysis. Statements like “very good,” “you can do more,” “you are the best,” and “that’s great work” were used to encourage the participants to complete steps and problems. Mistakes in the problems were corrected in parallel during each session. Guidance and prompting were gradually reduced in the later phases.

In the independent phase, the students were encouraged to use the AI tool. Encouraging statements were provided only at the end of the solution. Although students required assistance at the beginning of the phase, independence in solving problems was practiced by the students at the end of the phase (Table 3).

Follow-up sessions were conducted after the intervention. In this phase, only concepts and themes were assigned as homework. Students were asked to use the AI tool and develop the concept. During the follow-up sessions, most (79%) children solved the given problem independently.

Table 1. Demographics of the participants in the intervention group.

Variables	Category	Number
Gender	Male	8
	Female	2
Age	6 to 9	6
	9 to 12	4
Grade	2 and 3	7
	4 and 5	3
Primary diagnosis	ID	5
	ID and ASD	5

Table 2. The MDPS scale domain III: language (Expressive).

Age level in years	Item number	Domain 3 language (expressive)
0–5	21	Imitates five vowel sounds.
	22	Uses yes/no by nodding of head.
	23	Indicates basic needs by pointing or gesturing.
	24	Speaks five single words meaningfully.
	25	When asked, tells own name.
	26	Imitates sounds of animals and inanimate objects.
	27	Uses two-word phrases.
	28	Tells of five familiar objects.
	29	Describes actions of people using words.
	30	Uses words to indicate commands.
	31	Indicates sex.
5–7	32	Name five common vehicles.
	33	Name five common animals.
	34	Name five common vegetables.
	35	Name five common fruits.
	36	Recites rhymes of at least 3-4 lines.
	37	Uses adjectives like long-short, rough-smooth, and clean-dirty.
7–9	38	Uses complex sentences.
	39	Narrates simple jokes.
9+	40	Carries on simple conversations.

Table 3. Scores of the intervention group on the MDPS scale.

S.N.	Pre-test (100)	Post-test (100)	Follow-up (100)	Differences (pre-and post-test)	Variance	SD	t-value	p-value
1	50	79	83	29	169			
2	35	81	82	45	9			
3	40	85	90	45	9			
4	20	77	76	57	225			
5	15	45	56	30	144			
6	21	76	81	55	169			
7	12	89	91	77	1225			
8	43	74	84	31	121			
9	39	87	88	48	36			
10	36	80	84	44	4			
11	26	62	77	36	36			
12	44	89	92	45	9			
13	44	60	84	16	676			
14	59	92	92	33	81			
15	56	91	90	35	49			
Average	36	77.8	83.33333333	41.73333333	197.4666667	14.05228	9.393	0.0000001

RESULT

A pre-test was conducted immediately before the intervention. The children were not aware of the intervention, methods, or materials during the pre-test. The post-test was conducted after the 30 sessions of intervention.

The names of the students were noted as serial numbers.

During the pre-test, the mean score of children on the MDPS was 36%. In the post-test, the MDPS score increased to 77%. This shows that the intervention was effective. Follow-up sessions were highly beneficial for children, with a score of 83%. The score in Table 3 for the control group on the MDPS shows less difference, indicating that there was no significant difference in regular teaching. The pre-test scores of the intervention (36%) and control groups (36.5%) were almost equal. The post-test scores of both groups were significant.

The post-test scores of the intervention group (n=10) on the MDPS scale were higher than those of the control group (n=10), with a p-value of 0.0000001. There was a 41% increase in the post-test MDPS score compared to the pre-test score. A paired test was performed on the MDPS. When analyzing the pre-test and post-test scores, the difference was significant with a p-value of 0.00000001. As $p < 0.05$, the intervention had a significant impact on the experimental group.

DISCUSSION

A total of 20 sessions were scheduled. The number of sessions for each student varied (mean=20) because each student's IEP was customized. Better performers required fewer sessions than those who needed more time to understand the content. During the first phase, students faced problems adapting to the teachers and materials.

The feedback from the students was that "using the AI tool was interesting and more engaging than the regular books." "Children started to do their screen time effectively at home every day," said the parents. This shows that the students were interested in performing their daily activities more independently than ever before. The teachers regularly reported that the students started to think and

connect conversations in the AI-based activities. By doing these activities, children also develop their eye-hand coordination, healthy habits, and happiness in living an independent life. They unconsciously develop skills such as problem-solving and critical thinking. Additionally, non-targeted skills such as cooperation among the team, listening, waiting for the turn, spelling, reading, and understanding the meaning of the sentences are also achieved. The findings show that these activities not only help in developing functional skills but also use screen time effectively. The skills required for modern independent living are the outcomes of refined technologies. The results align with earlier findings on the contribution of ethnomathematics to academia.

Future Work

Based on this study, it can be recommended that other concepts in math, reading, writing, and science can also be learned through AI tools. More studies should be conducted on children with severe intellectual disabilities with a larger sample size to teach expressive language skills. Expressive language skills are highly related to vocational skills, which are an important factor in leading an independent life.

CONCLUSION

Using AI tools is not only fun but also encourages students to think in ways that they can understand. Personalized learning, real-time feedback, flexible access, and increased engagement will be enhanced. This illustrates that there is no strict division between independent skills and AI tool activities. AI tools contribute to healthy and independent human lifestyles.

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