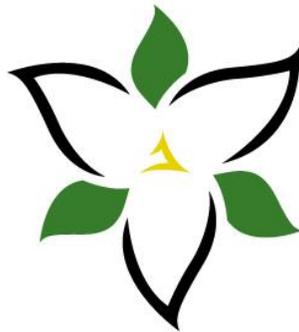


**Effectiveness of Online Teaching Methods for Students with
Learning Disabilities: Analysis of the JUMP Math Program**



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Introduction

The Learning Disabilities Association of Niagara Region (LDANR) offers various programs, focusing on numeracy, literacy and self-advocacy for children and youth with learning disabilities. One of the programs offered by the LDANR, with support from the Ontario Trillium Foundation, is an individualized numeracy tutoring program called JUMP Math, which is designed for children in grades 1 to 8. Students in the JUMP Math program have a diagnosed or suspected learning disability which leads to lower performance in mathematics and higher levels of math anxiety. Specifically, most children in the JUMP Math program experience difficulties due to dyscalculia, which is a mathematical learning disability that makes it difficult to comprehend numerical computations (Morsanyi et al., 2018). To continue supporting students with these difficulties during the COVID-19 pandemic, the LDANR has offered their JUMP Math program in a virtual environment.

Virtual Learning Environment

The LDANR was unsure about the effectiveness of the JUMP Math program in a virtual environment as studies have demonstrated reduced levels of motivation, concentration, and engagement for students with learning disabilities in online environments (Makarova, 2021). However, studies have also emphasized that students with learning disabilities can be successful in a virtual environment through the effectiveness of a multi-faceted approach to design, development and providing the lessons. By using a variety of teaching techniques, increasing engagement through activities, and building rapport with the students, it can help ease the math anxiety of students with learning disabilities (Petretto et al., 2021) and allow them to succeed in this type of environment. Furthermore, the importance of virtual manipulatives in the lesson plans and activities for the students has been shown to support students with learning disabilities

engage with the material and reduce math anxiety. By incorporating different approaches to teach mathematics to students with learning disabilities in a virtual environment, the effectiveness of the program can drastically improve (Park et al., 2021).

In the past, The LDANR has completed a quantitative analysis of the JUMP Math Program's effectiveness in both face-to-face and online environments which allowed us to determine how well the program supported growth in mathematics. In this report, there will be a quantitative analysis of the JUMP Math Program's effectiveness in an online environment, specifically examining whether the program enhances participants attitudes towards mathematics.

Methods

Participants

In the Fall 2021 program season, there were a total of 20 students who participated in the JUMP program in a virtual environment. These children were from many of Niagara's municipalities, and presumed to be from various socio-economic backgrounds, although no data regarding socio-economic status was specifically collected. Of the 20 participants, 13 were male and 7 were female. Their ages ranged between 7 and 13, with a median age of 9.5.

Procedure

The virtual JUMP Math Program sessions were completed through Microsoft Teams. The tutors provided one-hour sessions two times per week for a total of eight weeks to the participating children. During the tutor's first session, a pre-assessment was administered to gauge their student's level of mathematical knowledge as well as an attitudinal survey to gauge the child's attitude about math. Through the results from the assessment tool, the tutors could tailor their lesson plans to the unique needs of their students. At the end of the program, the

tutors administered the post-survey and the post-assessment tool to allow for quantitative metrics measuring the students' progress in their mathematical competence as well as their attitude toward mathematics.

The pre-survey and post-survey consisted of the same 12 questions, with an additional question on the post-survey which asked whether the child enjoyed the JUMP Math program. The survey includes Likert scale questions to address the self-perception of the students' comfortability, competence, and anxiety around mathematics. Some examples of the questions included "I am comfortable asking questions in math class", "I often use math outside of school", and "I think that this program will help me with math".

Results

The pre-survey and post-survey asked the participating children nine Likert scale questions to assess their attitude, anxiety, and confidence around mathematics. Through quantitatively analyzing the pre- and post-surveys, the children's attitudes and anxiety around mathematics were measured (see Table 1 in Appendix). For the pre-survey, a total of eleven children completed the Likert scale assessment where: 1=strongly disagree; 2=disagree; 3=neutral; 4=agree; 5=strongly agree (see Table 2 in Appendix). For the post-survey, total of ten children completed the Likert scale assessment (see Table 3 in Appendix). By analyzing the mean likert response for each statement (see Table 1 in Appendix), it is possible to discern any changes in students' levels of mathematical anxiety and attitude.

After analysis, it was found that there was an increase in the mean values for three Likert scale statements from the pre-survey to the post-survey: "I am comfortable asking questions in math class"; "I believe I can do well on math tests"; "I often use math outside of school". The remainder of the likert scale questions decreased, however, only the questions "I think I can

answer well when my teacher calls on me in math” and “I think I can do well when I am about to take a math test” decreased from “Agree” to “Neutral”. The remaining questions decreased slightly but still stayed within the same ranking on the likert scale. The limitations of this will be discussed.

Discussion

The pre-survey and post-survey comparison of the Likert scale statements provide insight, although limited, into the impact of the JUMP Math program on the attitude and anxiety towards mathematics of the participating children. The increase observed in the three Likert scale questions demonstrates improved confidence for the students to ask questions in class, perform on math tests, and apply mathematics to their daily lives. However, it is important to note the limitations of this analysis. As only ten students completed the post-survey compared to the 11 who completed the pre-survey, the difference in sample size and lack of matched data may skew the results and findings. Furthermore, the duration of the virtual learning environment compared to in-person sessions presents difficulties towards the effectiveness and impact of the program.

Despite the challenges caused by the COVID-19 pandemic, recent studies have demonstrated that mathematical learning through a virtual environment can be enhanced through use of spiral methods, regular repetitions, and using practical examples, especially for students with learning difficulties (Kadarisma & Juandi, 2021). Furthermore, assistance from parents for motivation can drastically improve the mathematical potential and attitude of their children (Riski et al., 2020). Additionally, there is potential for drastic improvement in the student’s confidence and attitude around mathematics through incorporating visual learning, hands-on experiences, and engagement from family/parents (Putri et al., 2021). To maximize the potential for mathematical achievement and confidence, self-regulated learning is an important concept to

include in the teaching process. Through teaching students goal setting, self-evaluation and self-reflection, the learning process can become more effective and the attitude of the children towards mathematics can improve (Fauzi & Widjajanti, 2018).

The current JUMP Math program incorporates goal setting and reflections but could increase its focus on self-awareness. By revisiting the current approach to the JUMP Math program, specifically as it relates to lesson planning, engagement strategies, and time management, the LDANR can further improve students' confidence around mathematics. Furthermore, engaging the family through supplementary, fun math activities designed to be done at home may help increase motivation and support for the children leading to improved attitude towards mathematics. Finally, encouraging tutors to use daily, practical tasks as examples in lesson plans and repetitive teaching styles, they will be able to help students improve their comprehension and mathematical achievement.

References

- Fauzi, A., & Widjajanti, D. B. (2018, September). Self-regulated learning: the effect on student's mathematics achievement. *In Journal of Physics: Conference Series* (Vol. 1097, No. 1, p. 012139). IOP Publishing. <https://doi.org/10.1088/1742-6596/1097/1/012139>
- Kadarisma, G., & Juandi, D. (2021, November). Mathematics Learning for Students with Special Needs During the Covid-19 Pandemic. *In Journal of Physics: Conference Series* (Vol. 2123, No. 1, p. 012008). IOP Publishing. <https://doi.org/10.1088/1742-6596/2123/1/012008>
- Lambert, R., & Schuck, R. (2021). "The Wall Now Between Us": Teaching Math to Students with Disabilities During the COVID Spring of 2020. *The Asia-Pacific Education Researcher*, 30(3), 289-298. <https://doi.org/10.1007/s40299-021-00568-8>
- Morsanyi, K., van Bers, B. M., O'Connor, P. A., & McCormack, T. (2018). Developmental dyscalculia is characterized by order processing deficits: Evidence from numerical and non-numerical ordering tasks. *Developmental neuropsychology*, 43(7), 595-621. <https://doi.org/10.1080/87565641.2018.1502294>
- Park, J., Bryant, D. P., & Shin, M. (2021). Effects of Interventions Using Virtual Manipulatives for Students With Learning Disabilities: A Synthesis of Single-Case Research. *Journal of learning disabilities*, 222194211006336. Advance online publication. <https://doi.org/10.1177/00222194211006336>
- Petretto, D. R., Carta, S. M., Cataudella, S., Masala, I., Mascia, M. L., Penna, M. P., Piras, P., Pistis, I., & Masala, C. (2021). The Use of Distance Learning and E-learning in Students with Learning Disabilities: A Review on the Effects and some Hint of Analysis on the Use during COVID-19 Outbreak. *Clinical practice and epidemiology in mental health : CP & EMH*, 17, 92–102. <https://doi.org/10.2174/1745017902117010092>
- Putri, H. E., Suwangsih, E., Rahayu, P., Afita, L. A. N., Dewi, N. K. Y. A., & Yuliyanto, A. (2021). Improving Elementary School Students' Self-Confidence during the Covid-19 Pandemic through

Concrete-Pictorial-Abstract (CPA) Approach in Online Learning. *Jurnal PAJAR* (Pendidikan Dan Pengajaran), 5(2), 306-316. <http://dx.doi.org/10.33578/pjr.v5i2.8193>

Riski, I. A., Fajri, S. N., Maulina, A. R., Sari, D. P., Lauditta, A. E., Yoenanto, N. H., & Fardhana, N. A. (2020). Strategi pembelajaran e-learning untuk ABK pada jenjang PAUD. *JURNAL LENTERA ANAK*, 1(01). <https://ejournal.unisnu.ac.id/jla/article/view/1474>

Appendix

Table 1. Mean Values of the Pre-Survey and Post-Survey Likert Scale Statements

Statement	Pre-Survey	Post-Survey	Difference
I am comfortable asking questions in math class	4.09	4.20	+0.11
I believe that I can do well on math tests	3.73	4.10	+0.37
I believe math is important for my future	4.64	4.20	-0.44
I think I can answer well when my teacher calls on me in math	4.09	3.50	-0.59
I think I can do well when I am about to take a math test	4.00	3.80	-0.20
I am not afraid to make mistakes in math class	4.45	4.20	-0.25
I often use math outside of school	2.91	3.10	+0.19
I believe that I can reach my goals in math	4.64	4.20	-0.44
I enjoy doing math	3.91	3.40	-0.51

Table 2. Statistical Table for Pre-Survey Likert Scale Statements

#	Likert Statement	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	I am comfortable asking questions in math class.	3.00	5.00	4.09	0.67	0.45	11
2	I believe that I can do well on math tests.	2.00	5.00	3.73	0.96	0.93	11
3	I believe math is important for my future.	3.00	5.00	4.64	0.64	0.41	11
4	I think I can answer well when my teacher calls on me in math.	1.00	5.00	4.09	1.16	1.36	11
5	I think I can do well when I am about to take a math test.	2.00	5.00	4.00	0.85	0.73	11
6	I am not afraid to make mistakes in math class.	4.00	5.00	4.45	0.50	0.25	11
7	I often use math outside of school.	1.00	5.00	2.91	1.24	1.54	11
8	I believe I can reach my goals in math.	4.00	5.00	4.64	0.48	0.23	11
9	I enjoy doing math.	1.00	5.00	3.91	1.16	1.36	11

Table 3. Statistical Table for Post-Survey Likert Scale Statements

#	Likert Statement	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	I am comfortable asking questions in math class.	3.00	5.00	4.20	0.75	0.56	10
2	I believe that I can do well on math tests.	3.00	5.00	4.10	0.83	0.69	10
3	I believe math is important for my future.	3.00	5.00	4.20	0.87	0.76	10
4	I think I can answer well when my teacher calls on me in math.	2.00	5.00	3.50	0.92	0.85	10
5	I think I can do well when I am about to take a math test.	2.00	5.00	3.80	0.98	0.96	10
6	I am not afraid to make mistakes in math class.	3.00	5.00	4.20	0.87	0.76	10
7	I often use math outside of school.	1.00	5.00	3.10	1.45	2.09	10
8	I believe I can reach my goals in math.	3.00	5.00	4.20	0.75	0.56	10
9	I enjoy doing math.	1.00	5.00	3.40	1.43	2.04	10