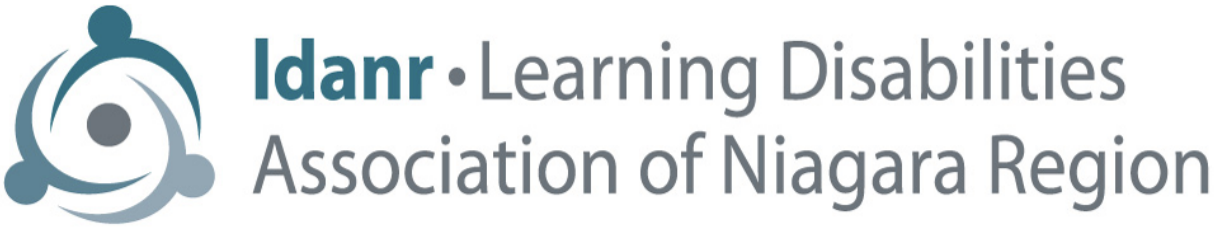
Participant's Experience and Progress in the LDANR's JUMP Math Program: A Case Study



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Founded in 1988, the Learning Disabilities Association of Niagara (LDANR), a non-profit organization, aims to provide resources and support to individuals with suspected, identified, or diagnosed learning disabilities (LDs). A learning disability is a lifelong condition, and it "affects one or more of the ways that a person takes in, stores, or uses information" (LDANR, 2021). Important to note, about 59.8% of disabilities in Canadian children are found to be LDs (LDAO, 2021). That is 3.2% of Canadian children who have diagnosed LDs, and more than half a million Canadian adults have a LD (LDAO, 2021). These high statistics are what make organizations such as the Learning Disabilities Association of Ontario (LDAO) and its branches, such as the LDANR, crucial in providing extra support to those who need it so they may be successful in their education and career.

It is important to note that living with a LD does not mean the individual cannot learn, but rather that they learn and process information differently. By offering various after-school programs to families within the Niagara Region, the LDANR provides leadership in advocacy, research, education, and LD services. As one of the LDAO regional branches, the LDANR works with school boards and agencies within the Niagara Region to help carry out their mission and goals. These programs are all uniquely structured to address specific LDs, such as mathematical LDs, which will be the focus for this study.

A mathematical LD, formally known as dyscalculia, results in "persistent problems in applying the basic methods of arithmetic and in knowledge of math facts" (Haberstroch and Schulte-Körne, 2019, para.6), such as simple addition or subtraction, the multiplication chart, or quantity, for example. To help children with dyscalculia, the LDANR offers the JUMP Math program that is made possible through funding support from the Ontario Trillium Foundation (OFT) and approval from the JUMP Math organization. Pairing a trained tutor with a student for

the duration of the program, the LDANR's JUMP Math program offers specially tailored numeracy tutoring to students with suspected, identified, or diagnosed learning disabilities such as dyscalculia.

The LDANR's JUMP Math Program is designed for students in grades one to eight who are displaying mathematical skills that are lower than their current academic grade level. Within the tutoring sessions, there are four areas of focus: patterning and algebra, application, operations, and number sense (Randhawa, 2021). Important to note, due to the ongoing COVID-19 pandemic, the JUMP Math program was once again conducted on an online format through Microsoft Teams, rather than its pre-pandemic in-person delivery method. A study done last year found that despite the online nature, the program was still successful in improving students' mathematical skills and capabilities while also improving their engagement and confidence in regards to math (Randhawa, 2021).

Previously, the program has undergone qualitative and quantitative research analyses to determine the efficacy of the program in both online and in-person formats. Now that the JUMP Math program has taken place for two full years in an online environment, the following research study will follow a case-study approach in which the progress of select students will be analyzed during their time in the JUMP Math sessions over the past years to determine how their mathematical capabilities and confidence grew throughout the program, and as a result of the program.

Literature Review

A recent study on the JUMP Math program in an urban-rural Canadian school board was found to have positive results. With 554 grade two and 592 grade five students as participants, the study was conducted for two consecutive school years. Progress was compared to the

students' non-JUMP peers, specifically asking if the JUMP participants had greater progress in math achievement than the non-JUMP students, who received the traditional problem-based approach (Solomon et al., 2019). The researchers defined the JUMP Math program as "a distinctive approach to math instruction whose key ideas find support in the scientific literature, for improving elementary math achievement" (Solomon et al., 2019, p. 1).

The findings found that the grade five students in the program had significantly greater progress in computation than the non-program peers, but there was no significant difference in problem solving (Solomon et al.m 2019). The progress was also found to be early on in the program, rather than towards the end (Solomon et al., 2019). For the grade two students in the program, there was no significant progress made in the first year compared to the non-program students, however, in year two, the program-students had significant progress in problem solving (Solomon et al., 2019). The researchers contested that the positive progress is important because "automatized math facts become stored in long-term memory thus freeing up limited working memory resources that can then be directed towards the conceptual aspects of the math to be learned (such as problem-solving)" (Solomon et al., 2019, p.28). This is particularly relevant to the student's in the LDANR's JUMP Math Program as students with learning disabilities often struggle with their working memory and as such, primarily struggle with foundational computational skills (Solomon et al., 2019). From these findings, the researchers suggest that the JUMP math program could be a valuable addition to classrooms (Solomon et al., 2019).

Parsley (n.d.) notes that over the last few years, schools, districts and community based organizations have called for more afterschool and summer programs to be made as a way of improving academic performance for children and youth. To address this need, an expert panel from the Institute of Education Sciences provided five recommendations for designing,

delivering and evaluating after-school programs based on existing research (Parsley, n.d.). These recommendations were:

1. Align the out of school time program academically with the school day.
2. Maximize student participation and attendance.
3. Adapt instruction to individual and small-group needs.
4. Provide engaging learning experiences.
5. Assess program performance and use the results to improve the quality of the program.

Using an interactive approach where students actively engage in their tutoring sessions and are able to express their goals, concerns, and provide input into their sessions, the LDANR's JUMP Math program encompasses all the recommendations except for the first one. The LDANR does not utilize the first pillar as students in the program are not working at grade level so the priority is placed on remediating foundational skills. However, they do try to teach foundational skills that are useful for concepts they are learning in their regular school day where possible. Further, as the student is paired one-to-one with a tutor, they are provided adapted and tailored instruction to individual needs. Both pre- and post- assessments are conducted, as well as formal research studies, to evaluate the quality of the program and bridge areas of improvement. Therefore, after-school math programs such as JUMP Math "[help] students clarify their thinking, construct meaning, and develop reasoning skills" (Parsley, n.d., para. 14), through assessment scores that the tutor can then use for informed lesson planning and enhance the effectiveness of the program.

Further, researcher Vandell (n.d.) found that students who participated in the Study of Promising After-School Programs showcased significant progress in standardized math test scores, and higher self-reported work habits. It was also noted that there is a correlation between

higher math grades and positive relationships between program staff and participants (Vandell, n.d.).

The benefits of after-school programs such as LDANR's JUMP Math Program are not limited to mathematical capabilities. Rather, after-school and summer programs also enhance social and emotional capacities which in turn improve cognitive and academic development, and they allow for better quality engagement and communication within families and the community (Riley & Peterson, n.d.). Overall, after-school math programs have been found to "enhance mathematics test scores and grades, school attendance, and student engagement in learning. Moreover, successful programs tend to have the most significant effects for students most at risk of failing in core subjects, such as math and reading, or dropping out of school" (Parsley, n.d., para.5).

Methods

Due to the progression of the COVID-19 pandemic, the Winter 2022 session was once again completed online through Microsoft Teams. The participants and their tutors met one-to-one in their tutor channels for one-hour sessions two times per week for a total of eight weeks. Overall, they were offered 16 tutoring sessions to enhance their mathematical competency and confidence. The LDANR was able to support 20 students this Winter, and 120 students over the duration of the OTF grant, who were behind in their mathematical capabilities through repeated mathematical practice, explicit instruction, and setting goals.

Over the first three sessions, participants completed a pre-assessment that the tutor then used to determine which mathematical concepts needed to be worked on during the program. Following the pre-assessment and with the help of the JUMP Math Teacher Resources, tutors designed their sessions around four specific mathematical areas: patterning and algebra,

application, operations, and number sense. These lesson plans do not directly align with the areas of the Ontario Mathematics Curriculum, however, the JUMP Math curriculum does state if the lesson plans include a required skill or knowledge found in the Ontario Curriculum (Randhawa, 2021). The beginning of the sessions are reserved for ten minutes of mental math practice to help build computational fluency (Randhawa, 2021) while the last 15 to 20 minutes are spent engaging in activities for the reinforcement of concepts learned during the lesson plan. As a final evaluation, the last three sessions were dedicated to conducting post-assessments.

The pre-assessment test is crucial as it offers a baseline measure of participants' mathematical understanding and skills, thus helping the tutors to tailor the lesson plans to the participants' needs. It also shows how confident and knowledgeable participants are in mathematics before the program. The post-assessment test serves to identify and demonstrate participants' improvement in their mathematical abilities and confidence levels as a result of the program.

As mentioned above, previous studies utilized quantitative methods to analyze the results of the post-assessment to determine improvements in mathematical skills, which helps to demonstrate the effectiveness of the JUMP Math program. However, a case study approach was used for this evaluation by following the progression of one participant who enrolled in multiple seasons of the program. Three pre- and post-assessment sets from the same participant in different seasons were analyzed and evaluated to determine improvement of scores in the four teaching categories: patterning and algebra, application, operations, and number sense.

Further, the participant was also asked to complete a JUMP Math Post-Survey in which the tutor asked the questions and scribed the participants' verbal answers. The first portion of the survey had questions that pertained to the participant's feelings towards mathematics and the

program, while the second portion of the survey was a math self-efficacy scale that used a five-point Likert scale. For the Likert scale, low self-efficacy was measured at 1 (strongly disagree) while high self-efficacy was measured at 5 (strongly agree). The survey also offered a visual at the bottom that included faces ranging from sad to happy to help the participant better understand the Likert scale scores.

Results

The following case-study results were gathered from a participant that had participated in three JUMP Math sessions, specifically from Winter 2021, Fall 2021, and Winter 2022. The pre- and post-assessment scores from the four concept areas of the program are analyzed herein. Important to note, in each of the four concept areas, there are levels A to H (with A being the lowest and H being the highest) that students are placed in based on their current mathematical performance and as they progress throughout the program, they have the potential to increase their level.

Application Results

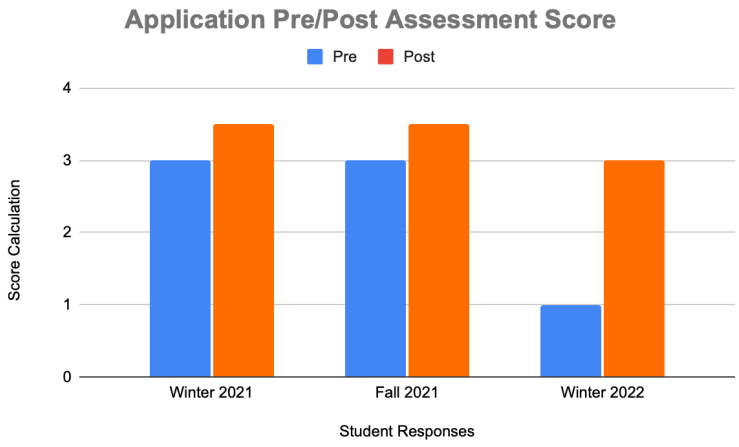

Figure 1. The student's progression in the Application section of the assessment throughout the three program sessions.

The highest achievable score was 5. In Winter 2021and Fall 2021, their pre-assessment score was 3/5 and their post-assessment score was 3.5/5, thus showing an increase of half a point from the program. In Winter 2022, the student's pre-score was 1/5 and their post-score was 3/5 , showing an increase of two points. The level remained consistent at level F.

Operations Results

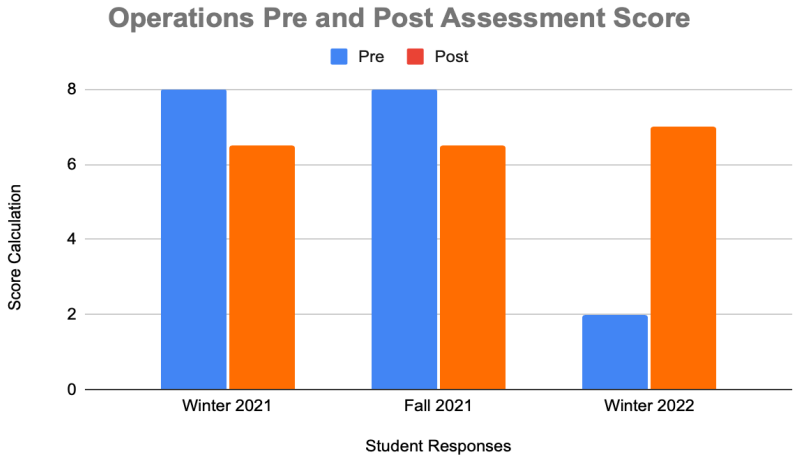

Figure 2. The student's pre and post results in the Operations section of the assessment throughout the three program sessions.

The highest achievable score was 10. In Winter 2021 and Fall 2021, their pre-assessment score was 8/10 while their post-assessment score was 6.5/10, showing a decrease of 1.5. However, there are a few reasons as to why the decrease may have occurred. Firstly, the participants' caregiver specifically said that their child had difficulty with division and did not seem to understand it or perform consistently at home or at school. Another reason could have been the online nature of the program in which the student found it harder to follow and comprehend lessons specifically pertaining to operations. The student could have also missed a few sessions, thus resulting in missed lessons and a decrease in the score. However, in Winter 2022, the student went from a pre-score of 2/10 to a post-score of 7/10, showing an increase of five points. The student began at level F and remained consistent throughout the program.

Number Sense Results

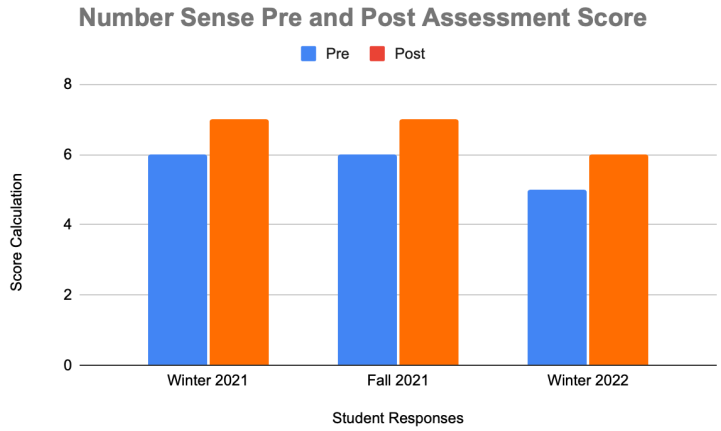

Figure 3. The student's progression in the Number Sense section of the assessment throughout the three program sessions.

The highest achievable score was 10 in the Number Sense portion of the assessment. In Winter 2021 and Fall 2021, their pre-assessment score was 6/10 and their post-assessment score was 7/10, thus showing an increase of one point from the program. In Winter 2022, the student showed another improvement of one point as their pre-score was 5/10 and their post-score was 6/10. The student began at level F and remained consistent throughout the program.

Patterning and Algebra Results

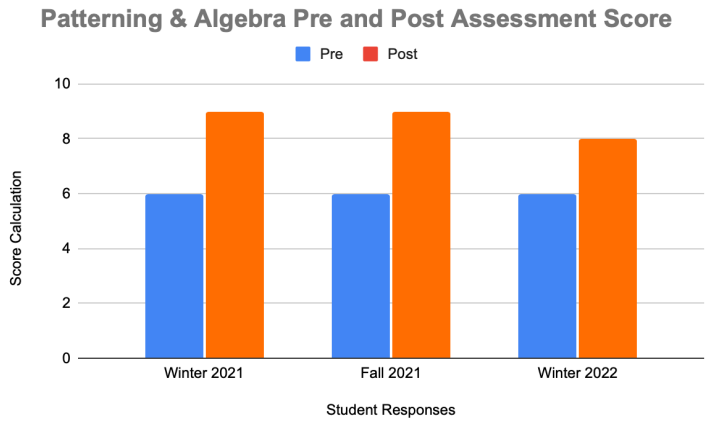

Figure 4. The student's progression in the Patterning and Algebra section of the assessment throughout the three program sessions.

The highest achievable score was 10. In Winter 2021 and Fall 2021, the pre-assessment score was 6/10 while the post-assessment score was 9/10, thus showing an increase of 3 points from the program. There was also an improvement in Winter 2022 as the student went from a pre-score of 6/10 to 8/10, thus showing a two point increase.

JUMP Math Surveys

In another post-survey from Fall of 2021, the participant reported they felt "OK at math" from the options of "bad at math", "OK at math", "good at math", and "very good at math". Further, they were asked questions with "yes" or "no" answers. The participant's responses can be seen in the chart below.

Question	Participant Response
I do well in math lessons at school	No
It is important for me to do well in my math lessons at school	Yes
I think this program helped me with math	Yes
I enjoyed JUMP Math	Yes

Evidently, the participant found that the program aided them with their mathematical skills while also enjoying their time in the program. The post-survey also asked a series of questions surrounding mathematical self-efficacy in which a Likert scale was used. The results can be seen below with the highlighted numbers representing the participant's answers.

	Strongly disagree *(Low self-efficacy)*	Disagree	Neutral	Agree	Strongly Agree *(High self-efficacy)*
I am comfortable asking questions in math class.	1	2	**3**	4	5
I believe that I can do well on math tests.	1	2	**3**	4	5
I believe math is important for my future.	1	2	3	**4**	5
I think I can answer well when my teacher calls on me in math.	1	2	**3**	4	5
I think I can do well when I am about to take a math test.	1	2	3	**4**	5
I am not afraid to make mistakes in math class.	1	2	3	**4**	5
I often use math outside of school.	1	2	3	**4**	5
I believe I can reach my goals in math.	1	2	**3**	4	5
I enjoy doing math.	1	2	**3**	4	5

The participant's responses centered around "Neutral" and "Agree", thus being on the better half of the scale. The responses show a progression of confidence in their mathematical capabilities and the ability to advocate for their needs at the close of the program.

Discussion

Although the study only included data from one participant, the pre- and post-assessment and survey results provide evidence of the LDANR's JUMP Math program's efficacy. The steady increases noted throughout the participant's three session blocks in the program, most notably in the Application, Number Sense, and Patterning & Algebra areas, show the positive impact of the program. Such improvements can also be beneficial by decreasing math anxiety and improving confidence, which can lead to better performance on math tests and more involvement within their math class at school (Randhawa, 2021). Similarly, the encouraging scores on the Likert scale for the self-efficacy aspect also showcase the participant becoming more empowered as they not only improve their skills and learn to navigate challenging mathematical questions, but also identify their strengths and areas of improvement.

It is important also to consider the areas of improvement and limitations of the present analysis and the JUMP Math program itself. As mentioned above, only one participant's data was reliable enough for this case study, thus leading to the potential of these results, and the program, being overlooked or undervalued. Another potential limitation is the ongoing COVID-19 pandemic as it continues to enforce online sessions rather than in-person sessions that allow for more engaging, interactive, and hands-on activities and tutoring, which participants can significantly benefit from. Online programming can cause screen fatigue that can leave the participant feeling tired and disengaged, resulting in less information and strategies being absorbed. The program and its facilitators also cannot control missed absences on the part of the

participant, which can lead to missing important lessons and creating delays in the students' progress. Lastly, specific difficulties that the participant experiences, as mentioned in the results section, can make it difficult to teach specific concepts. These difficulties might not be so prevalent if data was collated from all participants, but zooming in on one participant has the ability to highlight these differences. Notably, all these limiting factors can be considered to understand the decrease in the Operations area from Winter 2021 to Fall 2021.

Improvements in the participant's scores can be attributed to the different types of teaching and learning strategies that the program incorporates so that participants receive specifically tailored strategies to their learning style. For example, the participant's caregiver noted on the Fall 2021 participant information sheet that "repetition has been recommended" as a learning strategy - a strategy that the program advertises as being useful to incorporate in lessons. Further, studies have noted that virtual teaching/learning environments for students with learning disabilities can be improved by regular repetitions, utilizing practical examples, and spiral methods (Randhawa, 2021). The caregiver also noted that the participant has "benefitted from JUMP … programs in the past".

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