

Enhancement of Creativity in Math Skills of People with ID in Education Process

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Abstract: This paper describes the enhancement of the math skills of people with ID in the education process and development of the mathematics methodology. As well this research gives details of its piloting and evaluation with a cohort of learners with ID who were enrolled in an education course.

The objective of the correctional school is to provide learners with the necessary math training, to introduce them into the big world of math, to make it an effective means of learning about the surrounding reality, development of thinking and moral perfection.

All of the above determines the relevance of the problem of math education of children with mental retardation in the circle of calculations.

The aim of the study is theoretically substantiated and experimentally test the system of correctional and pedagogical work on the math education of younger school children with intellectual disabilities in circle math classes.

Learners with intellectual disability (ID) have to overcome many barriers and difficulties in order to access all levels of education and partake in college life. Thankfully, educational institutes around the globe are slowly beginning to examine how they can support the equal rights of individuals with ID. In Kazakhstan, one university has recently accredited an innovative education program for college learners with intellectual disabilities.

The results of the study are presented by the emergent methodology's which focuses on mathematics and realizes the important role that numeracy, which plays a great role in today's society. Despite the increased emphasis on general mathematics education, the authors found there to be a dearth of research regarding the development of such a methodology for learners with ID.

Keywords: Learners with intellectual disability, Mathematics education, education, Course development, methodology.

INTRODUCTION

The aim of this paper is to focus the design, piloting and evaluation of a mathematics methodology for learners with intellectual disability (ID) as part of an education program. The authors felt it was important to share this process given the sparse research available on curricula design, and more specifically mathematics curricula design, for learners with ID. The authors carried out a systematic review of research on curricula for learners with ID by analyzing articles from ten key journals. Consequently, very little is known about developing mathematics curricula for learners with ID. Considering the overwhelming interest in and amount of research about mathematics education for other groups of learners, the authors felt it was important to develop the same research-based guidelines to help

teachers improve their teaching of learners with ID. With this in mind, this paper describes the design, piloting and evaluation of a mathematics methodology for learners with ID who were enrolled in education course. The research was divided into three main phases. Firstly, a review of existing literature on developing mathematics curricula for learners with ID was conducted. The findings guided the design and development of the methodology. Once the methodology was developed it was piloted and evaluated with a group of learners with ID.

Overview of the Issue Having an intellectual disability is often associated with stigma and discrimination. People with ID are one of the most socially excluded groups and encounter prejudice and significant barriers that restrict their ability to access human rights. Despite being considered the leading socio-economic health care problem in developed countries, members of the public frequently show a limited understanding of ID. Individuals with ID are

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often viewed as non-human and as the outsiders of society.

The education of learners with disabilities has undergone several shifts in the past few decades. For example, in the year 2000, there was a policy of "normalisation". The education of learners with disabilities focused on training basic skills in self-care, socialization, and recreation. However, in recent times, inclusion has become "a global agenda" and education policies have been increasingly changing towards this model in many countries. However, there are a lot of varieties in the way that inclusive education is implemented across different nations. Ferguson's study determines that while some countries have developed broad inclusive practices, others still educate individuals with ID in special classes or special schools. This may appear to be conflicting with the notion of inclusion, given that one of its aims is to make education accessible and equal to learners with disabilities. However, there is evidence that different educational settings may expose individuals to different levels of stigmatized treatment. A study conducted found that young people with ID who are educated in integrated schooling often believe that their social identity is devalued. Those educated in segregated settings may be protected from an insight into the devalued status that people with ID can hold in society. On the other hand, studies have shown that inclusion allows learners with ID to make similar, or more, progress in their academic achievement and adaptive behaviour than separate educational settings. Irrespective of integrated or segregated schooling, opportunities for learners with ID to participate more fully in the core curriculum have greatly increased over the past two decades. This study found that there is a greater focus on individual strengths and fostering independence in the presence of high expectations for learners with disabilities. However, despite these improvements, some international research on learners with ID has criticized their schooling for focusing too much on care, and not enough on challenging learners academically, particularly in the subject of mathematics.

Large scale national achievement testing indicates that the majority of learners with disabilities do not reach grade-level proficiency in mathematics. For learners with ID, this situation becomes even more worrying since they may have limitations that lead to difficulties with the learning of certain mathematical concepts. For example, learners with ID are likely to experience difficulties with problem-solving and

abstract reasoning, which are fundamental to the learning of mathematics. They may also have difficulty with spatial relationships, distances, and sequencing which can interfere with the acquisition of mathematics concepts and skills, such as estimating size and distance and problem-solving. There are often struggles with remembering information that was presented which leads to confusion with the abstract symbols used in mathematics. Furthermore, some learners with ID struggle with motivation to learn mathematics and often require the mediation of the teacher to get involved with activities. This is especially true of more difficult and abstract activities in the subject that do not have an immediate and clear social function. Despite these typical features, in some research studies, learners with ID have succeeded in challenging areas of mathematics such as making sound mathematical decisions to solve word problems and creating their own strategies for solving arithmetic problems. A study carried out evidenced that if learners with ID are engaged, and their educational needs are supported through the use of effective resources, then they can experience success in their academic endeavours.

Many of the points noted in the review of literature in the previous section were considered for the design and development of a mathematics module in a recently accredited higher education program for college learners with ID. The module comprises of eleven, two-hour lectures over the course of an academic semester in a university. The module has four main aims:

1. To develop in learners the ability to think critically about mathematics, express viewpoints, discuss logically and problem solve effectively.
2. To equip learners with the mathematical skills that they may require on a daily basis.
3. To inspire learners to develop their own mathematics learning skills which they may need to confidently navigate today's society.
4. To encourage collaborative learning through project-based tasks incorporating mathematical skills and practical application.

The content is a mixture of mathematical theory and practice and includes traditional topics such as money and measurement. However, as it is recommended the module also includes other content areas such as statistics and probability and trigonometry. There is an

emphasis on teaching all topic areas within practical, real-life situations. For example, learners have to use their computers to plan holidays to various destinations and calculate their exact travel, accommodation and spending money budgets. These practical tasks are combined with improving learners' mathematical literacy. For example, learners have to work out their average spend per day on each holiday and the range of money that they spend per day. The majority of these tasks are impossible without the automation of basic mathematical skills (i.e. addition, subtraction, multiplication, and division). However, research shows that learners with mild to moderate ID often complete their schooling without mastering these essential basic skills. It was decided that there was not enough time to teach these skills competently on this module in twenty-two hours of contact time. Hence it was decided to ensure that learners were proficient with the use of calculators, both on their phones and using the Internet. The teaching approaches are a mixture of problem-solving and practical workshops that incorporate teamwork, collaborative learning and whole class input and discussion. This offers learners a flexible approach to learning with a special emphasis on peer teaching which is important given the range of abilities of learners with ID. Resources such as educational games and the use of manipulatives are regularly employed as an aid to learners learning and to foster inclusion and motivation. In terms of assessment, the formative assessment takes place regularly during the course with regular practical homework assignments and with learners invited to share ideas and discuss and debate views in each lecture. The use of regular questioning and the observation of student performance on in-class tasks enables the constant monitoring of performance and regular feedback. The summative assessment includes an end-of-term examination which is comprised mainly of multiple-choice questions.

METHOD

The methodology which has been used here gives an opportunity for researchers to identify the real condition of the development of math skills among learners with ID. And especially helps to improve the math skills for learners with ID. This methodology consists of a set of exercises and a set of questions which helps to see the real situation of the skills development process. Firstly in the first table, we show the information about participants who were involved in the control groups.

Participants

The study was done on a group of a hundred Kazakh undergraduate learners in two schools in Almaty city.

Experimental work was conducted by the state special (correctional) educational institution for learners and pupils with ID consisting of 20 learners 7a and 6b class. The study involved sixth-grade children: 6b-experimental class and 7a- control class.

Table 1: Participant's Details

Grades	Type of classes	number
7a	control	10
7b	experimental	10

According to the hypothesis put forward, we organized a pilot study, which includes three stages:

Table 2: Stages of Experiment

<p>Ascertaining</p> <p>In this stage, we observed and gain knowledge about the people who were involved and project the methodology for using during the experiment</p>
<p>Formative experiment stage we used our composed methodology for the learners which were consisted of a different set of exercises</p>
<p>Control experiment</p> <p>In this stage, we made a test in order to check the improvement of the level of formed skills of learners in math</p>

A special task, in this case, will be to carry out correctional and developmental work through math teaching: the development of math skills, calculation orientation, the ability to concentrate your attention, work with concentration, carefully, bring the work started to the end; education of math perception, their works, the math world around them.

In accordance with the designated purpose and tasks, the following research methods were used in the work:

Organizational (comparative, complex); empirical (observation, test tasks, teaching and control experiments);

Statistical (quantitative and qualitative analysis, synthesis of research results).

The focus group data were analyzed using thematic content analysis. Although this study did not involve a large amount of qualitative data, it was decided that two of the authors would carry out the analysis to increase comprehensibility and to provide a sound interpretation of the data. A coding scheme was generated based on the main themes which were identified from the transcripts. Each of the authors worked separately on the transcripts, which made the assessment of the consistency between their coding mandatory. The coding of each transcript was compared consecutively and any discrepancies were discussed. The final coding scheme consisted of three major codes namely module content and design, student feedback, and transfer of knowledge to

facilitate independence. Each of these themes will be discussed in more detail in the next section.

RESULTS

The learners described module content and design stating that they learned topics such as adding, subtracting, dividing, multiplying, budgeting, prime numbers, odd and even numbers, trigonometry, average, mean, and range.

The module consisted of assignments and a test that each student was required to complete in this table we would like to show the real answers which were given by some of the respondent learners.

Students	Responses	Remarks
S1	Stated that "The math's module has been really good so far. We learned about evaluations, numbers, dividing, multiplying. We did the exams. We learned how to use our calculators on our phone."	For most of the learners, this was the first time they had been introduced to such content.
S6	"Math class is very good because you get to learn a lot of stuff that you haven't learned before like adding (...) more subtraction and more multiplying. You actually get to do a lot more than you ever had done before and you don't know how good you are at it until you actually go into a math class and ID course."	Within both focus groups, learners described the teaching strategies and resources used in the mathematics module that they found to be effective in learning module content. They discussed how using technology during mathematics lectures made it easier to understand concepts. For example, the learners spoke about how the instructor would sometimes use the computer to teach the mathematics lesson and ask the learners to complete their mathematics exercise on the computer as well.
S5	Said "If you have an A4 page you're going to have to go through 100 pages or whatever. So, I think it's easier that way."	
S6	It's a miracle cause that's the first time I actually found out there actually was a calculator on the computer".	Described their views on using a computer in math class as a recourse tool "[The instructor] shows us how to use a calculator from the computer.

Other learners talked about how the mathematics module taught them how to use the calculator on their smartphones which they found to be helpful in completing assignments. While other learners spoke about how working in small groups was also helpful in learning module content. Learners described instructor feedback and support as playing an important role in understanding concepts. Learners were not afraid to ask the instructor for help or clarification. The instructor would go over the test and assignments with learners to make sure they understood how to do questions properly.

The ascertaining examination assumed the diagnosis of learners, the purpose of which was to study and identify the level of math qualities in the two sixth grades.

The study of the math experience of schoolchildren was carried out through the questioning of each child, during which the opportunity arose to clarify some details, to obtain additional information about the areas of modern art that concern the child. For the survey, questions were drawn up that related to the artistic and math tastes of children and their math experience. The work carried out allowed to judge the competence of children in the designated range of issues and their relationship to the selected components, revealing the essence of math qualities.

Analysis of the questionnaire and the result of the audit showed that the level of math experience and math preferences of schoolchildren is dominated by the average and below the average.

n/n	Questions	Yes	Not very	No
1	Do you like to attend math classes?	7	3	10
2	Do you know anything about math?	3	11	6
3	Do you like Math?	6	9	5
4	Do you like to learn to make math calculations	10	5	5
5	Do you like learn math formulae	12	5	3
6	Do you like to learn numbers	15	2	3
7	Do you like to learn math tasks	11	4	5
8	Do you like calculations	16	4	-
9	Do you prefer math rules	17	2	1
10	Do you think you can easily learn math?	14	3	3

CONCLUSION

Analysis of the progress of the experimental work aimed at testing the system of work on the math education of younger school children with intellectual disabilities in math classes developed by us, and the dynamics of student achievement, confirmed its advantage. Thus, our hypothesis, stated at the beginning of the work, was confirmed. The goal of the work is achieved.

The purpose of this paper was to describe the math skills development, pilot and evaluation of a mathematics module for learners with ID as part of a higher education program. As one of the very few studies on curricula for college learners with ID, the authors believe that the paper adds valuable knowledge to a basis for further development of an understanding of teaching learners with ID and their transition to higher education.

For the last twenty years, many international studies have produced negative findings related to the transition process and post-school life for young adults with disabilities. It is important that these young adults are given the opportunity to continue developing the skills needed for independent living and everyday life.

The piloting and evaluation of the module provide evidence that learners with mild and moderate ID realize the importance of mathematics in their everyday lives and respond positively to being challenged in the subject. This module with some minor changes based on the student feedback will be rolled out with a new

cohort of learners in the next academic year.

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