Using Math App Monster Numbers for improving Calculation of Mild Intellectual Disability Students

Lama Bendak

Corrrespondence:
Dr. Lama Bendak
Faculty of Education, Lebanese University
Beirut,
Lebanon
Email: lamabendak@gmail.com

Abstract

The purpose of this study is to highlight the importance of mobile math games for mildly intellectually disabled students which will reflect positively on their calculations. The quantitative approach was adopted where the total number of the intellectually disabled students in the study was 10 from two private schools. The study was limited to grades 1, 2 and 3, whose ages ranged from 6.8 to 9.10. The students were divided into two groups, where the control group had 5 mildly intellectually disabled students and the experimental group also had 5 mildly intellectually disabled students. The measuring instrument or tool that was used in this study is the Woodcock-Johnson III, Test of Achievement limited to the calculation section. The pretest was done during the first trimester of the school year. Then the educational math games for kids "Monster Numbers": addition, subtraction, numbers intervention was applied for two trimesters. After that, the posttest was done and the results were submitted for analysis, where the means and standard deviations, the independent samples T- test, and the paired samples T- test were calculated. The results of this study showed statistical differences to the benefit of the experimental group over the control group.

Key words: intellectual disability, mathematics, Woodcock-Johnson III, test of achievement-calculation

Please cite this article as: Lama Bendak. Using Math App Monster Numbers for improving Calculation of Mild Intellectual Disability Students. 2018;16(2):319-323. World Family Medicine. DOI: 10.5742/MEWFM.2018.93277

Using Math App Monster Numbers for improving Calculation of Mild Intellectual Disability Students

The Diagnostic and Statistical Manual of Mental Disorders DSM-5, places intellectual disability under the Neurodevelopmental Disorders section; which was previously called Mental Retardation. Intellectual Disability refers to a disorder that starts during the developmental period (American Psychiatric Association, 2013). It consists of certain intellectual deficits and challenges handling aspects of daily life like school, work, home, social life, health, and other things as well. Intellectual disability (ID) is an explanatory phrase for sub standard intelligence that occurs below the age of eighteen, which is the developmental period. According to DSM-5, there are three criteria that must be fulfilled in order for the diagnosis of ID:

(A) Deficits in intellectual functions, such as reasoning, problem solving, planning, abstract thinking, judgment, academic learning, and learning from experience, confirmed by both clinical assessment and individualized, standardized intelligence testing.
(B) Deficits in adaptive functioning that result in failure to meet developmental and socio-cultural standards for personal independence and social responsibility. Without ongoing support, the adaptive deficits limit functioning in one or more activities of daily life, such as communication, social participation, and independent living, across multiple environments, such as home, school, work, and community.
(C) Onset of intellectual and adaptive deficits during the developmental period. (American Psychiatric Association, 2013).

While DSM-4 emphasized IQ scores, this is not so with DSM-5. Instead, no particular score is indicated to establish diagnosis, and the assessment is done based on the individual's complete clinical presentation (American Psychiatric Association, 2013). The basis regarding this development was that this definition leaned more towards a conceptual rationale, and was not applicable to actual real-life cases. With the previous definition, an individual who met the cut off score could have adaptive issues in key areas of adaptive functioning which makes the

individual's actual functioning similar to that of people who have a much lower IQ score.

The various levels of severity (mild, moderate, severe, profound) are defined on the basis of adaptive functioning, and not IQ scores, because it is adaptive functioning that determines the level of support required. The severity level for mild ID is divided into three domains:

Conceptual Domain
For Preschoolers: There may be no obvious conceptual differences. For School-Age children and Adults: Difficulties in learning academic skills such as reading, writing, arithmetic, time or money. Support may be needed to meet age related expectations. For Adults: Abstract thinking, executive function (planning, strategizing, priority setting, cognitive flexibility) as well as functional use of academic skills (reading, money management) are impaired. There is a somewhat concrete approach to problems and solutions compared with age-mates.

Social Domain
Compared with typically developing age-mates, the individual is immature in social interactions. Examples: Difficulty in accurately perceiving peers' social cues. Communication, conversation and language are more concrete or immature than expected for age. Difficulties regulating emotion and behavior in age appropriate fashion. Differences are noticed by peers in social situations. Limited understanding of risk in social situations. Social judgment is immature for age. The person is at risk of being manipulated by others (gullibility)

Practical Domain
ID children may function age-appropriately in personal care, and sometimes need some support with complex daily living tasks compared to peers. In adulthood, supports typically involve grocery shopping, transportation, home and child-care organization, nutritious food preparation and banking and money management. Recreational skills resemble those of age-mates, however judgment related to wellbeing and organization around recreation requires support. In adulthood, competitive employment is often seen in jobs that do not emphasize conceptual skills. Individuals generally need support to make health care decisions and to learn to perform a skilled vocation competently. Support is typically needed to raise a family. (American Psychiatric Association, 2013).

The educational math games for kids (monster numbers) methodology aims to mix fun with learning. It is an android application that can be downloaded for free containing addition, subtraction, numbers, times tables, division, counting numbers, multiplication and sequence for kids. Designed by EducaGames, specialists in educational Videogames, fashioned by psychologists and professionals with extensive experience in the educational field, monster numbers is an excellent educational game for learning mathematics for kids and adults of all ages. It is described as a fun edutainment application. Run, jump, count, add, subtract, multiply (times tables) and divide to win. It's an actual game, with a highly adaptable edutainment design. It is age oriented; for ages: 4-5 (Preschool), kindergarten students will find age appropriate games to match their maturing level in mathematics: counting coins, logical sequence, number recognition, association quantity and numbers, sums of sets of coins (easy addition). While ages: 6-7 (first grade and second grade of elementary school) practice math activities: logical sequences, additions without regrouping, subtractions with coins and subsequently subtraction without regrouping.

The best part is that children will engage in learning math without realizing, due to the great adventure they are experiencing with Tob the squirrel. Our squirrel is lost in the world of monster numbers and the children will have to come to the rescue. To do this, they must overcome countless obstacles and try to recover Tob's spacecraft pieces. They can jump, run, slide, fly, shoot, all while doing fun math facts (addition, subtraction, multiplication….) that can always be adapted to the students' level.

Recent development of tablet computers offers new potential for math learning. Compared to desktop and laptop computers, tablets are light and portable. For example, the iPad weighs 1.44 pounds (0.653Kg) and the ipad mini weighs only 0.68 pound (0.308Kg). Most tablets have a long battery life that can last an entire school day without recharge. In addition, touch screens are easier to use than a mouse and a keyboard, and offer a better sensory experience to children by direct touch and physical movement (Paek, Saravanos, & Black, 2013). Moreover, the average weight of a mobile is 0.1 Kg. Now there are over one million apps in online stores. Moreover, an abundant amount of math apps are available in both the App Store and Google play (Zhang, M., Trussell, R. P., Gallegos, B. et al. 2015).

Literature review

A study on engaging students with intellectual disabilities through games based learning and related technologies (Brown, D., et al., 2013) has shown that Digital Game Based Learning (DGBL) can have a positive effect on some of the core development needs of people with intellectual disabilities and associated sensory impairments. Of current interest is the expansion of DGBL activities on mobile platforms. The RECALL Project describes the development and evaluation of a novel route learning system for people with disabilities using location based services (on the Android OS). Research has shown that route guidance systems suppress cognitive map development, and for a target audience described as having 'poor spatial skills', systems that develop route learning rather than guidance are required. Two studies are reported here. The first demonstrates that there were less navigational errors made, and less help required in the more independent usage of the system, than in the earlier training stages. The second focuses more on qualitative evaluation of soft skills and personal development via the use of the system, and of the gamified version of the software. It looks specifically at how a playful approach can aid the understanding of map based representations.

Another exploratory study on using math apps for improving student learning: an exploratory study in an inclusive fourth grade classroom (Zhang, M., Trussell, R. P., Gallegos, B. et al. 2015), was conducted in an inclusive fourth grade classroom, in which about half of the students were either at risk or had disabilities. The students used three math apps that employed different scaffolding strategies to support learning of decimals and multiplication. Pre- and Post-tests showed that use of the math apps improved students learning in mathematics and reduced the achievement gap between struggling students and typical students.

Another study on support to pupils with learning difficulties in mathematics (Zakelj, A., 2014) presents a model of assistance to pupils with learning difficulties in mathematics - Implementation of modifications for pupils with learning difficulties in mathematics (hereinafter – the model LDMAT) and LDMAT model's contribution to the teachers' competence to implement the support measures to pupils with learning difficulties in terms of the empirical study. The conceptual platform of the model LDMAT is based on the following principles: giving sense to mathematical knowledge, instruction as mutual activity of pupils and teachers, and the principle of participation. The results of the study have shown that LDMAT model's contribution to the qualification of teachers to assist pupils with learning difficulties is very positive and represents a significant contribution to the improvement of teaching practices in overcoming learning difficulties in mathematics. Among teachers, the LDMAT model was evaluated as the highest in the field of selection, planning and use of appropriate didactic tools; they also highlighted the key factors for raising pupils' learning achievements: an individualized approach, promotion of the use of multi-sensory learning, timely support, cooperation with parents, encouragement for continuous work, discussion between teachers, pupils and parents, early involvement of pupils and parents in the preparation of the assistance plan, encouraging pupils to self-learning, etc.

Statement of Research Question

Does the tablet or iPad math app "Monster Numbers"; the educational math game for kids: addition, sutraction, numbers improve the calculation of mild intellectual disabled students?

Design and method

The quantitative method was used in this research. The total number of mildly intellectually disabled students in this study was 10 from two private schools. The study was limited to grade 1, 2 and 3, whose ages ranged from 6.8 to 9.10. The students were divided into two groups where the control group had 5 students, and the experimental group had 5 students. The pretest, the Woodcock-Johnson III, Test of Achievement limited to the calculation section was done during the first trimester of the school year. Then the intervention was applied, that is the educational math games for kids: addition, numbers for two trimesters one session per week for 20 minutes each session. The level of the play was set for each student based on their result at the pretest, as the game depends on the chronological age which is not effective in our study and we set it according to the calculated age level of the Woodcock-Johnson III, Test of Achievement calculation section. Then the posttest was done and the results were submitted for analysis, where the means and standard deviations, the independent samples T- test, and the paired samples T- test were calculated.

Limitations

The intervention of educational math game for kids: addition, numbers for mildly intellectually disabled students was limited at school hours, so that it would have given a better perspective if students were able to play it at home with their parents or guardians.

Results

Two independent sample t-tests were used in this research and two paired tests, the independent sample t-tests were used to compare if the experimental and control groups were the same at the beginning of the study, the second independent samples t-test was applied after the posttest to compare whether there was a difference between the control group and the experimental group. The results of the independent samples t-test proved that our hypothesis was supported but not significantly. Two paired tests were used to check whether there is a difference before and after applying the Math app Monster training for both the control and experimental group.

Descriptive Statistics

The mean and the standard deviations of the experimental and control group are presented in the table below:

Table 1: Mean and Standard Deviation

	PRETEST		POSTTEST	
	Mean	SD	Mean	SD
CONTROL	3	2.550	5	2.550
EXPERIMENTAL	4	2.739	8	3.082

It is clear that there is a difference in the means between the control and experimental group. The means in the posttest for the Experimental group is higher than that of the control group.

Independents Samples T-test

An independent sample t-test was conducted between the control and experimental group before applying the test and after applying the test. The results are presented in Table 2.

Table 2: Independent t-test

	T	DF	SIGNIFICANCE
CONTROL-EXPERIMENTAL PRETEST	-0.598	8	0.567
CONTROL-EXPERIMENTAL POSTTEST	-1.677	8	0.133

Table 2 reveals a high significance in the posttest between the control and experimental group. According to the test, the posttest values are t(8)=-1.677, p-value = 0.133 which is more than 0.05. The significance should be less than 0.05 in order to consider that the posttest between the two groups is significantly different; however it's not the case here. On the other hand, the pretest values are t(8)= -0.598, p-value=0.567 which is greater than 0.05, so the pretest is the same for both groups. This shows that both groups are homogeneous before the test. It appears that there is some effect of the training on the experimental group since the significance of the posttest is less than that of the pretest.

The effect size was calculated using the following formula: d= (x1-x2)/mean SD= 3/2.816=1.065. This value is considered large, and thus an independent t-test showed that the difference between the two conditions was significant. Another way to show the effect of the test is by viewing the error bar chart which showed the 95% confidence interval of both groups.

Figure 1: Error Bar Chart for Pretest

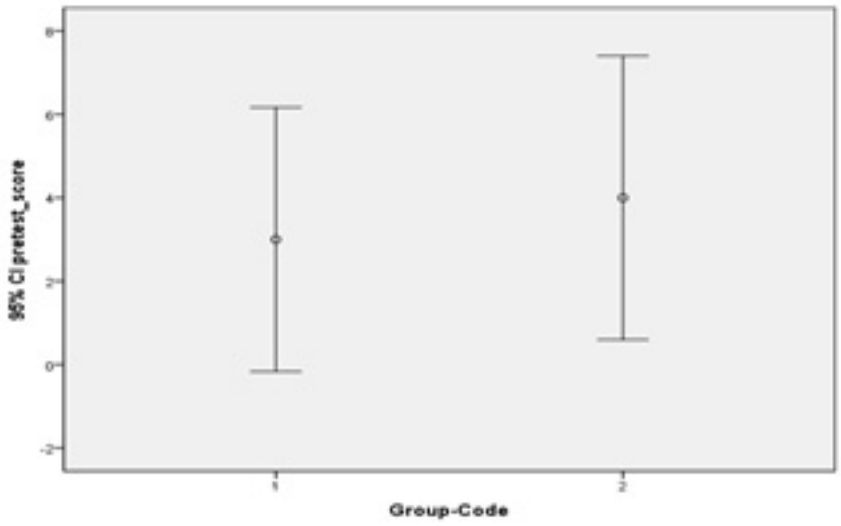
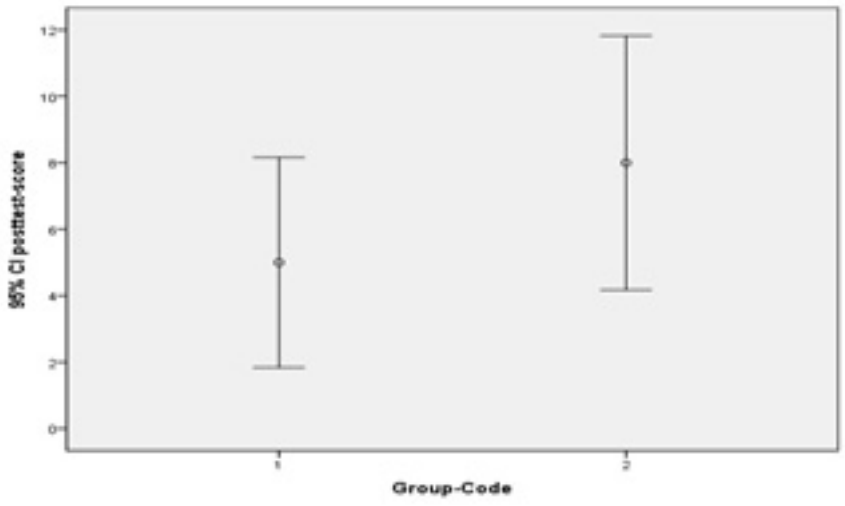


Figure 2: Error Bar Chart for Posttest



For the Error Bar Chart for the Calculation it is clearly shown how using the Math app Monster Numbers affected the results. The group code 2 which is the experimental group has a higher posttest range than group code 1 which is the control group.

Paired Samples T-test

The paired t-test is used to study if using the Math app Monster Numbers was effective or not. If the significance was less than 0.05 then this means that the group differs, and if the significance was more than 0.05 it means the group acted the same before and after the training. The paired t-test was applied on both experimental and control group before and after applying the Math app training and the results are shown below in Table 3.

Table 3: Paired t-test

	T	DF	SIGNIFICANCE
PRETEST-POSTTEST SCORE	-8.216	9	0.000

Table 3 shows that the results are: t(9)= -8.216, p-value =0.000. (The value is never zero but according to SPSS it is shown like this because usually SPSS rounds the values to 3 decimal places, so p must be less than 0.0005). So the significance is less than 0.05 which means that the group is significantly different and this proves the variation in the mean that SPSS calculated and it is shown in the table below.

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Pretest score	3.50	10	2.550	.806
	Posttest score	6.50	10	3.100	.980

This confirms that using the Math app Monster Numbers training has an effect on the groups, The mean of the posttest score is higher than the mean of the pretest score. Pair 1 represents pairs of pretest and posttest from the control and experimental groups.

The effect size was measured to be 0.6875 which isn't considered to be large effect size.

Conclusion

The tablet or iPad math app "Monster Numbers"; educational math games for kids: addition, numbers intervention did help the intellectual disabled students in developing their calculation skills. Based on the Woodcock-Johnson III, Test of Achievement limited to the calculation section, the experimental group showed significant improvement in calculation. It is therefore recommended that mobile applications are to be used in the teaching learning process.

References

American Psychiatric Association. (2013). Diagnostic and statistical manual of mental disorders: DSM-5 (5th ed.). Washington, DC: Author.

Bird, K., Savage, K. (2014). The ANIE: a math assessment tool that reveals learning and informs teaching. Markham, Ont: Pembroke Publishers Ltd.

Brown, D., et al. (2013). Engaging students with intellectual disabilities through games based learning and related technologies. Universal Access in Human-Computer Interaction. Applications and Services for quality of life UAHCI. 8011: 573-582. Springer, Berlin, Heidelberg. doi:10.1007/978-3-642-39194-1_66

Cheminais, R., (2015). Special educational needs for qualified and trainee teachers: a practical guide to the new change. London: Routledge.

Hannell, G. (2006). Identifying children with special needs: checklists and action plans for teachers. Thousand Oaks, Calif: Corwin Press.

Harris, J., (2010). Intellectual disability: a guide for families and professionals. Oxford: Oxford University Press.

Holt, M., Grills, A. (2016). Critical issues in school-based mental health: evidence-based research, practice, and interventions. New York: Routledge Taylor & Francis Group.

Jacobson, J., Mulick, J., Rojahn, J. (2007). Intellectual and developmental disabilities. New York: Springer.

Paek, S., Hoffman, D. L., & Black, J. B. (2013). Multi-modal interaction with virtual manipulatives: supporting young children's math learning. Paper presented at the International Computer Supported Collaborative Learning Conference, Madison, WI.

Sangster, M. (2015). Challenging perceptions in primary education: exploring issues in practice. London: Bloomsbury Academic

Santos, C. (2016). Instant memory training for success: practical Techniques for a sharper mind. Chichester: West Sussex, U.K.

Sheets, C. (2013). Elementary mathematics in context. Charlotte, N.C.: Information Age Pub.

Webb, N. (2015). Play therapy with children and adolescents in crisis.4th ed. New York: The Guilford Press.

Zakelj, A., (2014). Support to pupils with learning difficulties in mathematics. Procedia-Social and Behavioral Science. 159: 506-511. https://doi.org/10.1016/j.sbspro.2014.12.414

Zhang, M., Trussell, R. P., Gallegos, B. et al. (2015). Using math apps for improving student learning: an exploratory study in an inclusive fourth grade classroom. doi:10.1007/s11528-015-0837-y https://play.google.com/store/apps/details?id=com.playtic.monsternumbers&hl=en