

READ IT... SOLVE IT!

USING ICT FOR WORD MATHEMATICAL PROBLEM SOLVING FOR STUDENTS WITH DYSLEXIA IN CYPRUS

Kyriakos Demetriou



UNIVERSITY OF LEEDS

INTRODUCTION

- Why this research?
 - Inclusive Education : Schools for everyone
 - Differentiation of teaching for SEN
 - ICT: a tool for Inclusion
 - Dyslexia: How about Mathematics?
 - ICT resources in Cyprus (Mavrou, 2005)
 - Suitability of Educational Software
- Value of Mathematics

Scarcity of
Research

Heterogeneity
of difficulties

2

BACKGROUND

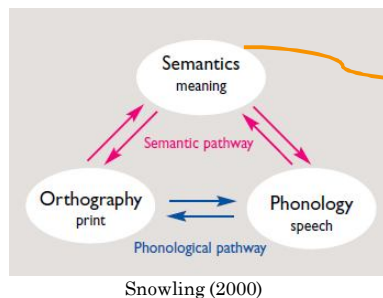
○ Dyslexia

- What is it?
- Difficulties

Specific developmental disorder which affects literacy across the life-span
(Reynolds et al., 2003; Snowling, 2000)

Grapheme-phoneme schema; phonological awareness; short-term and long-term memory; sequencing; processing; orientation; concentration

- Only difficulties in Reading and Writing?



Difficulty in tackling mathematical problems

- severe lacks in language
- language of mathematics
- syntax of mathematical problems (Miles, 1992)

ICT FOR DYSLEXIA



- ICT for students with SEN or without SEN (Rooms, 2000)
- Students with dyslexia
 - computers enable multi-sensory elements into the natural education process
 - game-like design: Mayer's multimedia principle → individual preferences in the use of animation, auditory narration and text (Taraszow *et al.*, 2007)
 - Learning → easily accessible
 - exciting way of teaching compared to traditional teaching approaches.
 - ICT: ultimate tool for better access to the curriculum for every learner (Lovless and Ellis, 2001)
 - collaboration with peers (Mavrou, 2005; Vygotsky, 1978)
- Restricted ICT facilities in Cypriot mainstream classroom. 4

METHODS



○ Purpose

- This study aims to explore the impact of the use of the available software for the design of learning environments for differentiation of instruction on
 - the performance,
 - classroom involvement,
 - peers interaction
 of students with dyslexia with difficulties in solving word problems in mathematics in the mainstream classroom in Cyprus.
- In two different settings
 - (1) students of the classroom in pairs/groups using computers in school's lab
 - (2) student with dyslexia with a parent using the computer at home for homework.

5

AIMS AND OBJECTIVES

- Using restricted ICT resources for students with Dyslexia in the mainstream classroom for:
 - Differentiation of teaching word mathematical problem solving (WMPS)
 - Increasing their classroom involvement
 - Increasing peers interaction
 - Improving performance?
- Exploration of the potential of restricted ICT facilities in Cyprus for WMPS



available	downloadable	free
non-commercial educational software	Web-based learning environments	Tools for designing WBLE

6

METHODS

- Participants
 - 23 Students
 - 22 +1 with dyslexia
 - 5th grade of Primary School
 - Limassol, Cyprus
 - Teacher of the classroom
 - Special Needs Teacher of the School
 - Parents of the student with dyslexia
- Case Study
 - 6 weeks
 - 12 forty-minutes sessions in the classroom
 - 6 thirty-minutes sessions at home (one session per week)
- Data Collection Tools:
 - Observations
 - Interviews
 - Computer Screen's Recordings
 - Pre-Tests and Post-Tests



7

RESEARCH DESIGN

Diagnosis of Dyslexia

Observations/ Interviews/
Pre-test

Design of WBLE

ICT training

Intervention:
Implementation of
evaluated WBLE

Observations/
Interviews/ Post-test

8

MATHEMATICAL PROBLEM SOLVING

Problem solving model (Krulik & Rudnick, 1987)



ΠΡΟΒΛΗΜΑ 2

Η Δήμητρα θέλει να επισκεφθεί τη φίλη της τη Μαρία που μένει στον τρίτο όροφο μιας πολυκατοικίας.

- Υπάρχουν 4 διαφορετικοί δρόμοι που οδηγούν στην πολυκατοικία που μένει η Μαρία.
- Στην πολυκατοικία υπάρχουν 2 εισόδοι που οδηγούν σε 2 σκάλες ή έναν ανελκυστήρα.

Από πόσες διαδρομές μπορεί να επιλέξει η Δήμητρα τη διαδρομή που θα ακολουθήσει;

Λύνουμε Προβλήματα στα Μαθηματικά 4

Καταλαβαίνω το πρόβλημα

	+		= 51
	+		= 17
	+		= 58

weebly for education

10

Πρόβλημα στα Μαθηματικά 4

Χρειαστικές Βοήθεια

Help!

Ο Μιχάλης και η Νατάσα σκέφτηκαν ότι πρέπει να κάνουν διάφορους συνδυασμούς για να τις επιλογές που έχει η λήμματα και να τις μετρήσουν.

Ο Μιχάλης πρότεινε να κάνουν ένα Πίνακα

Συνδυασμός	Αριθμός 1	Αριθμός 2	Αριθμός 3	Αριθμός 4
1	1	2	3	4
2	1	2	4	3
3	1	3	2	4
4	1	3	4	2
5	2	1	3	4
6	2	1	4	3
7	2	3	1	4
8	2	3	4	1
9	3	1	2	4
10	3	1	4	2
11	3	2	1	4
12	3	2	4	1
13	3	4	1	2
14	3	4	2	1
15	4	1	2	3
16	4	1	3	2
17	4	2	1	3
18	4	2	3	1
19	4	3	1	2
20	4	3	2	1

Η Νατάσα σκέφτηκε ότι ο πίνακας θα μας βοηθήσει για αυτό και πρότεινε να κάνουν ένα απλό σχέδιο και να μετρήσουν στη τους συνδυασμούς

Εσείς ποια στρατηγική θα επιλέγατε;

[Περίληψη](#) [Περίληψη](#)

weebly for education

Λύνουμε Προβλήματα στα Μαθηματικά 4

Λύνω το πρόβλημα

Μπορώ! Η Νατάσα έχει όκιο. Ένα απλό σχέδιο μπορεί να μας βοηθήσει να βρούμε τους συνδυασμούς.

Κατεβάστε το αρχείο στον υπολογιστή. Σχεδιάστε και μετρήστε τους συνδυασμούς.

[Download File](#)

[Download File](#)

WE

ANALYSIS

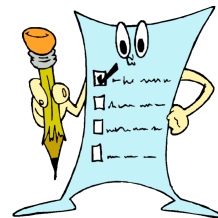
- Content Analysis
 - audio recordings
 - video recordings
 - observation notes
 - diary recordings
 - peers interviews
 - student's with dyslexia interview
 - computer's screen recordings
 - teacher interview
 - special teacher of the school interview
 - students' work and essays
 - pre-tests and post-tests
 - school documents
- Comparisons



13

FINDINGS

- Data analysis is under processing
- Not safe conclusions
- Before the implementation
 - Students
 - want to use the computer during the lessons
 - had no opportunity to work individually or in groups on the computer
 - sit in groups of 4-5 pupils → collaborating learning.
 - Teacher
 - uses the single computer in the classroom
 - encourages students to collaborate but the student with dyslexia does not contribute a lot in the group.
 - Low rates of participation in the classroom
 - Specific weaknesses in solving word mathematical problems



14

FINDINGS

○ During the Implementation

- all students showed great interest and enthusiasm
- participation rate was significantly increased
- collaboration in pairs proved to be very helpful → students showed significant improvements
- the direct provision of feedback → helpful and entertaining
- no any change in terms of acceptance of the student with dyslexia from his peers
- positive results → during the implementation of the programme at home
- student with dyslexia works more individually and less support from his mother is needed



15

FINDINGS

○ After the implementation

- Students
 - prefer to work on the computer for WMPS
 - found WBLE more helpful
 - found text, sound, navigation, game-like design, feedback, interaction with computer helpful, exciting, useful and relaxing
 - prefer the collaboration in pairs or small groups while they are working on WBLE
- Student with dyslexia
 - admits that WBLE increased his self-confidence in solving mathematical problems with the computer
 - participates in the same extent as before
 - no significant improvements in participation during the instruction without the use of the computer
- Teacher
 - supports the idea but it is time consuming in design, creation and implementation
- Increased participation and better performance the day after the session at home
- Parents: useful, helpful, innovative, increased interest, exciting, game-like



16

CONCLUSIONS



- weaknesses of the programme in achieving permanent and long-lasting changes and improvements when it is applied in short-term period
- difference between a programme for the differentiation of the instruction and an interventional approach to dyslexia
- Promising results from the use of the computer for solving mathematical problems in the classroom
- ICT + collaborative learning → possibility of using the computer in WMPS in Cypriot primary schools for differentiation
- Positive outcomes: participation, equal access, performance, self-confidence
- significant difficulties in implementing the programme in environments with limited ICT facilities
- promising results from the use of the computer for solving mathematical problems at home for students with dyslexia.

17

REFERENCES

- Arksey, H., & Knight, P. (1999). *Interviewing for Social Scientists: An introductory resource with example*. London: Sage.
- Coltheater, M. (1996). Phonological Dyslexia: Past and Future Issues. In M. Coltheater (Ed.), *Phonological Dyslexia: Special Issue of the Journal Cognitive Neuropsychology*. East Sussex: Psychology Press.
- Ecalte, J., Magnan, A., Bouchafa, H., & Gombert, J. E. (2009). Computer-based Training with Ortho-Phonological Units in Dyslexic Children: New Investigations. *Dyslexia*, 15(3), 218-238.
- Gagatsis, A. (1999). Communicative interaction situations between children with symptoms of dyslexia constructing geometrical features. *Early Child Development and Care*, 151, 29-40.
- Hatcher, J., & Snowling, M. J. (2002). The Phonological Representations Hypothesis of Dyslexia: From Theory to Practice. In G. R. J. Wearmouth (Ed.), *Dyslexia and Literacy: Theory and Practice*. Chichester: John Wiley and Sons.
- Krulik, S., & Rudnick, J. A. (1987). *Problem solving: A handbook for teachers* (2nd ed.). Boston: Allyn and Bacon.
- Lovless, A., & Ellis, V. (Eds.). (2001). *ICT, Pedagogy and the Curriculum. Subject to Change*. London: Routledge Falmer.
- Markou, S. N. (1993). *Δυσλεξία: Θεωρία, Διάγνωση και Αντιμετώπιση με ειδικές ασκήσεις*. [Dyslexia: Theory, Diagnosis and Treatment with special exercises]. Athens: Ellinika Grammata.
- Mavrou, K. (2005). *Computer Based Collaborative Learning in Integrated Classrooms for Disabled and Non-disabled students: Cases of pairs' interaction analysis in Cyprus*. Paper presented at the Inclusive & Supportive Education Congress: An International Special Education Conference. Inclusion: Celebrating Diversity?, Glasgow, 1-4 August 2005.

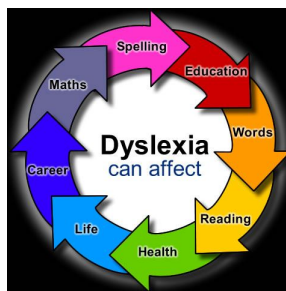
18

REFERENCES

- Merriam, S. (2002). *Qualitative Research in Practice: examples for discussion and analysis*. San Francisco: Jossey-Bass.
- Ramus, F., Rosen, S., Dakin, S. C., Day, B. L., Castellote, J. M., White, S., & Frith, U. (2003). Theories of developmental dyslexia: insights from a multiple case study of dyslexic adults. *Brain :a Journal of Neurology*, 126, 841-865.
- Rooms, M. (2000). Information and Communication Technology and Dyslexia. In J. Townend & M. Turner (Eds.), *Dyslexia in Practice: A Guide for Teachers*. New York; London: Kluwer Academic/ Plenum Publishers.
- Snowling, M. J. (2000). *Dyslexia*. Oxford: Blackwell.
- Symeonidou, S. (2008). *How can mathematics reach children with learning difficulties?* Paper presented at the Research in Mathematics Education, Conference of five cities: Nicosia, Rhodes, Bologna, Palermo, Locarno, Lefkosia: University of Cyprus Press.
- Taraszow, T., Wahl, J., Laouris, Y., Scheiter, K., & Gerjets, P. (2007). *Using Dynamic Visualization with written explanation to by-pass information processing deficits of children with reading difficulties*. Paper presented at the EARLI Conference, 14-16 November 2007., Maastricht, The Netherlands.
- Vygotsky, L. S. (1978). *Mind in Society*. Cambridge, MA: Harvard University Press.

19

THANK YOU



Source: http://www.poipassion.com/fire_and_poi_info/dyslexia_and_brain_gym.php

20