Teaching Strategies for Third Level Science Students with Dyslexia and/or Dyspraxia

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Abstract

Teaching strategies at third level institutions are traditionally based on visual and verbal means. These methods can disadvantage students who have difficulty with reading and writing (Department of Education and Science, 2001). A survey of first year science students in the Institute of Technology in Tallaght (ITT) Dublin by the National Learning Network in November 2007 estimated that 10% of students have a specific learning difficulty such as dyslexia or dyspraxia. This is in line with national and international surveys conducted by associations such as the Association for Higher Education and Access (AHEAD, 2004) in Ireland and the Irish Association for Dyslexia.

In this paper, modes of lecture delivery of three scientific modules taught at level 7 and level 8 were critically evaluated and modified to ensure students with dyslexia and/or dyspraxia are accommodated. Feedback and conclusions were summarized and recommendations made.

The initial part of the study involved a review of published literature to identify the teaching strategies which accommodate the learning styles of students with dyslexia and/or dyspraxia and compared to the lecture delivery strategies used. The delivery of parts of the modules taught were then modified to include teaching strategies aimed at improving learning by students with dyslexia and/or dyspraxia. Feedback from students was obtained at the end of the modules in the form of questionnaires and interviews. Qualitative analysis from student feedback was also supported by reflective entries, peer discussions and exam results. Definitive and quantitative judgements are difficult to make due to the small population size in this study.

The study concluded that the use of visual images, concept mapping, virtual learning environment and global (in addition to sequential) teaching styles are preferred by dyslexic and/or dyspraxic students. A multi representational approach in lecture delivery will accommodate learning for students with a diverse range of learning styles including those with dyslexia and/or dyslexia.

Keywords: Teaching Strategies; Dyslexia; Dyspraxia; Third level; Science

1. Introduction

It is estimated that 9% of the population in Ireland may have a Specific Learning Difficulty (SpLD), (National Learning Network, 2007 , AHEAD, 2004). SpLDs include Dyslexia, Dyspraxia and Aspergers Syndrome and Attention Deficit Hyperactive Disorder.   It is estimated that over 30% of third level students with disabilities are affected by a specific learning difficulty (The Dyspraxia Association of Ireland, 2005), (Loftus, T, 2004).

A screening of first year science students at a Third Level Institution by the National Learning Network in 2007 aimed to identify the learning styles of the students and highlight any possible specific learning difficulties. Approximately 23% of students screened were identified as requiring further assessment to address a possible specific learning difficulty.

Difficulties encountered by third level students with dyslexia and dyspraxia are summarised by AHEAD (Loftus, T., 2004), the Association of Dyslexia Specialists in Higher Education (AHSHE) and in universities guidelines such as the University of Hull and Liverpool John Moore University as follows;

- Language, e.g. spelling, reading, grammar, punctuation, structuring essays, learning new words, definitions, terms,
- Phonological problems: e.g. problems acquiring information/language from aural means,
- Visual sensitivity: problems with text, especially large bodies of dense text which use an unfriendly fonts (e.g. Times New Roman)
- Short term memory: while long term memory may be good, short term memory may be poor, leading to problems getting information into long term memory. This also has implications for comprehension of text, performing tasks, constructing reasoned arguments,
- sequential tasks: in the absence of a big picture combined with short term memory problems, various aspects of sequential tasks cause great difficulties struggles with conventional learning techniques: sequential, verbal reasoning.

It is recognized that each student with a SpLD has individual difficulties but that there is considerable overlap among SpLDs. Teaching strategies aimed specifically at supporting students with Aspergers Syndrome and Attention Deficit Hyperactivity Disorder are not within the scope of this paper.

2. Method

Literature, primarily based on the Irish and UK educational system, was reviewed to assess what teaching strategies ensure lecture delivery is inclusive for students with dyslexia and/or dyspraxia. Three modules taught to undergraduate and post graduate science students were modified in line with best practice and recommendations advised by published literature and guidelines. The study was designed as an action research project following the McNiff model for action research (McNiff, 2002) in as much as practically possible and carried out during a 13 week semester.

AHEAD recommends a teaching approach that is multisensory, sequential, cumulative, repetitive and relevant (Loftus, T., 2004). The NLN advises a number of strategies can be specifically aimed at helping students with co-ordination and organization difficulties which is commonly experienced by people with dyspraxia (NLN, Nov. 2007). Some strategies which can be implemented by the lecturer include:

- Use checklists to focus on tasks (assessments or practical work). Clarify what needs to be done and the timeframe. Ensure a timetable with deadlines is provided.
- Divide work into reasonable parts and mark achievements against each task.
- Use alternative methods for recording information such as a voice recorder for lectures,
- Demonstrate in addition to telling students how to achieve a task.
- Present written information using large arial font, with colored backgrounds other than white.

Recommendations were also made by the NLN (NLN, 2007) on how to facilitate learning by students with dyslexia;

- Offer the option of a mind mapping format to record information rather than always a literacy based task, present information using concept maps,

- Use colored backgrounds for lectures
- Use large arial font,
- Use images as much as possible to supplement text.

The majority of lectures at third level are presented using a verbal, sequential approach which does not accommodate all learning styles. Students with specific learning difficulties frequently learn better through a global, visual and kinestic approach (*Every Student Matters*, 2006). The E4 project conducted by the Irish Partnership for the Education for Employment addressed how to create an inclusive learning environment for adolescents and adults (E4 Project, 2007) through multisensory teaching methods. A variety of formats should be used to present information including the use of multimedia when available. Information should be presented in parallel forms to accommodate the widest range of learning styles and abilities, for example; orally through a lecture, visually through pictures kinesthetically through demonstration, and using technology based programs. Studies conducted in DIT (*Every Student Matters*, 2006), by Adams and Brown, 2007 and Farmer et al, 2002 also stress that a multi representational approach is needed to facilitate diverse learning styles.

Specific teaching strategies found and recommended to benefit students with dyslexia and/or dyspraxia include;

- Use of models, computer animation, virtual learning environment and simulations and visual images.
- Concept mapping has also been found to appeal to many students with dyslexia and/or dyspraxia (*Every Student Matters*, May 2006)
- An outline of lecture material can help a student's recognition strategies (Adams & Brown, 2007 and Huitt, K.L. 1999)
- Provision of notes in advance to students with dyslexia and /or dyspraxia is recommended by many groups associated with dyslexia or dyspraxia (SESS, DAI, NLN, AHEAD).
- Remote access to digital lecture material supports all students in particular students with reading or organizational difficulties (Adams and Brown, 2007).

- A word document allows the student to more time to listen and customization of lecture material to suit individual needs. The use of a database such as moodle allows an organized structured lecture course.

- The provision of a course syllabus, course outline and lesson plans (Loftus, T.L, 2004 and Huitt, K.L., 1999) and ADSHE (in Reasonable adjustments for Academic Department and Guidance for Good Practice).

These approaches mirror many recommendations made to support students with dyslexia and/or dyspraxia at secondary level, (Sweeney, 2007). The recommendations made in the literature by the NLN, AHEAD, Every Student Matters, SESS, ADSHE and in the E4 Project are in line with the UK University for Learning (UDL) Framework which aims to maximize learning opportunities for diverse student populations.

Lecture delivery of three science modules was critically evaluated for inclusive teaching strategies focusing on facilitating students with dyslexia and/or dyspraxia. A review of teaching strategies using the recommendations was conducted based on findings from the literature. Findings were summarized and checked as follows;

1. Is lecture material available in electronic format which can be customized and supplied prior to lectures?

2. Is all course material available in a planned organized structure?

3. Is a module and lesson plan provided?

4. Is the text used in presentations large Arial font?

5. Do presentations have colored backgrounds?

6. Are multisensory teaching strategies used? e.g. Active learning, enquiry based learning, problem based learning, multimedia, visual images, demonstrations, computer animations, virtual learning environment,

7. Is it clear how the information relates to previous information or to the real world? E.g. practical examples, outlines, summaries, concept maps,

8. Are alternative methods available for recording information? e.g. voice recorder.

Several strategies listed above were already in place such as the use of moodle, inclusion of learning outcomes, course syllabus and plan and practical examples in lecture material. However, there was significant room for many more changes firstly, a multisensory approach was adapted as much as possible: images such as mind maps, videos, diagrams, sketches, pictures, diagrams, laboratory demonstrations were added and secondly a holistic rather than a sequential approach was used; outline of the lecture material at the start of lectures, summaries of information after the lecture in the form of text and concept maps, practical examples and case studies were used when possible.

3. Results

Feedback was obtained through anonymous questionnaires completed by students, private interviews with students, verbal feedback during class and through reflective entries and discussion with lecturing peers. Questionnaires were designed to establish if the improvements had helped achieve a more equitable learning environment. Students were invited to contact me directly if they were diagnosed or suspected they had dyslexia and/or dyspraxia to get their individual feedback and interviews were conducted.

One third of the students completed the questionnaire and two students with previously diagnosed dyslexia and/or dyspraxia wished to speak to me privately. Feedback on teaching strategies was invited during class and verbal feedback was frank and frequent. Comments were primarily communicated through a small number of students whose views appeared to be supported by the majority. Unfortunately, only two students were willing to identify themselves as having a specific learning difficulty (privately) so the strategies which are best suited for students with dyslexia and/or dyspraxia could not be confirmed. However, it was possible to conclude the success of the different teaching strategies which is summarised below in table 1.

Table 1; Student feedback from preferred teaching strategies questionnaires.

Summary of feedback for teaching methods used in three modules						
	Module	Systems Validation		Drug Delivery		Environmental Management
	no of students	26		22		31
	no of respondants	10		10		3
Question: What helped you learn during this module?	% helped a lot	% helped a little	% helped a lot	% helped a little	% helped a lot	% helped a little
lecture material	100		46	54	100	
images	80	20	58	25	100	
video	NA	NA	54	54	NA	NA
summary at end of lecture	30	50	38	54	100	33
typical exam question	60	40	63	25	67	
case studies	70	30			67	33
preparing lab reports	60	40	NA	NA	NA	NA
outline	50	40	33	63	67	33
assignment	80	10	63	33	33	33
virtual learning tool	10	70	NA	NA	NA	NA
lab sessions	50	20	NA	NA	NA	NA
concept map	NA	NA	17	17	67	33

Preferred teaching strategies are the use of imagery and multimedia, reviewing typical exam questions, laboratory demonstrations. A virtual learning environment tool used was popular among undergraduates but reported as not useful for a post graduate class. Summaries, concept maps and outlines were also considered useful. Conventional representation of information using in bullet point style and spoken about in lectures is still a popular teaching method for many students. Preferences varied for most teaching methods which reflect the learning style diversity in the class. Specific teaching strategies favoured by the two students with possible dyslexia and/or dyspraxia included concept maps, summaries, imagery, VLEs, multimedia and the use of moodle.

Table 2; Summary of student feedback from preferred teaching strategies questionnaires

	Module	Three modules
	no of students	**79**
	no of respondants	**23**
Question: What helped you learn during this module?		**Preferred method %**
lecture material		75
images		57
video		54
summary at end of lecture		51
typical exam question		51
case studies		50
preparing lab reports		50
outline		48
assignment		42
virtual learning tool		40
lab sessions		35
concept map		33

3. 4. Conclusions and Future Work

It was difficult to conclude definitely if specific strategies were successful in improving the learning environment for dyslexic or dyspraxic students because of the low sample size. However, written and verbal feedback from students, peers, own reflections did allow conclusions on the success of teaching strategies used;

- A visual approach, specifically the use of images, appeals to most students,

- The use of concept maps appealed strongly to some students,

- The use of moodle or a equivalent systems for posting lecture material before lectures is very important for students with reading, writing and organisational difficulties,

- Laboratory demonstrations by the lecturer did not engage many students,

- The use of video/DVDs is worthwhile to supplement lectures but requires an associated activity/deliverable to ensure attention,

- Outlines at the start of lectures and summaries at the end of a lecture got variable responses but is needed to facilitate all learners,

- A virtual learning environment tool used was popular among undergraduates but not successful for a post graduate class. In retrospect, the content of the material for the post graduate students was too basic for level 9 students, rather than an unsuccessful teaching tool.

- Traditional lecture delivery using powerpoint slides with information in bullet points and discussed further by the lecturer is still a preferred teaching method for many students. This conventional approach must be supplemented rather than replaced.

- Learning styles vary and this is reflected in the preferences expressed by students.

A multi-representational approach used is a more inclusive approach. A learning environment which accommodates all learner styles including those with dyslexia and/or dyspraxia is created if a diverse range of teaching strategies are used in combination with some specific modifications. A summary checklist has been devised which recommends a quick way to assess if teaching methods at third level facilitate students with dyslexia and/or dyspraxia;

Checklist for inclusive Teaching Strategies at Third Level

1. Is lecture material supplied prior to lectures?
2. Is a module and lesson plan provided?
3. Are learning outcomes presented and referred back to after topic completion?
4. Is the text used in presentations large Arial font?
5. Do presentations have colored backgrounds?
6. Are multisensory teaching strategies used? e.g. Active learning, enquiry based learning, problem based learning, multimedia, visual images, demonstrations, computer animations, virtual learning environment eg skillpad,
7. Is it clear how the information relates to previous information or to the real world? E.g. practical examples, outlines, summaries, concept maps,
8. Do you recommend any text which has audio facilities?

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9. Do you offer a diverse range of continuous assignments? eg group/individual project/presentations in addition to in-class assessments.

10. Students with reading difficulties should be offered digitalized versions of lecture material to allow the use of text to speech software.

11. Students should be informed about the use of concept mapping software and interested students should be allowed use through learning support.

In line with the action research approach described by McNiff (McNiff, 2002) new issues emerged during the study which require further investigation;

1. Problem based learning is an active learning strategy which can supplement/replace some material of the modules taught through oral and verbal means. Therefore, PBL may be preferable to students with specific learning difficulties. It did not form part of this project but is an area worth consideration.

2. Investigation on the internet and with colleagues could reveal the availability of useful virtual learning environment tools appropriate for other modules and levels.

3. Assessments also need to be evaluated to establish all learning styles are catered for and do not disadvantage any group of students. Evaluation of the suitability of each assessment type for the diverse range of students was outside the scope of this study but is required to assess the inclusiveness of assessment methods.

4. POD casts of lecture material was referenced during the literature review as a means to assist students who required an alternative to reading lecture material. The technology and knowledge to use POD casting of lectures is worth investigation.

5. Digital versions of lecture material may be available. The library could be asked to maintain a database of books which are available in digital version and request digital versions of new books.

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