فعالية برنامج مقترح للتدخل على العجز المكتسب والوظائف التنفيذية لدى الطالبات الجامعيات ذوات صعوبات التعلم

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ملخص: هدفت هذه الدراسة الي اقتراح برنامج للتدخل يساعد الطلاب الجامعيين الذين يعانون من صعوبات التعلم (LD)للتغلب على أعراض العجز المكتسب (LH) ولتقييم جدوى وفعالية هذا البرنامج. تتكون العينة من ثماني طالبات في مقرر علم النفس العصبي من قسم علم النفس الاتي اشتركن في هذه الدراسة. وكانت جميع الطالبات الثمانية قد فشلنا في النجاح في هذا المقرر على الأقل مرة قبل اجراء البحث. تم تقييم معدل الذكاء الخاص بهن قبل التدخل لتحديد مجالات القوة والضعف لديهن. بالإضافة إلى ذلك، لتقييم فعالية البرنامج، تم إجراء اختبار الوظيفة التنفيذية لديهم باستخدام الكمبيوتر في ثلاث ظروف، قبل التدخل، في نهاية التدخل، وثلاثة أشهر بعد الانتهاء من التدخل. وقد تم أيضا استخدام مقياس التقييم الذاتي للعجز المكتسب قبل وبعد التدخل مباشرة. وقد تمت أيضا تتبع الأداء الأكاديمي للطالبات خلال فترة تقديم البرنامج ومن خلال أيضا اختبار نهائي. كشفت نتائج البحث أن برنامج التدخل لم يسفر عن أي تحسن كبير في الأداء الأكاديمي للمشاركين في سياق الدراسة المعنية؛ ومع ذلك، فقد اجتازوا المقرر، واعتبر أن هذا يمثل إنجازًا أكاديميًا كبيرًا. علاوة على ذلك، انخفض العجز الذي اكتسبته الطالبات، وذاد أدائهم على الوظيفة التنفيذية واستمر حتى بعد ثلاثة أشهر من الانتهاء من البرنامج. وخلص الباحثان إلى أن برنامج التدخل المقترح كان ناجحا في مساعدة الطلاب الجامعيين الذين يعانون من LD وتناقش الحدود والمقترحات لهذا البرنامج لدراسات مستقبلية في هذه الورقة.

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الكلمات الدلالية: برنامج تدخل، العجز المكتسب، الوظائف التنفيذية، صعوبات التعلم، الطالبات الجامعيات.

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The Effectiveness of a Proposed Intervention Program on Learned Helplessness and Executive Functioning in Undergraduates with Learning Disabilities

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Abstract: The aim of this study was to propose an intervention program that facilitated undergraduates with learning disabilities (LD) to overcome symptoms of learned helplessness and to evaluate the feasibility and effectiveness of this program. A small neuropsychology section of eight psychology students were recruited for this study. All eight students had failed the course at least once prior to the research. Their IQ was assessed before the intervention to identify their areas of strength and weakness. Additionally, for the purpose of evaluating the effectiveness of the program, a computer-based executive functioning test was administered on three occasions: before the intervention, at the end of the intervention, and three months following the completion of the intervention. A learned helplessness self-rating scale was also administered prior to and immediately following the intervention. The students' academic performance was monitored during the course period and via a final exam. The results of the research revealed that the intervention program did not result in any significant improvement in the participants' academic performance in the course of study in question; however, they did pass the course, and this was considered to represent a considerable academic achievement. Furthermore, the students' learned helplessness decreased, and their executive functioning increased. The level of executive functioning was persistent even three months after completion of the program. The researchers concluded that the proposed intervention program was successful in helping undergraduates with LD. The limitations of the program and suggestions for future research are discussed in this paper.

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Key Words: Intervention Program, Learned Helplessness, Executive Functioning, Learning Disabilities, Undergraduates Students

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Introduction:

It is widely reported that undergraduate students who have learning disabilities (LD) are vulnerable to academic failure (Hall, 2010; Sparks & Lovett, 2013; Watson & Boman, 2005). This is particularly the case when no support is put in place to facilitate their learning and development (for a review of reasons for such lack of support see Couzens et al., 2015). Any learning issues that students have can be compounded when they experience continuous failure, as this can act as a barrier that prevents them from seeking assessments and assistance to improve their cognitive abilities. Instead, many of them develop learned helplessness symptoms, which drive them to skip classes and exams and withdraw from courses (Francis, 2011; Klassen, Krawchuk, Lynch & Rajani, 2008; Lee & Carson, 2014; Markward, 2002; Peleg, 2011). For this reason, it is important to pay attention to any learned helplessness symptoms that undergraduates exhibit and to work with them to reduce the negative behaviours and attitudes that such conditions can engender. It is anticipated that identifying and dealing with learned helplessness symptoms can help to improve the academic performance of undergraduates with LD (Miller & Atkinson, 2001; Voughn & Fuchs, 2003).

Improving Academic Performance in Students with LD

In order to reduce the negative effects of LD on undergraduates' academic performance, a number of existing research studies have examined the effects of intervention programs on students during their university program. A study by Richman, Rademacher and Maitland (2014) investigated the effects of a coaching intervention on 24 university students with LD. Between 12 and 24 coaching sessions were delivered to the students during one academic term. Their academic achievement, executive functioning and self-determination were assessed before and after the intervention. The most significant finding from this study was that, following the intervention, students exhibited a better ability to cope with academic demands such as attending classes and meeting submission deadlines. However, the study did not prove that the intervention resulted in an improvement in the students' final grades. Similar results, in which interventions engendered positive changes in

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behaviour and attitude but did not result in an improvement in students' scores, were demonstrated in alternative intervention studies that target university students (Blood, 2010; Mowat, 2009). This intriguing pattern was also found in correlational studies that established that some attitudes, such as learned helplessness and self-esteem, are not directly correlated with students' grades (Heraldvalae, 2001).

Several intervention studies have sought to improve specific academic skills in students with LD (Boyle, Rosen & Forchelli, 2014; Chiang & Liu, 2011; Dennis, Knight & Jerman, 2014). For example, a study by Dennis, Knight and Jerman (2015) examined the effects that training students on model drawing strategies had on their ability to solve mathematical problems. The researchers found that, while the students did demonstrate an improved ability to solve problems that were similar to those they had been exposed to when they were taught the strategies, this ability did not transfer to alternative mathematical problems. As such, the intervention achieved positive, but limited, effects.

An alternative method of helping undergraduates to overcome their LD is changing the learning environment. This can be accomplished by assigning students with LD to small sections (Moat, 2009), using a new response system where all students have the chance to respond to the teacher's questions without the need to wait for permission (Blood, 2010), or using interactive computer-based teaching models (Conway & Amberson, 2011). The results of many of these studies have demonstrated an increase in students' positivity and behaviours such as rate of response in class (Blood, 2010) and the ability to work in teams (Moat, 2009).

The research studies outlined above indicate that intervention can have a significant effect on the learning outcomes of undergraduates with LD. However, positive effects are often specific and limited to narrow areas. For instance, general support and training might improve students' attitudes and behaviour (Richman, Rademacher & Maitland, 2014). Changing the learning environment by adopting a particular teaching method has similar effects on behaviours and attitudes (Conway & Amberson, 2011); however, both types of interventions do not significantly improve academic achievement. Providing training on specific modules or academic skills is

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effective on the module/skill of training but do not transfer to other modules (Dennis et al., 2014). Therefore, there is a need for an intervention that combines multiple approaches to deliver significant positive effects in terms of both the attitudes and achievements of students with LD (Miller & Atkinson, 2001).

Training Working Memory (WM) as an Intervention

LD are normally associated with working memory (WM) impairment, most commonly time executive functioning (the function of the central system in WM) (Baddeley, 1986). In fact, several studies have attempted to examine the effect that training WM has on the achievement of students with LD (Gropper, Gotlieb, Kronitz & Tannock, 2014) and any intellectual disabilities they exhibit (Danielsson, Zottarel, Palmqvist & Lanfranchi, 2015). Both of these studies sought to ascertain whether providing specific training on WM tasks improved students' performance in these tasks, and whether any improvement that was identified could be transferred to other WM tasks and to other executive functioning tasks such as reading comprehension tests and students' exam scores.

A study by Gropper, Gotlieb, Kronitz and Tannock (2014) examined the effect of a five-week WM training program on students with LD. The WM performance of 62 undergraduates with LD was assessed before the training using a combination of computer-based WM tasks and self-rating scales. Twenty-five training sessions were then completed by a group of the sample (39 students), using different working memory tasks from those used in the first assessment. Finally, the students' performance was assessed twice, three weeks and two months after completion. Pre-assessment and post-assessment involved computer-based WM tasks that are very similar to the training tasks, WM tasks that were different in their demands from the training tasks, and more general attention tasks and academic achievement measures. In addition, a rating scale of symptoms of ADHD in adults and a further scale of cognitive failures were used in both assessments. The results indicate that WM training only improved students' performance on tasks that resembled those in which they were specifically trained. No significant improvement in the students' abilities was demonstrated when they attempted alternative WM and cognitive tasks.

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However, WM training exercises were deemed to have significant positive effects in terms of reducing ADHD symptoms. This was demonstrated by two factors: a significant decrease in the participants' scores in the two self-rating scales compared to their scores in the pre-assessments, and a significant improvement in perceptions of their own abilities versus those who were not trained on the computer-based tasks. The most influential finding of this study was that providing students with opportunities to complete computer-based WM tasks can reduce the behavioural problems that students with LD exhibit. In addition, given that the scales employed were self- rating scales, the findings did, at least, indicate that WM training could improve participants' attitudes toward themselves.

The Current Study

Having reviewed previous intervention studies that have specifically targeted undergraduates with LD, the current study was based on a combined intervention program. This program involved modifying teaching and assessment methods in conjunction with cognitive training to alleviate students' negative self-perceptions of their abilities and to improve their academic performance. Using such approaches, this intervention program aimed to optimise the effectiveness of the intervention programs identified in previous research. It was anticipated that the extent to which this program succeeded in improving both students' attitudes and academic performance and achievement would determine whether an approach that combines multiple interventions in one program that is specifically targeted at undergraduates with LD should be adopted.

The method of teaching in this course consisted of active learning that was supplemented with concrete materials. Specifically, the students were involved in labelling, drawing and building concrete and abstract models of the structures and mechanisms discussed in the lectures. After that, they were provided with an opportunity to reflect on the models and their learning by solving several activities after each lecture. Previous research indicates that such an approach can help students to grasp information and maintain knowledge over a long period of time (Bouck, Satsangi, Doughty & Courtney, 2014). As suggested by multi-media theory, concrete

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pictures leave a lasting impression, while abstract pictures allow students to develop a clearer understanding of the relations between information in actions in the short term (Maison, Pluchino, Tornatora & Ariasi, 2013). Additionally, research has shown that applying written labels to images of body organs represents a useful learning approach for medical students who do not have LD (Pourahmadi, Javeshghani, Najafipour & Bigizadeh, 2013). The role of the lecturer was to provide instruction in line with concrete learning activities so as to help the students understand the relationship between the class activities and the concept (Vitale, Black & Swart, 2014).

Secondly, as WM impairment is very common in students with LD (Baddeley, 1986; Swanson, Moran, Lussier & Fung, 2014), this current study incorporated a weekly training program through which a small number of WM tasks were taught each week. The aim of this training was to improve the students' self-regulation by increasing their commitment to the exercise through rewarding them with course credits in return for performing the computer-based tasks. In addition, the purpose of the weekly WM training sessions was to examine whether the improvement in a particular computer-based task could be transferred to alternative WM tasks. The aim of the program was also to examine whether combining learning environment changes and computer-based training had an additive effect on both executive functioning and students' attitudes.

Finally, the method of assessment was modified in this program. Open book exams were administered fortnightly during the course. Open book exams assess reading comprehension, which is essential for academic learning and is typically impaired in students with LD (Montague, Maddux & Dereshiwsky, 1990; Saini, Chauhan, Chaudhary & Das, 2012). The questions contained in the open book exams conducted in this course incorporated consideration of the levels contained in Bloom's Taxonomy of Learning Domains; these are memorisation, comprehension and application (Mason et al., 2013).

Method

Participants

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This research was performed in the form of a case study that involved two groups of students. The experimental group consisted of an undergraduate class of eight students with learning disabilities who were aged between 23 and 38 years old (with a mean age of 26 years and one month), and the control group consisted of a further eight undergraduate students who were aged between 21 and 27 years old (with a mean age of 22 years and 6 months). The study was carried out over the course of one academic year, and the sample was determinedly chosen. The experimental group consisted of a small section of students who were completing one scientific course, neuropsychology, in the Psychology Department. Every participant had failed the course on at least one occasion. All students were females and did not have any physical impairment. Students in the elected neurological psychology section were categorised as poorly performing students according to their cumulative average, which was lower than 3.00 (the maximum average is 5.) In contrast, the students in the control group were categorised as highly performing according to their cumulative averages, which were higher than 4.0. All participating students signed a consent form stating their agreement to be involved in the study and the students with LD were rewarded course credits in return for performing the computer-based training tasks and course activities.

Materials

Stanford-Binet 5 intelligence scale. The Arabic version of the Stanford-Binet 5 intelligence scale standardised by Safwat (2011) was used to assess the IQ and cognitive abilities of both the experimental and control groups. This scale is an individually administered test of intelligence. The scale includes ten subtests: fluid intelligence, knowledge, quantitative reasoning, visual-spatial processing, and working memory, across both verbal and non-verbal domains. Administration of the assessment commenced with verbal knowledge and non-verbal fluid intelligence as routing subtests to determine the starting level of the remaining subtests. The scores of the two routing subtests were then used to estimate the general intelligence score. However, from a practical point of view, complete administration of the scale, which lasts up to two and a half hours, can give a better estimation of an individual's general

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intelligence score. This general intelligence score is a standard age score with a mean of 100 and a standard deviation of 16. Similarly, verbal and non-verbal intelligence and a score of each of the five composite factors can also be calculated and converted to a standard age score with a mean of 100 and a standard deviation of 16. The standard deviation scores indicate whether the participant's score is above or below the average, and this helps to identify students with LD. Students who score above 84 are deemed to be of an average intelligence, while those who score below 84 in one composite factor are considered to have a learning disability (American Psychological Association, 2013).

The learned-helplessness scale. This scale was developed by the authors to assess four dimensions of learned helplessness:

(1) Negativity, which means being careless and refraining from completing any work related to the point of learned helplessness, whether it is in the academic, occupational or social field (13 statements).

(2) Escaping, which means avoiding and refusing to participate in any work related to the point of learned helplessness. It also describes how people with learned helplessness tend to quit any work they are forced to start without giving clear or valid explanations for doing so because their focus is on escaping the situation (12 statements).

(3) Inflexibility, which describes an inability to provide solutions to avoid previous failure. Students with learned helplessness always use the same approach to studying. This consistently leads them to failure and makes them feel weak in such situations because they are not able to change their method of thinking or working (11 statements).

(4) Satisfaction with low scores, which means being satisfied with low scores and perceiving them as sufficient reward for the work invested. In such cases, students with learned helplessness try to give justifications for their low scores, even though they know they are invalid. They do not try to improve their scores (11 statements).

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In total, the scale included 47 statements that could be administered individually or in groups. Participants were required to respond to each statement by selecting the extent to which they agreed with a statement using a five-point scale that ranged from strongly agree to strongly disagree. Completing the whole exercise took the participants between 10 and 15 minutes.

Validation of the scale. Two independent judges who are experts in psychology assessed the content validity of the learned helplessness scale. These individuals judged whether each statement was clear and appropriately aligned with the definition of learned helplessness and its dimensions. Amendments to the structures of the statements were made according to the judges' suggestions.

The predictive validity of the scale was examined by calculating the correlation between the scores of the 101 participants in terms of the learned helplessness scale and their academic average. Using Spearman's rank correlation coefficient test, a significant negative correlation was found between students' learned helplessness scores ($M = 121.79$, $SD = 48.96$) and their academic average ($M = 3.88$, $SD = .84$), $r = -.817$, $p < .001$). Similarly, the participants' academic averages demonstrated significant negative correlations with their scores in all four dimensions of the scale: negativity ($M = 32.21$, $SD = 12.8$), $r = -.81$; escaping ($M = 30.23$, $SD = 14.54$) $r = -.77$; inflexibility ($M = 30.84$, $SD = 10.7$), $r = -.79$; and satisfaction with low scores ($M =28.51$, $SD = .13.$), $r = -.79$, $p< .001$. These scores indicated that the scale did represent a suitable measure of learned helplessness. They also indicated that each dimension of the test provided an accurate estimation of each of the learned helplessness characteristics. High scores in the questionnaire predicted low academic averages.

Reliability of the scale. Internal consistency of the scale was assessed using Spearman's rank correlation coefficient to determine the correlation between the total scores of the scale and the scores of each dimension. A significant correlation was found between the total scores and the scores of negativity, escaping, inflexibility and satisfaction with low scores, $r = .9$, .91, .93, and .91, $p < .001$, respectively. Correlations between the dimensions of the scale were also deemed to be significant.

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Negativity showed a significant correlation with each aspect of escaping, inflexibility and satisfaction with low scores, $r = .76$, .8, and .73, $p < .001$, respectively. Escaping showed a significant correlation with inflexibility and satisfaction with low scores of $r = .83$ and .88, $p < .001$, respectively. Finally, inflexibility and satisfaction with low scores show a significant correlation, $r = .83$, $p < .001$. These significant correlations indicated that the scale is reliable, and its dimensions work as a unit. It was determined that the scale was scientifically viable as a means of evaluating learned helplessness characteristics in students. However, it was acknowledged that further studies would be required to verify a wider use of the scale on a large sample population.

Computer-based working memory tasks. These tasks were designed by Eldowah and Khalil (2006) and were based on the design of working memory tasks used in several studies (Baddeley, 2000a; Eldowah, 2012; Elsherief,2007; Huill, 2003; Norman & Shallice, 1986; Paivio, 1986; Smith & Jonides, 1999; Swanson, Mink, & Bocian, 1999).

Phono spatial tapping tasks. This task was used as a screening test because it involves all functions of working memory components suggested by Kim and Han (2002). The task consisted of four different conditions, which involved different requirements. In general, each trial started by presenting the target card in the middle of the screen. The target card appeared in the form of a large square that was divided into four smaller squares. Each of these squares included four circles. The circles were numbered from 1-16. During the presentation of the target card, a red light appeared on one of the circles (e.g., circle 3) in line with a spoken word that was transmitted to the participant through the headphones she was wearing (e.g., car). Then, the red light moved to a different circle from a different square (e.g., circle 13) in line with a different spoken word (e.g., school). The target card then disappeared, and a blank interval screen was presented for 2000 ms. After that, the test phase began during which the participant was presented with the image of a card on the screen that was similar to the target card. The red light and spoken words were simultaneously presented in one of four methods: (1) visually and phonologically congruent with the

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target card (e.g., numbers: 3 & 13, words: car and school); (2) visually congruent and phonologically incongruent with the target card (e.g., numbers: 3 & 13, words: sea and wolf); (3) visually incongruent and phonologically congruent with the target card (e.g., numbers: 4 & 16, words: car and school), (4) visually and phonologically incongruent with the target card (e.g., numbers: 6 & 15, words: loin and plane). See Figure 1 for an illustration. The participants were asked to identify the above conditions by pressing a certain button. The keys 'Z, X, . & /' on the keyboard were assigned to each of the above four conditions, respectively. They were given 5000 ms to respond to ea ch test card. If a participant did not respond in the given time, the next trial commenced, and no response was recorded. There were three levels of density in each condition, resulting in 12 blocks, each of 10 trials. The exercises that were of a low level of density involved presenting the red light in two positions along with two spoken words. As presenting the red light in line with the spoken words lasted 2000 ms, each of the target cards and test card lasted for 4000 ms at this level. The medium level of density exercise involved presenting the red light in three positions along with three spoken words. Finally, the high level of density involved presenting the red light in four positions along with four spoken words. The time of the presentation of the cards increased by 2000 ms for each density level respectively. The whole test lasted approximately 30 minutes.

[Figure1]

Serial and parallel recall tasks. These tasks were designed to measure executive control centre processes, including multiple-task coordination, task switching and memory updating. The tasks were divided into two types: (1) serial recall tasks and (2) parallel recall tasks. There were eight trials for each type of task, and the presentation of the two types of task was intertwined. The total task took about 10-15 minutes to complete. In the serial recall tasks, visual words and numbers were presented in a sequential order. Three levels of density were available for this task: low, medium, and high, which included three, four and five stimuli in each sequence respectively. In each trial, participants were instructed to memorise a sequence of words and numbers, which were presented for 1000 ms for each stimulus.

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The presentation phase was then followed by an interval screen for 2000 ms, followed by the test phase. In the test phase, a list of words and numbers were presented in small squares. These squares could be moved using the mouse pointer. Participants were instructed to move the stimuli and re-arrange them according to the order of presentation. The students were presented with instructions to check the order they had selected at the bottom of the screen. The participants were then required to click on the 'OK' button on the screen to confirm their answer and progress to the next trial.

In the parallel recall task, the stimuli were simultaneously lined-up on the screen. The duration of the presentation varied according to the level of density; i.e., 3000ms, 4000 ms and 5000 ms for the low, medium and high levels of density respectively. The participants gave their responses using a method that was similar to the serial recall task.

Visual-Spatial Tapping Tasks. In these tasks, visual-spatial paths were presented on the screen. Twenty squares filled with numbers ranging from 1-20 were shown on the screen in a random order. Each trial involved presenting randomly numbered squares on the screen (learning phase) where a red light appeared sequentially on three, four or five random squares. The red light appeared for 100 ms on each square. Then, an interval screen was presented that displayed an irrelevant word in the centre. After that, the test phase followed, during which a screen similar to that of the learning phase was shown, and the red light was presented in the same or in a different sequence. See Figure X for an example. Participants were instructed to press 'Z' when the path of the red light was the same as the learning phase and to press '/' when the path of the red light was different to the learning phase. There were 24 trials in each level, and the task lasted approximately for 16 m.

[Figure2]

Design & Procedures

Screening tests. Each participant’s intelligence was screened using the Stanford-Binet 5 intelligence scale. Two of the researchers, who are lecturers in the psychology department, together with another research assistant, tested the intelligence of each student on an individual basis. Each testing session lasted

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approximately two and a half hours. Another screening test was employed to assess students' working memory, and this was administered during one of the course classes at the beginning of the term. The test was a computer-based test that assessed the executive central control via a visual-spatial tapping task.

Concrete and active learning programme. The concrete and active learning program consisted of four components: (1) concrete learning materials; (2) interacting activities with feedback; (3) open book quizzes, checking for knowledge, comprehension and application; and (4) computer-based working memory training.

The course topics in neuropsychology included the following: Research methods in neuropsychology, neuron cells, glial cells, supporting systems, electrical and chemical transfer, central neuron system, spinal cord, sympathetic and parasympathetic systems, neurotransmitters, and physiology of emotion, learning and motivation. As the academic term consists of 15 lecturing weeks, including the introduction and revision weeks, the students attended 13 lectures during this period. Each lecture was a three-hour session. The method of teaching was consistent across all lectures. The lectures were introduced by one of the researchers, a senior lecturer with nine-years' experience of teaching the neuropsychology course at the university. To ensure that the teaching method following the planned strategy, one of the researchers attended two lectures of the course as an observer. These two lectures were randomly chosen. The planned teaching strategy was to ask students to produce graph organisers (abstract representations) and venial models (concrete representations) of all course materials. The instructor provided examples on the board and then asked the students to simulate the example and expand it to cover similar information. For instance, the instructor started the chemical transfer topic by drawing the cell membrane and pasting receptors on it. The students were then asked to produce similar designs. After that, the instructor reflected on this design and visually described the information using the model. Following this, the students were asked to repeat the description individually. When the instructor was confident that all the students had received all the relevant information and reflected on it, paper-based activities were distributed to the students. These activities involved different types of

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questions, including correcting the wrong word, filling the gaps, answering direct questions, matching phrases, arranging words to make a correct scientific sentence, labelling pictures, and interpreting a situation from the perspective of neuropsychology. Students were allowed to work on the activities as individuals or groups. When the tasks were completed, the students' responses were assessed and corrected and they were given feedback along with the model answers. Depending on the adequacy of time available during the lecture, the students solved the activities either in the class or as homework.

The students' progress in the course was assessed on a bi-weekly basis (seven quizzes in total). The test questions consisted mostly of multiple-choice questions with few short answer questions. Similar to existing intervention studies on students with learning disabilities, such as that by Ciullo, Falcomata & Vaughn (2015), the quiz questions were set by one of the researchers. This individual was a lecturer in the department and did not participate in teaching the course. The students' responses were reviewed and amended by the other two researchers. The level of questions consistently targeted the three bottom levels of Bloom's taxonomy (Bloom, 1956). In each quiz, the questions were divided into three categories. One-third of the questions assessed knowledge and ability to recall the studied information, one-third of the questions assessed comprehension, and one-third of the questions assessed application. The design of the quizzes utilised in the course was gradually changed as the term progressed. The first three quizzes were open book quizzes. Each quiz included two reading pieces from the course; each piece consisted of nine questions and was introduced for half an hour. The following two quizzes (Quiz 4 & 5) were listening quizzes, whereby students listened to two separate pieces (Quiz 4) or listened to the same piece twice (Quiz 5). Students were given nine questions for each listening aspect, and they were given time to read the questions before the audio was played. They were also given an extra 10 min to answer the questions after the audio text had terminated. The sixth quiz was a longer version of the open-book quizzes, whereby the students read a whole chapter of the course textbook. This chapter had not previously been explained to them. The students were required to answer 12

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questions about the text. This task was designed to ensure the students were given an opportunity to process a given text, either visually or auditory, while trying to answer different levels of questions. Since closed tests do not allow assessment of comprehension and application without being confounded with the ability to remember, open book tests solved this issue by moving away from assessing students' long-term memory to assessing their ability to extract knowledge, comprehend, and then apply their knowledge in various situations. Finally, the seventh quiz was administered during the last class in the course. This time, the test was not an open book test; rather, it was an exact mock final test. This final test aimed to verify whether the students had gained the knowledge and ability required to pass the final test. The timing of the mock test was ideal for the students because they were not under pressure due to other course requirements or final exams.

Another component of the learning program for this course was in the form of computer-based training tasks: the serial and parallel recall tasks and following visual-spatial paths task. Students were required to complete 14 training sessions on two different working memory tasks, once a week. They were given copies of the tests and were allowed to practice the training sessions in their own time.

Post-assessment of program outcomes. Three measures were taken at the end of the program. First, the final exam, which counted for 40% of the total course grade. Second, the visual-spatial tapping computer-based task was administered again, and the results were compared those obtained during the first administration. Finally, the questionnaire of learned helplessness was administered as a retroactive and post-assessment. Each participant was given two copies of the questionnaire. One copy asked the participants to express whether they agreed or disagreed with the statements when they started the course (retroactive response). The other copy asked the participants to rate the statements based on their current feelings and thoughts. The students were debriefed at the end of the program about their feelings and experience with the program and were asked whether they felt they had improved their study skills as a result of completing the course and whether they felt they had made academic progress.

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Follow-up assessment. Three months after the students completed the neuropsychology course, they were asked to perform the visual-spatial tapping task. This task was administered to assess whether the outcomes of the program, if found, prevailed over a longer period of time.

Results

IQ Scores

The IQ scores revealed that, of the participants, two students classified as slow learners, five as holders of specific learning disabilities, mainly in quantitative reasoning, and one student had an average IQ score. An independent sample t test showed a significant drop in the IQ scores for the experimental group ($M = 92$, $SD = 5.78$) compared to the scores of the control group ($M = 114.75$, $SD = 2.19$), $t(14) = 10.41$, $p < .001$. Similarly, nonverbal intelligence for the experimental group ($M = 93$, $SD = 8.05$) was significantly lower than that of the control group ($M = 112.5$, $SD = 2.45$), $t(14) = 6.55$, $p < .001$. In the same way, the verbal intelligence for the experimental group ($M = 91.63$, $SD = 5.5$) was significantly lower than the verbal intelligence of the control group ($M = 114.13$, $SD = 4.42$), $t(14) = 9.02$, $p < .001$. A similar pattern of results were shown for all subtests, fluid reasoning, $t(14) = 3.63$, $p < .01$, knowledge, $t(14) = 2.99$, $p < .01$, quantitative reasoning, $t(14) = 12.18$, $p < .001$, visual spatial processing, $t(14) = 4.25$, $p < .001$, and working memory, $t(14) = 5.73$, $p < .001$. See Table 1 for the means and standard deviations for each subtest. A repeated measure ANOVA was used to examine the difference between the subtest scores of the students with LD, and the difference was highly significant, $F(4, 28) = 7.4$, $p < .001$, $MSe = 51.32$, $\eta^2p = .51$.

Learned Helplessness

The participants' responses to the learned helplessness questionnaire were scored according to a five-point scale, with a score of five denoting "strongly agree" and one denoting "strongly disagree". As there were four dimensions in the questionnaire, each participant had five scores, four sub-scores and one total score. The maximum total score was 235. Finally, the mean scores for the students with LD were calculated for each dimension and for the whole questionnaire.

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In general, the students' responses to the post learned helplessness questionnaire showed a decrease in the total score, $t(7) = 20.96$, $p < .001$, reflecting an improvement in students' attitudes. The total score on the retrospective learned helplessness questionnaire was $M = 146.75$, $SD = 28.01$, while the total score for the post questionnaire was $M = 106.13$, $SD = 14.51$. The drop in the scores from the retrospective questionnaire to the post questionnaire was significant in all subtests: negativity, $t(7) = 12.39$, $p < .001$, escaping, $t(7) = 12.21$, $p < .001$, inflexibility, $t(7) = 16.81$, $p < .001$, and satisfaction with low results, $t(7) = 16.87$, $p < .001$.

Computer-Based Working Memory Tests

Participants performed ten trials in each of the four conditions (congruent words and locations, congruent words and incongruent locations, incongruent words and congruent locations, and incongruent words and locations), each of three levels. The correct responses provided in the given time were allocated either one, two or three for levels 1, 2, and 3, respectively. A zero score was given for an incorrect response or no response. The scores for each of the four conditions were independently calculated for each of the three levels, giving each participant 12 different scores. Then, the means across participants for each level in each condition were calculated. However, since preliminary analyses of the results showed a similar pattern for all three levels, and for the purpose of the study, the scores were collapsed across all conditions and levels for each student (the maximum total score for each student was 240). For ease of presentation, only the mean scores for each time of testing will be presented here.

Nonparametric Friedman test for related groups showed a significant main effect of time of testing, $X^2(2) = 9.75$, $p < .01$. Post hoc tests using Wilcoxon signed-Rank test with Bonforroni correctiong showed a significant main effect between participants performance at the beginning of the program, median = 93.5 (75.75 to 111.5), and their performance in the post test, median = 201 (169.25 to 214.25), $Z = 2.52$, $p < .017$. However, performance in the follow up test, median = 216.5 (204.5 to 231.75), was not significantly different from performance in the post test, $Z = 1.12$, p = ns.

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When comparing the performance of students with LDs in each of the three tests with the performance of the students from the control group, Mann-Whitney U test with Bonforroni correctiong indicated that there was a significant difference between the performance of the control group, mean rank= 12.5, and the performance of students with LD before the program, mean rank = 4.5, $U = 36$, $p < .01$. All other comparisons were not significant.

Academic Achievement

Six quizzes were administered during the academic term for the purposes of the academic assessment. As the quizzes varied in their total scores, a proportionally corrected score was calculated by dividing each individual score by the maximum score for the quiz. This gave students scores ranging between 0.0-1.0 for each quiz. It was expected that the students' performance would improve during the course, and that this would be reflected in their quiz scores. Nevertheless, linear regression showed no significant results, $r = .26$, p = ns. See Table 2 for the mean and standard deviations of the scores in each quiz.

In general, continuous assessment, including quiz scores, activities, class work and computer training tasks, accounted for 60% of the total score in this course. The average of students in the continuous assessment was $M = 48.88$; the highest was 54, and the lowest was 43. On the other hand, the final exam score accounted for 40% of the total score, and the students' average was $M = 23.75$; ranging between 16 and 36.

All eight students passed the course with an average grade of 72.63. The final scores of the students were very similar. Four students obtained a 'C' grade (a score between 70-79), one student obtained a D+ grade (between 65-69), and two students, who were classified as slow learners, achieved a D grade of 61 (the pass grade is 60). One student showed an outstanding improvement in her exam performance and this student had failed in this course prior to intervention. At the end of the intervention program, she obtained an A grade (a score of 90).

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Discussion

Learned helplessness is commonly exhibited by undergraduates with LD (Falzon & Camilleri, 2010; Klassen, Krawchuk, Lynch & Rajani, 2008; Voughn & Fuchs, 2003; Peleg, 2011). As such, the current intervention aimed to design a program that successfully delivered an encouraging and rewarding learning environment for students with LD while also providing training exercises that effectively trained their working memory. Both methods were perceived to develop the students' executive functioning and to improve their attitudes toward their abilities, which was perceived to represent a decrease in symptoms of learned helplessness, as assessed by the self-rating learned helplessness scale. Indeed, the findings revealed that the students' scores in the learned helplessness scale did decrease, indicating that the intervention delivered positive outcomes.

One might argue that the learned helplessness scale that was used in this study was a self-rating scale that employed the now-then technique (i.e., it was filled twice at the same time but corresponding to now experience and retroactive experience). It is feasible to argue that this created bias that influenced the students' beliefs about the effects of the intervention program; i.e., they were aware of the general aim of the intervention program. Nevertheless, previous research has proven that this now-then technique is valid for testing the effects of learning programs on student's attitudes (Townsend & Wilton, 2003). Additionally, students' beliefs about themselves are the core of learned helplessness problems. If students start to change their beliefs about their abilities and effectiveness of new learning methods, this can be considered to reflect an improvement in their attitudes. In addition, all eight students who were involved in the research completed their assignments, attended the classes when the quizzes were administered, passed the course and described their experiences on the program in a positive manner.

The decrease in the learned helplessness scores of the students might also be responsible for the fact that the students completed regular training on WM tasks. If the learned helplessness had not been reduced during the program, the students may not have responded to the training domains. In fact, completing the computer-based

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training tasks required a great deal of commitment and motivation (Tam, Nakonezny & Hughes, 2014). As such, learned helplessness could have acted as a barrier that prevented students from participating in such tasks. However, the fact that the students completed the WM training could be seen as a further indication that their symptoms of learned helplessness had been reduced.

This study clearly shows that WM training resulted in a persistent improvement in the students' executive functioning computer-based task, even three months after the program completion. The improvement in this task might be specific because it did not transfer to the students' exam scores. It is also not possible to attribute the improvement in this task solely to the WM training. The concrete learning activities that were provided during the course and the changes in students' attitudes might also have contributed to such improvement. However, the intervention, at least, succeeded in improving the students' performance in the executive function computer-based task, and this indicates that there is a distinct possibility that executive functioning performance can be improved by variables that are different from merely completing training on the same task. Future studies can examine what exact types of intervention can improve executive functioning and how such improvements can be transferred to other general cognitive tasks.

It is important to acknowledge that the results of this study were limited due to the small sample size utilised. However, it is not unusual for studies of this nature that aim to examine the effect of interventions on students with LDs to include small sample sizes; for example, that conducted by Berger (2008). Additionally, the intervention was conducted over a period of approximately four months with an additional follow-up after four months. This could be one explanation for the fact that the students did not exhibit a significant improvement in their quiz scores. The null effect of intervention programs on students' scores has been demonstrated in previous studies; for example, that conducted by Chiang & Liu (2011). It is also worth noting that the current study combined elements that have been proven to improve the exam scores of undergraduates with no LDs, including labelling structures (Pourahmadi, Javeshghani, Najafipour & Bigizadeh, 2013) with techniques that have been

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specifically designed to improve the academic performance of disabled students (Bouck, Satsangi, Doughty & Courtney, 2014). It was anticipated that the positive effects identified in such studies would also be manifested when utilising similar techniques with undergraduates with LDs.

A further issue that is worth noting concerns the trend to include students with LD in large sections. This study suggested that small sections, which consist only of students who encounter difficulties in passing a scientific course, are likely to decrease the learned helplessness scores of students. However, this is not readily accepted, and alternative studies have found that there is a need to include students with LDs in regular classes in order to avoid stigmatising them (Gresham, & Elution, 2010).

On the whole, the intervention program was successful in decreasing learned helplessness and its negative effects on students' attitudes. However, the question as to how such interventions can be effectively employed to accomplish better academic achievement for students remains open and is recommended as a subject of future research. Future studies may attempt to eliminate the negative effects of LD despite their hidden nature.

The intervention program in this study shed some light on the elements that must be further examined in terms of their effects on students with LD. These variables include concrete learning experiences based on the course materials, frequent open book assessments, WM training and segregated sections for students who are encountering learned helplessness. Further studies may also benefit from systematically evaluating the procedures and outcomes of this intervention program.

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Figure Captions

Figure 1. An example of the phono spatial tapping task. This figure shows a trial from the phono spatial tapping task, where both words and spatial information in the target card and the test cards are congruent.

Figure 2. An example of the visual tapping task. This figure shows a trial from the low-density level in the visual tapping task. The trial highlights three squares (1-8-18). Then an interval screen with an irrelevant word (Volcano) appears followed by the test phase. The test phase will highlight (1, 8 and 16) consecutively; in this case, participants are supposed to press '/ ' to indicate a mismatch between the target and the test phase.

Table 1 Means and standard deviations for IQ scores of each subtest

Group	Value	FI	K	QR	VS	WM
Experimental group	M	97.88	98.38	82.38	95.75	88.38
	SD	9.14	11.72	4.1	9.9	6.59
Control group	M	112.25	111.63	113.5	113.38	119.63
	SD	6.48	4.44	5.95	6.28	6.39

FI= Fluid intelligence

K = Knowledge

QR= Quantitative reasoning

VS = Visuospatial processing

WM= working memory

Table 2 Means and standard deviations of the quiz scores

	Quiz 1	Quiz 2	Quiz 3	Quiz 4	Quiz 5	Quiz 6
M	.85	.63	.78	.87	.74	.71
SD	.3	.11	.12	.13	.1	.09

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Figure 1

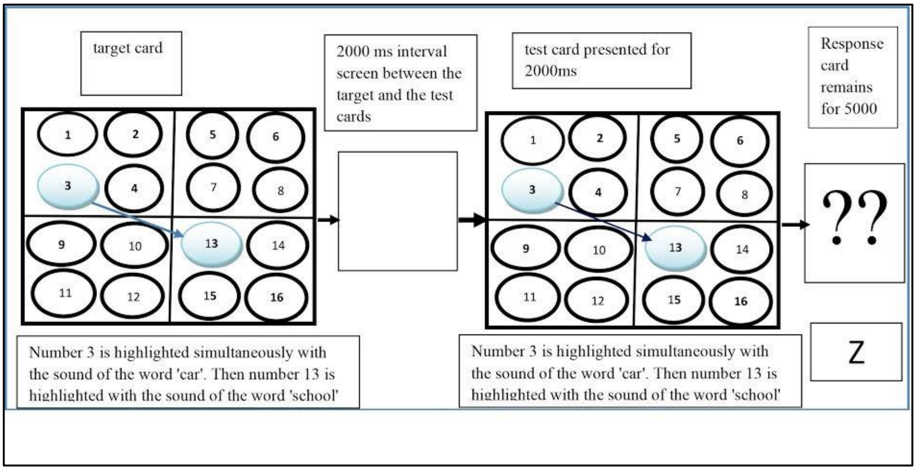
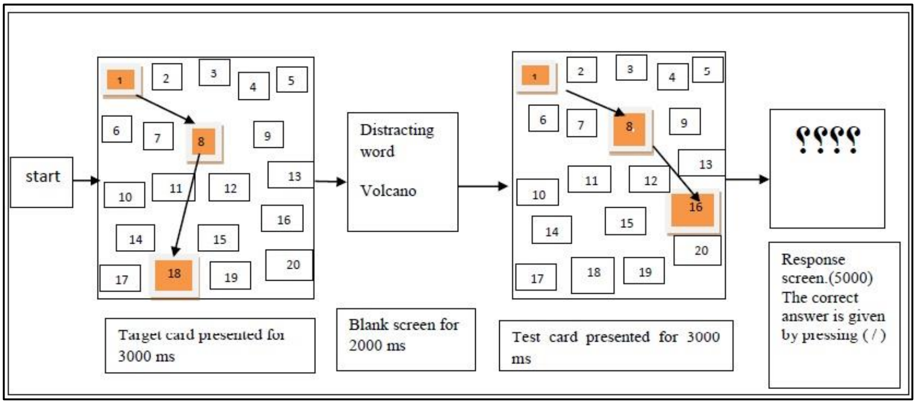


Figure2



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