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Memory Aids as a Disability-Related Accommodation? Let's Remember to Recommend Them Appropriately

Allyson G. Harrison[1], Alana Holmes[2], and Bethany Pollock[1]

Abstract

Memory aids are now frequently provided to elementary and secondary school students to increase their success in achieving provincial curriculum standards. While such an accommodation may meet the immediate goal of improved academic performance it may not be warranted based on an actual long-term memory retrieval impairment and may therefore be inequitable, providing an unfair academic advantage relative to non-disabled students. Furthermore, providing memory aid accommodations inappropriately may rob students of the opportunity to learn effective study and retrieval strategies, leading instead to dependence on an accommodation that may not be continued once they enter post-secondary education. An appropriate accommodation at the post-secondary level of education removes a disability-related barrier (functional impairment) and assists only those facing such barriers; under human rights legislation, accommodations are not implemented to guarantee success, reduce anxiety, or provide unequal access to material. Memory aids improve the retrieval of information from long-term storage for everyone. As such, the current widespread provision of this accommodation prior to post-secondary studies must be evaluated critically, with such supports offered only when justified. A six-step process for determining when memory aids are an appropriate accommodation within the post-secondary setting is provided and discussed.

[1]Queens University, Kingston, ON, Canada
[2]Cambrian College, Sudbury, ON, Canada

Corresponding Author:
Allyson G. Harrison, Regional Assessment & Resource Centre, Queens University, 68 University Avenue, Kingston, ON, Canada K7L 3N9.
Email: harrisna@queensu.ca

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Introduction

There is currently a disconnect between the guiding principles underlying the determination and implementation of academic accommodations in the K-12 school system and those that apply to the post-secondary system (Harrison et al., 2008; Madaus et al., 2010; National Joint Committee on Learning Disabilities, 2007). In Canada, each province has specific educational legislation that applies to provision of accommodations in the K-12 school system. For instance, in Ontario, provisions governing special education were introduced into the Education Act by the Education Amendment Act, 1980, more commonly known as Bill 82 (Ontario Ministry of Education, 1981). This legislation allows elementary and secondary schools to provide academic accommodations and supports to any student who is identified as an "exceptional learner," with the goal of aiding academic success. These special education laws do not apply to post-secondary students. Specifically, as ensured by the Canadian Human Rights Act (R.S., 1985, c. H, s. 38; 2003, c. 22, s. 137(E)), Section 15 of the Canadian Charter of Rights and Freedoms (1982), and various provincial Human Rights Codes, post-secondary students with bona fide disabilities are entitled to appropriate accommodations, services, and supports in their post-secondary programs any time the impairments that arise from their disability interfere with equal participation or with their equal opportunity to demonstrate knowledge and skill.

It is during the transition from high school to post-secondary that conflicts regarding the purpose of accommodation may arise. Indeed, unlike elementary or high school, accommodations at the post-secondary level are not implemented solely to allow for improved performance or to ensure academic success (Roberts, 2012). Accommodations at the post-secondary level serve only to equalize the opportunity to participate (by removing artificial barriers to such equal participation) without compromising the integrity of the academic task. Human rights legislation does not require any specific accommodation for any given condition in any particular setting (Roberts, 2012). Instead, provision of reasonable accommodations requires an understanding of the objective functional impairments experienced (determined relative to most other individuals in the general population (Lovett & Lewandowski, 2015)), the nature of the required task, and the bona fide task requirements of a given course or program.

One academic accommodation that appears to have gained popularity in recent years is the provision of memory aids. Memory cues enhance memory functioning of all individuals (Duchnick et al., 2002; Tombaugh & Schmidt, 1992). In fact, the finding that cued recall is superior to free recall is so well established in cognitive psychology that it generally is not even questioned. Indeed, Roediger (1973) talks about this common knowledge when he says: "One of the most effective methods of improving memory for a series of briefly experienced episodes—rivaled only by imagery instructions and mnemonic devices—is the presentation of retrieval cues at the time of recall"

(p. 644). This means that providing such cues to only a few individuals in a class would raise significant issues of reverse discrimination and accommodation fairness. As such, memory aids would appear to be a disability-specific accommodation that should be provided only in very specific and limited circumstances. In practice, however, this accommodation appears to be recommended more and more frequently in the K-12 school system.

At the post-secondary level, there has been a notable increase in the number of Canadian students arriving at their chosen college or university having previously been provided with memory aids as an academic accommodation, or requesting that such accommodations now be made available for them in their current studies (College Council on Disability Issues, 2018; Harrison, 2019; King, personal communication, June 9, 2020; Parsons, personal communication, November 7, 2019). While no specific information exists regarding the number of elementary and secondary school students who are being given this accommodation, anecdotal information and a review of specific school websites across Canada reveals that this accommodation is becoming increasingly routine in K-12 schools (e.g., Ontario Teachers' Federation (n.d.) which specifically suggests memory aids as environmental strategy for students with memory problems; Alberta Education (2010); Ministère de l'Éducation de Quebec, de l'Enseignement supérieur et de la Recherche (2015); Ontario English Catholic Teacher's Association (n.d.)).

In response, colleges and universities across the country have scrambled to try and put in place some limits on what this accommodation involves at the post-secondary level; however, Disability Services Office (DSO) staff are not school psychologists and so do not feel comfortable questioning the accommodation recommendations made by professionals or contained in formal individual educational plans (Harrison & Wolforth, 2012). As such, there is a need to identify under what circumstances a memory aid accommodation might be reasonable, and to better understand what diagnostic tests must be given in order to support such an accommodation recommendation.

When Might Memory Aids Be Required?

The purpose of academic accommodations at the post-secondary level is not to enhance performance or ensure success, but rather to allow an *otherwise qualified* individual the opportunity to *participate equally* (Roberts, 2012). In the case of memory aids, *otherwise qualified* would mean that the person actually knows the information required; however, due to the negative effects of a neurological disorder, they are unable to access this information spontaneously, but with a cue they can retrieve the stored information. *Participate equally* means that the accommodation should allow an *otherwise qualified* person an equal opportunity to demonstrate what they know, but not give them an unfair advantage relative to other students.

An essential requirement of almost all post-secondary courses is mastery of course material, including learning and understanding the concepts taught (Roberts, 2012). As noted above, one of the most agreed-upon findings in cognitive psychology is that

memory cues help all individuals retrieve more information than can be recalled spontaneously (for further research on this topic see: Fay et al., 2005; Schmidt et al., 1992; Thomson & Tulving, 1970; Tulving, 1974; Tulving & Thomson, 1971; Watkins & Tulving, 1975). This means that cueing would actually help all students and thus has the potential to provide an unequal benefit to the accommodated student relative to their peers. As Roberts (2012) notes, "Accommodations are meant to level the playing field. . . not tilt it to the student's advantage, or act as insurance against failure" (p. 78).

The Human Rights Tribunal of Ontario (HRTO) has upheld these principles, making it clear that the aim of accommodation at the post-secondary level is to provide *otherwise qualified* applicants with an equal opportunity to meet legitimate academic standards. For example, one recent ruling concluded that, "The purpose of granting accommodations . . . is to ensure that test takers with disabilities are neither disadvantaged nor advantaged in comparison with non-disabled test takers" (*Cohen v. Law School Admission Council*, 2014, para. 127). By contrast, the decision noted that, "this situation is very different from the [high school] environment where the primary purpose of accommodating disabilities . . . is to maximize the student's learning" (para. 129). In other rulings, the HRTO also upheld that the purpose of academic accommodations at the post-secondary level is not to ensure success but simply to allow for equal access (e.g., *Worthington v. Algonquin College of Applied Arts and Technology*, 2012).

Logically, it therefore follows that clinicians should be cautious when recommending memory aids, and do so only when there is objective and compelling data to support that the student is *otherwise qualified* (i.e., that they actually did learn the information initially) yet are *unable to participate equally* due to a neurological impairment that interferes with spontaneous retrieval of learned material. To demonstrate both of these characteristics, a clinician would need to use objective testing to evaluate that (a) the student actually learned the information initially; (b) despite investing maximal effort, they failed to retrieve this learned information spontaneously; (c) they could retrieve the stored information when given cues; and (d) that the difference between their spontaneous recall and cued recall is significantly larger than for most other students. This latter point is essential, given that cued recall helps all individuals and accommodations are not meant to provide a student with better access to information than is true for their non-disabled peers.

Psychometric Considerations in Evaluating Long-Term Memory Retrieval Deficits

To document the need for a memory aid, one must first establish that retrieval of information from long-term memory is faulty. Many popular memory assessment batteries do not provide this type of information or do so only through the active calculation of supplementary index scores. Test selection is therefore crucial to determining the legitimacy of the need for memory aids. Simply because a test has the word "memory" in its title does not mean that it is actually useful in identifying poor free-recall long-term memory.

One popular misconception appears to be that low scores on tests of auditory working memory are sufficient to compel a memory aid accommodation (e.g., Linda Houston & Paquet-Bélanger (n.d.)). Tests of auditory working memory (e.g., digit span, mental arithmetic) do not measure long-term storage and retrieval of information. Although this term contains the word "memory," working memory is not an actual store of memory like long-term memory. Auditory working memory does not require that the temporarily held information be transformed or transferred into long-term storage, only that the information be held for a few seconds. This mode of memory is modality-specific, decays rapidly unless actively rehearsed, and has a very limited capacity—only about seven discrete pieces of information can be housed in working memory at any one time (Baddeley, 1990). There is no meaningful relationship between auditory working memory and long-term memory deficits. Therefore, a deficit on an auditory working memory test does not demonstrate the need for memory aids. For instance, individuals with severe Korsakoff's syndrome, who cannot lay down new memories, have no difficulty performing on immediate auditory working memory tasks (Schmidt & Tombaugh, 1995). Conversely, children with severe learning and attention disorders often have auditory working memory deficits but excellent capacity to retrieve previously learned material (Kibby & Cohen, 2008). Hence, auditory working memory deficits alone are not sufficient to demonstrate impaired spontaneous recall of learned information.

Pure memory failure is due to deficits in long-term memory consolidation, usually seen in Alzheimer's disease or bilateral temporal lobe dysfunction. By contrast, there are a subset of individuals with neurological injuries or disorders who have adequate ability to store information in long-term memory, but have impaired spontaneous long-term memory retrieval (Baum et al., 1996; Curtiss et al., 2001). In clinical practice, such retrieval problems are often identified when the person shows unusually enhanced recall performance following some type of memory retrieval cue (not simply recognition). Discrepancies that show significantly better cued memory performance compared with free recall performance have been considered markers of impaired retrieval (Lezak, 1995). In order to evaluate this type of long-term memory retrieval impairment, one must therefore first ensure that information has been learned and stored. Whatever information is initially learned should then be transferred to long-term storage for later retrieval; hence, one must control for initial amount of storage when evaluating later retrieval capacity. For instance, someone who learns 5 of 15 words initially and then recalls all five words after a 30-minute delay does not have a long-term memory retrieval impairment, as their spontaneous recall of what was initially encoded is perfect! Recalling only 5 of 15 words may be normatively weak, resulting in a below average normative score, but the impairment for this person is with rate of initial learning rather than with long-term memory retrieval. Therefore, in order to evaluate problems with long-term memory retrieval one must have a memory measure that accounts for the amount of initial learning when interpreting the meaning of any delayed memory score, both in free and cued recall conditions (Tombaugh & Schmidt, 1992; Wechsler, 2009). Few memory tests do this.

In order to adequately ensure that learning has occurred, one also needs to present the "to-be-learned" information more than once (Erikson & Scott, 1977; Tombaugh & Schmidt, 1992). Repeated presentations of the to-be-learned material reduces the impact of other factors such as distractibility or attention deficits, provides valuable information regarding the efficiency and the speed of the learning process, and increases the likelihood that the information was both learned and transferred into long-term storage. Most memory tests also fail to do this, providing only single-trial learning options.

An adequate assessment of memory should differentiate between information that has actually been forgotten (memory loss) and information that is present but cannot be accessed or retrieved spontaneously (retrieval problem). The most effective and simplest way to address this problem is to provide recall measures that range from free recall through cued recall to recognition. Since this procedure also mirrors the improved performance shown by all individuals (i.e., free recall is harder than cued recall, which in turn is harder than recognition memory), there must be evidence that the cued or recognition memory boost shown by an examinee is much greater than for most other people in the general population in order to support provision of memory aids. This again requires some type of method to control for initial amount learned and for ceiling effects. Few memory tests do this adequately.

Frequency of Long-Term Memory Disorders in Adolescents and Young Adults

Apart from severe neurological disorders or injuries (e.g., severe traumatic brain injury, brain tumors, epileptic disorders, bilateral hippocampal lesions, carbon monoxide poisoning, hydrocephalus, severe frontal lobe dysfunction), long-term memory disorders are extremely rare in children or young adults (Majerus & Van Der Linden, 2013). Even children with severe learning or attention problems fail to have impaired long-term recall of previously learned information (Kibby & Cohen, 2008). Hence, it should be rare to require memory aids at the college or university level unless the student has a documented severe neurological disorder.

Unfortunately, adolescents or young adults often mistakenly believe they have long-term memory problems when, in fact, they never paid attention to or learned the information in the first place. It feels like a memory problem to them (or to others who interact with them) when in fact the problem is one of an initial attention deficit, as you cannot remember that to which you did not first pay attention (Watson & Strayer, 2010). Such may be the case when, for example, students study for a classroom test by reading through material in highly distracting environments while simultaneously monitoring their social media channels. These circumstances divide an individual's attention, which is finite, across multiple tasks and limit the amount of information that can then be processed for storage into and retrieval from long-term memory (Anderson et al., 1998). Because the examinee did not transfer the information into long-term storage in the first place, they cannot retrieve it later. However, this is not due to memory retrieval failure.

Another good example of this type of problem is found in individuals with severe frontal lobe dysfunction. They fail to recall information due to inefficient learning strategies and/or failure to attend to the to-be-learned information. As such, accurate evaluation of memory problems depends on the quality of initial learning required in the test and varying methods of evaluating long-term storage and retrieval (Lemos et al., 2014). In other words, one must first ensure that the information was attended to adequately and control for frontal system impairments (Lemos et al., 2014). Many memory tests fail to do this adequately.

There are other causes for altered memory functioning. For example, we know that individuals recall information best if they are in a state similar to the one in which they learned the material (Izquierdo & Diaz, 1983). Hence, students who engage in recreational drug use while studying may experience memory problems when trying to retrieve the information in a sober state. Other non-organic factors can also affect memory. For instance, severe anxiety can result in inconsistent or erratic performance and disrupt initial attention. Such examinees are often so focused on self-conscious perceptions of failure or scanning the environment for potential threats that they fail to actually encode the material initially (Bar-Haim et al., 2007; Cisler et al., 2009; Derryberry & Reed, 2002; Eysenck et al., 2007). This is a problem with initial learning, not recall. In these cases, there is not an inability to spontaneously retrieve learned information, and so a memory aid would not be a reasonable accommodation. Similarly, those with depression show a general slowing during the initial "learning" phase, but retain perfectly all the information they initially encoded (Hermens et al., 2010; Tombaugh & Schmidt, 1992). Due to depression-related attention deficits, they often fail to pay attention initially, thus limiting rate of learning (Hermens et al., 2010; Schweizer et al., 2018). Here too, the problem is not forgetting of learned information or a retrieval problem, but rather slowness in learning and storing the information for later retrieval. Such a deficit would logically require a reduced course load accommodation to allow the individual more time to learn the information. Having learned the information, those with depression have been shown to have adequate ability to spontaneously access this learned information (Hermens et al., 2010). Further, individuals who are depressed often don't guess for fear of being wrong, but if pushed they can generate the correct answer. This would suggest the need for academic coaching and positive learning support for the student rather than memory aids.

Another group who may do poorly on memory tests in a psychological assessment for possible learning or attention problems are individuals who are performing in a non-credible manner. These are people who produce memory scores that, while initially seeming impaired, are in fact, implausible. These individuals may or may not have a genuine neurological impairment; this cannot be determined due to their non-credible performance. Reasons for such non-credible performance vary: they may be disengaged in the assessment process in general; may invest little effort in the learning phase as they believe their memory is poor; or may be motivated to perform poorly in order to obtain academic accommodations or other benefits (Fuermaier et al., 2017; Green, 2007; Green et al., 2001). Whatever the reason, it is therefore imperative to objectively evaluate the credibility of memory problems before deciding if memory

aids are reasonable. This is especially true given research findings showing that low test-taking effort has a greater negative effect on obtained memory scores than does amount of documented brain injury (Green et al., 2001), and that clinicians are extremely poor at subjectively identifying when such non-credible performance is occurring (Faust et al., 1988a, 1988b).

Finally, two separate memory systems exist, one for language-based information and one for visual shapes and figures (Baddeley, 2000), and each operates independently. As such, one cannot extrapolate findings from one memory system to the other. In other words, when considering the need for memory aids, the modality of the memory deficits should be logically linked to the area of academic complaint/skill challenge. For example, auditory memory problems are unlikely to exert any influence on hands-on learning tasks (such a carpentry, dental hygiene, etc.) whereas visual memory deficits might interfere in the performance of such visually-based tasks and thus require an external memory support.

Suggested Guidelines for Determining Whether Memory Aids are a Reasonable Academic Accommodation

Over the past 10 years, memory aids have been provided freely and without evidence-based support in the K-12 school system in many Canadian provinces; as a result, they have become a highly requested accommodation within the post-secondary education setting. Research shows that almost all persons, not just those with disabilities, benefit from cues (e.g., memory aids) when asked to recall information to which they were previously exposed. Thus, in order to allocate memory aids in a manner than is judicious and fair, evidence must be gathered to show that any individual receiving such a support has: demonstrated an ability to learn designated material; difficulty retrieving it under conditions of free recall; and a marked improvement in producing the information in response to cues, over and above the improvement found for all other individuals their age. This is the only way to ensure that the memory aid is not overly beneficial to the recipient but simply confers a similar level of opportunity for knowledge demonstration. Basing the provision of memory aids on self-reported memory challenges, previous use of memory aids, subjective anxiety reduction, or on a sole subtest containing the word "memory" in its title is insufficient evidence of a deficit in retrieval of previously learned information from long-term memory. Before educational psychologists recommend memory aids as an accommodation at the post-secondary level of study, they must garner the above data through the selection and administration of appropriate standardized tests capable of measuring initial free recall learning and cued learning. The following are suggested guidelines for determining when to provide memory aids as a disability-related accommodation.

1. First and foremost, the memory complaints must be credible. This requires that the assessor employ validated measures of performance validity. If the clinician did not objectively measure performance validity, then the post-secondary institution cannot be sure that any reported memory deficits are genuine. Clinicians

cannot simply employ "clinical judgement alone" to decide if the client was investing good effort, as studies show that clinicians usually fail to identify symptom exaggeration using this method (Faust et al., 1988a, 1988b). Careful selection of performance validity tests is needed. Examples of well-validated performance validity tests with good sensitivity and a low false-positive rate include the Word Memory Test (Green, 2005), the Medical Symptom Validity Test (Green, 2004), and the Victoria Symptom Validity Test (Slick et al., 1997). By contrast, tests like the 15-item test (Lee et al., 1992) or the Test of Memory Malingering (TOMM; Tombaugh, 1996) are not sufficient on their own, as these both have a very high false-negative rate (i.e., they fail to catch all but the most severely exaggerating performers; Armistead-Jehle & Gervais, 2011; Lindstrom et al., 2009; Love et al., 2014) and don't necessarily evaluate feigning of academic memory impairments.

2. The recommendation should be based on more than simply low scores on auditory working memory tests, as these do not measure retrieval from long-term memory. Hence, simply identifying low scores on Digit Span, mental Arithmetic, Letter-Number Sequencing, or the Working Memory Index of the Wechsler Adult Intelligence Scale (WAIS; Wechsler, 2008) or Wechsler Intelligence Scale for Children (WISC; Wechsler, 2014) is not proof of difficulties in long-term memory retrieval (see recommendations #3 and #4 for examples of more appropriate tests/assessment methods). Poor performance on these subtests/indices may instead indicate some challenges with attentional filtration. Namely, only content in attentional focus can be committed to memory. Thus, poor performance on these subtests/indices may help explain why an individual has challenges initially learning some types of information, particularly after one exposure. Knowing this may assist clinicians in recommending other more effective learning methods to aid with the initial encoding of information into memory.
3. The memory test employed must explicitly inform the examinee that later recall will be required, and ensure that actual learning has taken place over a standardized period of time, controlling for lapses in attention during the learning phase. Hence, tests like the Rey Complex Figure (Meyers & Meyers, 1995) are inappropriate, as the examinee may not have been actively trying to learn the figure during the initial copy phase of the test (see above for issues regarding attention and memory), and there is no standard time allowed for the copy phase. Forgetting the picture later may therefore be due to impulsive haste in the initial drawing, or inattention due to problems with motor copying (where the person exerts so much effort just trying to make the lines that they fail to attend to the actual picture they are copying).
4. When evaluating the meaning of a low delayed memory score, clinicians should use a test that controls for initial amount learned, or make these "percentage retained" calculations manually. Percentage retained can be calculated only if the number of items presented initially is equal to the number to be remembered after a time delay. It is defined as the long-term retention

> score divided by the last learning trial score multiplied by 100. For instance, the California Verbal Learning Test-II & -3 (Delis et al., 2000, 2017) offers a five-trial list learning paradigm, tests for both immediate and delayed free recall, immediate and delayed cued recall, and recognition-cued recall. Further, it allows the clinician to control for initial amount learned when evaluating delayed recall, and offers "recall contrast measures." The delayed recall scores from the Wide Range Assessment of Memory and Learning (WRAML-2; Sheslow & Adams, 2003) also control for initial learning so long as one uses the Retention score (difference between Trial #4 and Delayed Free Recall), but it does not evaluate cued recall. Finally, the Learning and Memory Battery (LAMB; Schmidt & Tombaugh, 1995)[1] allows clinicians to calculate a percent retained score, identifying how much of the initially learned material was forgotten.

The Wechsler Memory Scale-IV (WMS-IV; Wechsler, 2009) provides calculations for a supplementary score called "Contrast Scaled Scores" (Wechsler, 2009, p. 153). These contrasts adjust the obtained delayed memory score for the examinee's level of immediate memory. The resulting scaled score is interpreted in the same manner as other test variables. In other words, contrast scores between 8 and 12 show that the immediate and delayed scores do not differ from each other, and therefore there is no loss of learned information. A score that is above 12 shows that, in fact, long-term recall is better than expected given what was initially encoded, while one below eight suggests loss of previous information. The technical manual of the WMS-IV notes:

> The delayed memory age-adjusted scaled score informs practitioners of the individual's recall after 20 minutes compared to same age peers. However, the contrast score has a different meaning than the age-adjusted scaled score. The contrast score reflects the examinee's ability on delayed recall when you take into account how much information he/she learned in the immediate condition. It reflects the degree to which the examinee forgot the material learned during the immediate condition. (p. 153)

This score should be calculated and interpreted. Notably, the WMS also offers a contrast score for "delayed recall versus recognition memory." Unfortunately, the manual states that the normative scores for this measure are highly skewed and have a non-normal frequency distribution. As such, they offer only cumulative percentage norms, which are much less specific and reliable.

Another well-normed test that ensures that all these aspects of memory are evaluated is the Memory module of the Neuropsychological Assessment Battery (NAB; White & Stern, 2003). The test manual also notes that a poor score on long term recall can be due to difficulties with attention, initial storage, or retrieval, and thus provides information to help differentiate between these reasons. The list-learning paradigm in particular offers a secondary "list learning percent retention" score to control for initial amount learned when interpreting amount remembered. The test does not offer a cued recall option. However, it does offer a "discriminability index"

which evaluates raw score differences in recognition memory, and the Recall versus Recognition variable measures improvement from free recall to forced-choice recognition to help identify if the long-term memory problem is due to storage or retrieval issues. The story learning task offers information regarding the percentage of phrase units recalled from the second initial learning trial until the delayed trial, but it does not offer cued recall.

The Test of Memory and Learning-2 (TOMAL-2; Reynolds & Voress, 2007) provides a learning curve profile over six trials and normative means for the number of words recalled on each trial. It is not clear whether it has any metric around the usefulness of cuing in the delayed trials. The manual states, "the two cued conditions are provided so you may test the limits to determine whether the examinee's recall failure is due to initial learning problems or a retrieval problem." Manual calculations of the difference between Trial #6 of initial learning and the Delayed Free Recall trial can show the percentage retained or lost. One may also calculate a percentage improvement with cues score by comparing Cued Delayed Recall with Trial six of initial learning.

5. Given that memory aids offer cued recall accommodations, the memory test should allow a clinician to evaluate whether cues aid in recall, and determine if the improvement in scores is better than the improvement enjoyed by most individuals. *It should go without saying that this would be relevant only if the delayed recall score (controlled for initial amount learned) is impaired* (e.g., falls below the 16th percentile as per DSM-5 guidelines for Mild Neurocognitive Disorder (American Psychiatric Association, 2013)). Since recognition memory is the easiest form of memory, the memory test used should offer a continuum of free recall, cued recall and then recognition memory. Most memory tests do not offer such options; those that do include the CVLT-II or 3, the NAB, and the LAMB.
6. Finally, clinicians must be clear in stating that the recommended memory aids may not be appropriate in every course. Indeed, even when memory aids are deemed appropriate in general, these should be designed by the student and vetted by their professors so that the professor can ensure that the content of the memory aid does not cross the line into what is considered "essential learning outcomes," that is, the knowledge/skill a student needs to demonstrate in order to meet the learning objective(s) of the course in a prescribed manner. Additionally, the professor may feel that it is reasonable to provide all students in class with this option rather than allowing only one student to employ such memory aids.

In general, the content of the memory aids should typically be restricted to cues, which can take the form of mind maps, mnemonics, rhymes, or acronyms—something that triggers a fund of associated information and facts. These cue sheets should make sense only to the student who designed them. A formula memory cue sheet would contain formulas in notation form, but only those that the student is unable to remember;

no instructions/steps or specific examples are included and no essential information or conversion steps should be included. Examples of appropriate cueing sheets are available on various post-secondary websites (see http://www.disabilityissues.ca/english/Link_docs/Carren%20Tatton%20&%20Jacinda%20Frazer-%20Memory%20Aid%20Sheets.pdf, and https://humber.ca/student-life/swac/accessible-learning/information-faculty/find-details-about-specific-accommodations/memory).

Future Research

Assumptions about the usefulness of memory aids to ensure that the performance outcomes of individuals with specific memory impairments reflect the same attributes, abilities, and knowledge as their non-impaired peers are predominantly based on research from the cognitive rehabilitation field. Compensatory rehabilitation approaches to memory impairment seek to bypass the deficit and teach the individual how to use certain strategies to solve functional problems (Kapur & Wilson, 2009). External memory aids are the most effective and widely used intervention for the rehabilitation of neurologically-based memory impairments (Sohlberg et al., 2007). However, our review of the literature failed to uncover a single study examining the effect of memory aids on academic performance for younger students with and without identified long-term memory retrieval impairment. This is therefore a necessary area of future study. The research reviewed above shows clearly that all individuals benefit from the provision of memory aids. What requires further investigation, however, is whether students with specific long-term memory retrieval impairment experience a differential boost (Fuchs & Fuchs, 2001) in their performance when provided with memory aids relative to their non-disabled peers. That is, although all students will likely benefit from memory aids to some degree, do those with neurologically-based long-term retrieval problems derive more benefit from such cues than do non-disabled students? To operationalize this, studies should ensure that the same assessment measures are completed by students with and without specific long-term memory retrieval impairments under both aided and non-aided conditions (see Goegan & Harrison, 2017 for a recent example of this approach). Exploration of the impact of memory aids on the performance of students in various subjects and on different assessment methods would also be warranted.

Conclusion

The provision of memory aids as a means to maximizing the success of students in elementary and secondary school is enjoying current widespread use within the education systems of many provinces. The merits of this approach are up for debate when one considers that memory aids are *not* commonly deployed in the post-secondary education system and thus students transitioning from high school into college or university are required to adapt quickly to test-taking without memory aids. This means students may arrive at college or university dependent on memory aids and

with under-developed study skills or strategies for encoding, storing and retrieving information from long-term memory. Furthermore, these students may have been incorrectly lead to believe they have a memory impairment based on a working memory score or problems that are due to rate of initial learning; failing to provide such students with accurate information may cause potential harm and rob them of the ability to overcome their perceived difficulties effectively.

As noted in his introduction to this special issue, Shaw (in preparation) warned that educational psychology is often viewed as a field that relies more on myths and "feel good" practices rather than evidence-based research. The information reviewed above indicates that providing memory aids to students without a proven long-term memory retrieval disability is tantamount to providing an unfair competitive advantage, as cueing helps all individuals retrieve learned information more effectively. While offering such accommodations may "feel good" in the short term, it may ultimately do more harm (to both the student and to his/her peers) in the long term. In order for memory aid accommodations to be fair and defensible, those involved in recommending and assigning such supports (clinicians, school psychologists, and accessibility staff) need a clear set of guidelines outlining the full extent of information to be weighed before concluding memory aids are appropriate. Determination of the appropriateness of a memory aid accommodation requires more than self-report, a single low score or past receipt of a memory aid accommodation. Careful test selection is required such that the initial amount of free-recall learning is contrasted with what can be retrieved with the assistance of cues, and other causes for the reported memory deficits must be considered. Engaging in these more defensible practices will help ensure that memory aid accommodations are recommended only when the students has a genuine functional impairment in memory retrieval, so as to provide equal, not excessive, access within the post-secondary learning environment.

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ORCID iD


Allyson G. Harrison https://orcid.org/0000-0002-0426-2011

Note

1. The Learning and Memory Battery (LAMB) published by Multi-Health has been out of print since 2011; however, updated norms for post-secondary-aged students were collected by Harrison and Holmes (2010) and are available from these authors.

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Author Biographies

Allyson G. Harrison is a clinical neuropsychologist, currently employed as the clinical director of the Regional Assessment & Resource Centre at Queen's University, one of two centers mandated to support postsecondary students through the provision of assessments, applied research, and professional development for psychological practitioners. She also holds an appointment as an associate professor in the Department of Clinical Psychology at Queen's University. Her research is dedicated to issues of differential diagnosis in LD and ADHD.

Alana Holmes is a clinical psychologist with substantive experience in educational systems. Presently, she is the staff psychologist and manager of the Northern Ontario Assessment and Resource Centre (NOARC), one of two centres mandated to support postsecondary students through the provision of assessments, applied research, and professional development for psychological practitioners (www.noarc-cerno.ca). Her current research initiatives are designed to improve the assessment and accommodation of adults with learning disabilities.

Bethany Pollock is a clinical neuropsychologist who specializes in neurodevelopmental disorders, including Intellectual Disabilities, Learning Disabilities, Attention Deficit/Hyperactivity Disorder, and Autism Spectrum Disorder, in children, adolescents, and adults. She currently works with the Regional Assessment Resource Centre at Queen's University conducting Psycho-Educational and Neuropsychological Assessments for various post-secondary institutions, supervising graduate/post-graduate students, and providing peer review services for other practitioners in Ontario.