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# Self-Regulated Learning in a Dynamic Coaching Model for Supporting College Students With Traumatic Brain Injury: Two Case Reports

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**Objective:** To describe a program that integrates self-regulated learning theory with supported education for college students with traumatic brain injury using a dynamic coaching model; to demonstrate the feasibility of developing and implementing such a program; and to identify individualized outcomes. **Design:** Case study comparisons. **Setting:** University setting. **Participants:** Two severely injured students with cognitive impairments. **Interventions:** A dynamic coaching model of supported education which incorporated self-regulated learning was provided for students with traumatic brain injury while attending college. **Outcomes:** Outcomes were both short and long term including decontextualized standardized test scores, self-reported academic challenges, number and specificity of reported strategies, grades on assignments, number of credits completed versus attempted, and changes in academic status and campus life. **Results:** Students improved on graded assignments after strategy instruction and reported using more strategies by the end of the year. Students completed most of the credits they attempted, were in good academic standing, and made positive academic decisions. Performance on decontextualized tests pre- and postintervention was variable. **Conclusions:** It is feasible to deliver a hybrid supported education program that is dynamically responsive to individual students' needs and learning styles. Reasons for including both functional and standardized test outcomes are discussed. **Keywords:** *brain injury*, *cognitive rehabilitation*, *college students*, *self-regulation*, *supported education*

THE Centers for Disease Control and Prevention report that 1.7 million individuals sustain a traumatic brain injury (TBI) in the United States annually.[1] Most of these injuries are mild, yet even individuals who sustain moderate or severe injuries can have good outcomes given advances in early medical management and rehabilitation. Attending college after TBI is a realistic goal for many. Unfortunately, the propensity for TBI to result in diffuse or localized injury to the frontal lobes results in impaired executive functions. Thus, individuals can have dual impairments of cognitive processes (eg, recall) and of the ability to self-regulate (self-monitor and self-control) the same processes (eg, metamemory).[2] The ubiquitous attention, memory, learning, and social-emotional impairments coupled with executive function and self-regulation impairments place these individuals at unique risk for postsecondary failure. The National Longitudinal Transition Study-2 reported that students with TBI whose injuries occurred prior to college had substantially lower college graduation rates than their nondisabled peers.[3]

There are relatively few studies, though, that have described the cognitive, psychosocial, and physical challenges faced by students with TBI transitioning into college.[4–9] Dawson et al[10] examined correlates of ability to return to work or school and found that cognitive factors, depression, and poor coping affected students' productivity. In an older study, high school and college students with TBI reported expending more effort when studying, needing to use study strategies, engaging in fewer extracurricular activities, changing relationships with peers, and lower grade point averages (GPAs) than prior to their injury.[11] In recent survey studies, nearly all who had attended college after TBI reported more

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*This article is dedicated to the memory of Mark Ylvisaker.*

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cognitive, time management, social, and academic challenges than those without TBI.[4,12] The reported academic challenges (such as difficulty studying) were predicted by the number of cognitive impairments and, to a lesser extent, by psychosocial issues.

## SUPPORTED EDUCATION FOR COLLEGE STUDENTS WITH TBI

Descriptions of supported education programs for students with various disabilities are readily available, although few have been tailored to students with TBI. Wetzel et al[13] described a program for students with disabilities in which coaches identified strategies based on students' strengths and weaknesses. Other key components of this program included using accommodations, technology, community resources, and ongoing monitoring of students' progress.[14] Students who frequently used these services had higher GPAs than students who infrequently used these support services. Harrington and Levandowski[15] described a community college program for students with brain injury that consisted of retraining cognitive processes. Students improved on standardized test scores postintervention, although there was variability across students. On the basis of these findings then, it appears important for students to access services and stay in frequent contact with providers, and that improvement on standardized tests could be expected.

Measures of change in supported education studies include course grades, GPA, time to degree, and academic standing. Decontextualized, standardized test scores can provide additional measures of cognitive change in students with TBI. These kinds of measures describe some, but not all, of the changes college students may experience while they receive support. Indeed, large functional treatment effects can be expected when targeting self-identified functional, complex activities, with less improvement anticipated on decontextualized tests.[16] Still, the most obvious measure missing is one that provides evidence of the effectiveness of specific, individualized strategies and supports. The specificity of students' strategies may be one such measure. Strategy specificity may be related to better performance, reflecting the student's ability to understand, use, and describe in detail how strategies are used.

An additional challenge in developing the current program is that intervention methods and data analysis in earlier studies were not described in sufficient detail to allow for replication, now a standard requirement of intervention studies. Therefore, the purpose of the current study was to determine whether it is feasible to implement a supported education program that integrates best-practice methodology while documenting individualized outcomes for college students with TBI.

## INTEGRATING SELF-REGULATED LEARNING WITH SUPPORTED EDUCATION FOR STUDENTS WITH TBI

Models of self-regulated learning and self-efficacy in learning come from educational, cognitive, and developmental psychology (for review, see Dunlosky & Metcalf[17]). These models typically include generation of task specific goals, planning (including strategy selection, weighing pros and cons), carrying out the plan, self-monitoring performance, and making adjustments in the plan.[18] There is evidence that emphasizing accurate self-monitoring improves the likelihood that adults will make self-control decisions to use effective strategies if available to them.[19] Self-efficacy—one's beliefs about the ability to be successful, and the ability to identify goals and create plans to accomplish those goals—plays an important role too.[20] College students who demonstrate good self-efficacy are more likely to be self-regulated learners as well; they set specific goals, use more effective strategies to reach those goals, and are more likely to adjust the plan when needed than students without good self-efficacy. It is not too surprising then that students with good self-efficacy are also ones who achieve academically.[21]

The ability to self-regulate learning after TBI can be compromised due to a range of problems. These include difficulty identifying goals, reduced accuracy of self-monitoring, and problems making self-control strategy decisions that are needed to update and adjust plans to reach goals.[2,22] If one is unable to self-regulate learning, it may be possible to learn strategies, but these will remain context-dependent; the individual may not be able to flexibly apply the strategy under different conditions and will not be able to make adjustments when needed. Individuals with frontal lobe injury after TBI are less accurate at predicting future recall[23] and are more accurate when judging their past performance.[24,25] In addition, adults with TBI can base strategy decisions on their self-assessments when explicitly provided with the opportunity to do so and they are capable of adjusting their self-assessments with self-feedback.[26,27] Thus, an intervention that emphasizes functional, academic skills while explicitly requiring students to self-assess their performance and make adjustments could have a positive impact on students' academic performance. This is especially important for students who have little or no college experience since their injury.

The intervention provided in this study is based on these self-regulation principles, the coaching model described by Getzel et al,[13] and the flexible and dynamic intervention described by Ylvisaker and Feeney.[28] Intervention was organized around 3 themes that emerged from a prior factor analysis of the kinds of academic challenges individuals with TBI reported when attempting

college: studying and learning, time management, and relating to others.[12] In addition to the emphasis on self-regulation, several best practices in cognitive rehabilitation were adhered to as well: (1) that evaluation and intervention of skills must include activity- and participation-based assessment; (2) that personal and environmental factors are considered during evaluation and intervention; (3) that the transfer of skills is not expected to occur without explicit linkages in the context where skills are used; (4) that proper training is required for external compensatory aids, including technology, to be effective; (5) that direct instruction to use strategies is most effective when practice is distributed; and (6) that collaborative learning helps create positive behavioral routines.[29–35]

## GENERAL METHODS

### Participants

Two college students were referred to the study by campus disability service counselors. Students had no mental health diagnoses, other neurological diagnoses, aphasia, motor speech disorders, or history of learning disabilities or attention deficit disorder. They were native speakers of English and had normal vision and hearing. Medical records verified their injuries and rehabilitation history. Neuropsychological test reports described students' cognitive strengths and weaknesses and provided recommendations for academic accommodations. Student 1 was a 20-year-old male who was 14 months postinjury. Student 2 was a 20-year-old male who was 10 months postinjury.

### Procedures

Intervention was provided while students were enrolled in the first 2 semesters upon returning to college after being injured. Students were tested, surveyed, and interviewed prior to intervention at the start of the first semester and at the end of intervention after the second semester. All procedures were approved by the university internal review board and students provided written consent before participating.

### Pre- and postintervention measures

Several measures were included: standardized test scores; number of reported strategies; strategy specificity ratings; grades within the semester; GPA; credits completed versus credits attempted; and academic, work, and living decisions.

The first author tested students prior to intervention and the second author tested students after intervention. A trained graduate student scored all of the tests without knowing students' identities or the purpose of testing. To screen cognition and memory, the *Repeatable Battery for Assessment of Neuropsychological Status* (RBANS[36]) was administered prior to intervention, during the winter break and after intervention. The RBANS correlates with other neuropsychological tests and most subtests have acceptable reliability and internal consistency when administered to adults with TBI.[37] The *National Adult Reading Test* (NART[38]) provides an estimate of preinjury verbal and performance intelligence quotient (IQ).[39] The *Functional Assessment of Verbal Reasoning and Executive Strategies* (FAVRES)[40] examines the accuracy and rationale of various executive functions in complex and functional activities. It is noteworthy that many standardized tests could not be readministered because of the recent neuropsychological testing that was necessary to document students' need for accommodations.

Students also completed the *College Survey for Students With Brain Injury* (CSS-BI) from which information about strategies and academic and life changes was obtained.[4] The CSS-BI includes questions about postinjury symptoms, academic experiences, use of services, and life changes. Individuals rate the degree of agreement or disagreement with each statement using a Likert rating scale. Responses on the CSS-BI were used in structured interviews pre- and postintervention. Students were asked to explain their answers to survey items and to provide examples. Additional questions about strategies were included; for example, for the statement "I have to review material more since being injured," the interviewer asked, "What do you do to review material more? Are there any strategies you use to help with this?" Interviews were conducted by the first author prior to intervention. After intervention, a trained interviewer who was blinded to the study's purpose and participants' background conducted the interviews.

The number and specificity of strategies were compared across semesters. Strategy specificity is evidence that students have experience using the strategy, including how and when to implement it. Steps were taken to guard against examiner bias when identifying strategies and describing their specificity. First, the interviews were independently transcribed by 2 volunteers who were unaware of the purpose of the study or when the interview was conducted (pre- or postintervention). Few discrepancies were identified in the transcriptions and these were resolved. Statements about strategies were extracted from the transcriptions. Three reviewers who were blinded to student identity and interview condition then rated each strategy as 1 = *very vague*, 2 = *vague*, 3 = *specific*, or 4 = *very specific*. The rating instructions were as follows:

> Rate each strategy from "very vague" to "very specific." For example, if you wanted to save money, a vague strategy would be "to spend less," while a specific strategy would be "to use coupons from the newspaper for groceries." One way to think

about specificity is to imagine whether or not you would be able to carry out the strategy exactly the way she or he described it.

A total of 46 strategies were extracted and rated across interviews and students. Each rater obtained test-retest reliability within themselves (ie, giving the same rating to strategies that were reported more than once) before obtaining an interrater agreement of 96%.

### Coaching intervention

Students participated with coaches in guided conversations about their strengths and weaknesses based on their neuropsychological and supplemental test results, during which practical applications were mapped onto students' academic interests and goals. A general academic plan and specific goals were organized around the 3 themes of studying and learning, time management, and relating to others. Goals were then applied to specific courses. Conversations focused on study skills and time management strategies that could be useful versus ones that were likely to be ineffective for each course. In addition, students were encouraged to form a "team" of individuals who could be supportive to them in the coming academic year (eg, family, friends, disability service counselors, vocational rehabilitation counselors). Finally, students were encouraged to use their academic accommodations.

Direct, individualized coaching support was provided by the 2 authors, who are experienced in cognitive rehabilitation and are certified speech-language pathologists. Coaching sessions started after the student had received at least one graded assignment in the targeted course(s). Intervention occurred over 2 semesters and students were encouraged to meet with coaches weekly for about 1 hour.

Making metacognitive experiences explicit was an integral part of coaching sessions. Students were taught to use strategies and to self-assess their effectiveness and amount of effort using direct, metacognitive instruction. Each session included direct instruction on agreed-upon strategies, and later in the semester students reported on the use, effectiveness, and the amount of time and effort strategies were taking. For large, complex academic assignments that had multiple steps, students and coaches identified the steps and the schedule to complete the assignments. Each week, students reviewed their progress and made adjustments to the overall plan as needed. In addition, every assignment (eg, papers, quizzes) was reviewed with students each week. This process helped to instantiate self-regulation routines as they explicitly reviewed the effectiveness of their strategies and their performance. These real academic experiences provided tangible evidence that strategies worked (or did not), leading students and coaches to make decisions about whether to continue to use a strategy based on real-life costs and benefits. Students' weekly schedules were reviewed at each session. Additionally, continuous self-assessment of performance with and without using accommodations provided tangible evidence of the need for accommodations.

Students were followed through the end of the summer, although intervention concluded at the end of the second semester. With coaches' assistance, the opportunity to create a portfolio during the summer was offered. Electronic portfolios describe students' relative strengths and weaknesses, along with descriptions of various study and learning strategies and time management tools that were beneficial throughout the prior academic year. The process of creating portfolios provided a structure for students and coaches to summarize how, when, and why specific strategies were used and how they could be used in future courses and assignments.

## RESULTS

### Case study no. 1

#### *Participant*

Student 1 was a 20-year-old male who had completed his freshman year of college when he sustained a severe TBI in a motor vehicle accident. Hospitalization included a craniotomy, 2 weeks of retrograde amnesia, 6 weeks of posttraumatic amnesia, and orthopedic injuries. He completed 2.5 weeks of inpatient and 12 months of outpatient rehabilitation that included occupational, physical, and speech-language therapy. It is also noteworthy that he had a sports-related concussion at the age of 8 years from which he reported no long-term effects.

Prior to his injury, student 1 completed 25 college credits with a 3.2 grade point average in an undeclared major. After the TBI and rehabilitation, he completed a 4-credit summer course before returning to college in the fall. His academic accommodations included taking examinations in a distraction-free environment, time-and-a-half for tests and assignments, and a note taker.

He was referred to the study by disability services when he was 14 months postinjury and 20 years of age. Three months prior he had completed a neuropsychological test battery. The neuropsychologist's report indicated average verbal and nonverbal intellectual functioning and verbal comprehension, low-average working memory, low-average processing speed, and high-average perceptual organization. Student 1 had superior performance on tests of visual sequential reasoning and visual construction, and average performance on a test of visual attention. He had low-average scores on tests of executive function, very low-average verbal

memory, average recognition memory, and impaired delayed recall that improved with visualization. A test of academic achievement showed high-average reading, average spelling, and low-average-to-average mathematics scores. The neuropsychologist's report stated that his impairments were in executive functions, auditory attention, and recall.

### Preintervention measures

Scores from additional testing done 3 weeks prior to intervention are located in Table 1. Performance on the NART estimated student 1's preinjury verbal IQ within normal limits. Repeatable Battery for Assessment of Neuropsychological Status scores on immediate story memory, delayed story recall, and semantic fluency were 1.5 SD or more below the mean for his age group.[41] His total RBANS score placed him in the 12th percentile. Performance on the FAVRES showed executive function limitations in organizational skills and providing verbal rationales, and slow processing in complex reasoning activities, all of which required the integration of reading, writing, and verbal explanations.

On the CSS-BI, student 1 identified 4 of 13 general problems after his injury: physical problems with his legs, physical problems with his arms, memory problems, and attention problems (see Table 2). Of the 13 academic challenges listed on the survey, he agreed with 5: review material more, do not always understand assignments, forget what was said in class, get overwhelmed while studying (studying and learning), and others do not understand my problems (relating to others). His interview provided additional details for each of these problems. No challenges in time management were reported. He identified 13 different strategies, suggesting that he had awareness and knowledge about the need for and use of many strategies before intervention began although most were rated as vague or very vague. His GPA goal for the first semester was to maintain a B average.

### Coaching intervention

Student 1 registered for 9 credits in 2 courses in the first semester: a writing course and a foreign language course (the latter he had taken previously and now audited). In addition, he worked 3 hours a week at a part-time job. He participated in 14 weekly coaching sessions that averaged 1.07 hours (SD = 0.48), totaling 15 hours. To work on *studying and learning,* coaches addressed several areas, including taking notes, creating note cards, self-quizzing, and writing long papers. To address in-class note-taking strategies, he started the semester by recording class lectures with a digital audio recorder and taking notes himself so that later he could review and fill in his notes. However, this was time consuming, so coaches introduced him to the SmartPen, which records while the student writes on special paper and allows the student to review recordings by touching notes with the pen tip. He used this technology for the rest of the semester.

Coaches also instructed him to make note cards of keywords from readings and lecture notes, to review note cards using distributed practice, and to self-quiz. Direct instruction was used to identify the steps needed to write 4- to 5-page papers for the social science course, including taking notes from readings, creating thesis statements, organizing supporting evidence, writing multiple drafts, and learning how to edit. He brought in several drafts for 2 different papers so that he could get coaches' feedback. By student preference, no support was provided for the foreign language class.

Prior to the first semester, student 1 kept track of his schedule and e-mails with a SmartPhone and he had reported no *time management* concerns on the CSS-BI. Yet, as the semester began, he reported that studying was very time consuming. Therefore, to help him track this, coaches introduced a plan-do-review form on which he predicted how long an activity took and then recorded how long it actually took.

Even though student 1 had indicated on the CSS-BI that "others do not understand my problems," socializing was not a priority at this time. Yet, self-advocacy is critically important for students with any kind of disability, so *relating to others* was implicitly addressed through self-advocacy. First, a team meeting was held so that team members could learn about the coaching program and could learn about ways to support the student. Second, coaches validated that he had informed instructors of his disability and accommodations. Finally, coaches arranged an informal meeting between student 1 and another student who had successfully graduated from college after sustaining a TBI.

In the spring semester, student 1 enrolled in 3 courses (12 credits) with coaches' guidance: intermediate foreign language, basic mathematics, and a literature and writing course. He attended 15 weekly coaching sessions that averaged 1.01 hours (SD = 0.22), totaling 15.25 hours. At the request of the student, intervention included *study and test-taking strategies* in the mathematics course, and learning foreign language vocabulary and grammar. For the mathematics course, the student received instruction on organizing and displaying mathematics calculations clearly on quizzes and assignments, and he developed practice questions from which he could quiz himself. For the foreign language course, instruction was provided for studying vocabulary and grammar using flashcards; rather than associating vocabulary with other vocabulary, he imagined the orthographic form on the word relying on his visual memory. He received no support for the literature and writing course.

**TABLE 1** *Pre- and posttreatment test measures compared to age-related means and SDs*

| | Student 1 | | | Student 2 | | |
|---|---|---|---|---|---|---|
| | **Pre-intervention** | **Break** | **Post-intervention** | **Pre-intervention** | **Break** | **Post-intervention** |
| **RBANS (percentile, raw score)[a]** | | | | | | |
| Immediate memory percentile | 7th | 7th | 19th | 16th | 16th | 13th |
| List leaning | 26[b] | 29 | 30 | 24[c] | 24[c] | 26[b] |
| Story memory | 14[c] | 11 | 16[b] | 19 | 19 | 17 |
| Delayed memory percentile | 27th | 21st | 42th | 21st | 13th | 34th |
| List recall | 8 | 5 | 6 | 3[d] | 2[d] | 4[c] |
| List recognition | 20 | 20 | 20 | 20 | 19[b] | 20 |
| Story recall | 6[d] | 7 | 9[e] | 11 | 10 | 12 |
| Figure recall | 15 | 15 | 18 | 14 | 9[d,f] | 14[e] |
| Language percentile | 12th | 53rd | 16th | 4th | 70th | 4th |
| Semantic fluency | 15[c] | 21[e] | 16[c,f] | 9[d] | 25[1] | 8[d,f] |
| Naming | 9 | 10 | 9 | 9 | 9 | 9 |
| Attention percentile | 21st | 16th | 21st | 2nd | 50th | 16th |
| Digit span | 9 | 8[b] | 9 | 8[b] | 12[e] | 10 |
| Coding | 58 | 57 | 57 | 42[c] | 59[e] | 49[f] |
| Visuospatial percentile | 30th | 50th | 63rd | 21st | 30th | 73rd |
| Figure copy | 19 | 20[e] | 20[e] | 17[c] | 19[e] | 19[e] |
| Line orientation | 16 | 15 | 18[e] | 19 | 17 | 20[e] |
| RBANS Total score percentile | 12th | 18th | 23rd | 5th | 25th | 16th |
| **NART** | 102 | | 107 | 93 | | 100 |
| **FAVRES SS Total accurate** | 50[d] | | 60[d] | 70[d] | | 40[d,f] |
| **FAVRES SS Total rationale** | 60[d] | | 46[d] | 111 | | 68[d] |
| **FAVRES SS Total time** | 78[c] | | 86 | 109 | | 121 |

Abbreviations: FAVRES, Functional Assessment of Verbal Reasoning and Executive Strategies; NART, National Adult Reading Test; RBANS, Repeatable Battery for Assessment of Neuropsychological Status.
[a]Raw score SDs from the RBANS Supplement.
[b]≥ SD below mean.
[c]≥1.5 SD below mean.
[d]≥2 SD below mean.
[e]Improvement of >1.0 SD.
[f]Decline of >1.0 SD.

**TABLE 2** *Reported symptoms, academic experiences, number of strategies, and the specificity of strategies prior to and after intervention during the first year of college postinjury*

| | Student 1 | | Student 2 | |
|---|---|---|---|---|
| | **Preintervention** | **Postintervention** | **Preintervention** | **Postintervention** |
| Reported symptoms | | | | |
| Number of TBI-related symptoms reported | 4 | 5 | 6 | 4 |
| Number of postinjury academic experiences reported | 5 | 4 | 0 | 0 |
| Reported strategies | | | | |
| Number of strategies | 13 | 16 | 7 | 10 |
| Number of strategies rated as specific, vague | 5, 8 | 13, 3 | 3, 4 | 3, 7 |
| Average specificity rating (and SD) | 2.4 (0.86) | 2.9 (0.63) | 2.5 (0.34) | 2.3 (0.18) |
| Median, mode of specificity rating | 2, 2 | 3, 3 | 3, 3 | 2, 2 |

Abbreviation: TBI, traumatic brain injury.

Because he had learned reading and writing strategies in the first semester, we were interested in observing how well he generalized these strategies to different courses in semester 2. As in the first semester, the choice of courses to emphasize in coaching sessions was based on the likelihood of difficulty as predicted by neuropsychological weaknesses and on student preferences.

To address *relating to others* in the second semester, coaches arranged a meeting with 3 students with TBI where students conversed informally over pizza about their injury and their college experiences. Self-advocacy was addressed on an as-needed basis. For example, student 1 was reluctant to use his test-taking accommodations for in-class quizzes and examinations in the large mathematics course. After failing grades on the first 2 quizzes, he approached instructors about his accommodations. Having sensed some instructor resistance, he remained reluctant to pursue it further. After discussing this, however, the coach and student approached the instructor together. The student explained his accommodations and the instructor complied. Finally, student 1 asked the foreign language instructor to meet with him informally to work on his conversational skills. *Time management* was not addressed in the second semester. He continued to use the SmartPhone regularly, and his work hours increased to 4 to 5 hours weekly. In the summer after intervention had ended, student 1 met with coaches to create his portfolio of strengths, weaknesses, and effective strategies in preparation for the following year.

**Postintervention measures**

Three weeks after the last coaching session, testing was completed. Student 1 reported 5 general symptoms on the CSS-BI at the end of the second semester. These included the same ones he identified prior to intervention with the addition of "having difficulty with academics" (see Table 2). He endorsed 4 academic challenges including the same ones identified before the first semester with the exception of "getting overwhelmed while studying." He indicated that he was unsure whether this was a problem anymore. He was also unsure about having fewer friends now, whereas at the beginning of the academic year he had indicated that he had the same number of friends as before. He qualified this now by stating that he just had different friends now, "friends who do not drink." He reported using 3 more strategies at the end of the second semester than he had reported prior to intervention. There was also a shift toward using more specific strategies.

Student 1's grades on assignments changed after study strategies were implemented. In the first semester, Student 1's grades on lengthy papers and essay examinations improved from Cs to Bs only after he received individualized instruction. He also reported that note taking (including use of the SmartPen) and other study strategies were very helpful and his final grade was a B+ in the social science course. His grades in the unassisted foreign language course were tracked and these remained constant (C+s, Bs).

In the first semester, the plan-do-review form allowed student 1 to predict and document the amount of time study activities took. After using the form for 3 weeks, his prediction-performance discrepancy went from 150 minutes to 20 minutes per week. Later in the semester, he reported that he was not keeping track of time, but rather used the form to create a checklist of study activities to be completed.

In the second semester, consistent but small improvements in mathematics were observed once he used his accommodations, organized and showed his work on quizzes (and was able to get partial credit) and reviewed basic algebra. Quiz scores went from 56% without instruction and extended time, to 68% (a C-) with instruction and extended time. His final grade was a C+. Thus, it is likely that the combination of targeted instruction and support and encouragement to use his accommodations in the large mathematics class worked together to improve his performance.

In the second semester literature and writing course, student 1 wrote papers independently and requested that the coaches review only 1 draft. He received an A- in this course. Furthermore, he consistently met with his foreign language instructor to practice conversing. He received a B+ in this course. In total, student 1 attempted and completed 12 credits with 3.3 GPA in the second semester.

Although considered secondary outcomes, some of student 1's decontextualized test scores improved by 1.0 SD or more as indicated on Table 1. Improvements were observed in language and visuospatial abilities. Specifically, semantic fluency and figure copying accounted for most of the improvement. Some additional improvement in visuospatial scores occurred at the end of second semester with improvement in line orientation, whereas the improvements in language were not maintained. Gradual improvements in delayed memory were observed with the largest improvement seen in story recall. Overall, student 1's RBANS total score improved over the course of the academic year while he received coaching. On the FAVRES, the only notable change was that he got faster at completing complex reasoning tasks, but without any real change in accuracy or in his rationales. On the NART, his estimated verbal IQ improved slightly but remained average.

Other secondary outcomes were life and academic changes. Student 1 completed all of the credits he attempted and remained in good academic standing throughout the year. In the summer after coaching had ended, he completed a photography course in which

he received an A and he created a portfolio with the coaches' assistance. He is deciding on an academic major, working 6 hours a week, initiated contact with Vocational Rehabilitation Services (VRS), and will be studying abroad next year. He reported to the VRS counselor that his year in college would have been very challenging without the support of the return-to-college program.

## Case study No. 2

### *Participant*

Student 2 was referred to the study after experiencing a TBI from a fall about 10 months prior. He had completed 2 months of college when he was injured. He had a Glasgow Coma Scale score of 7 at the scene, had bilateral epidural hematomas, intraparenchymal and intraventricular hemorrhages, and a basilar skull fracture. Coma was induced for several days and posttraumatic amnesia lasted for several weeks. He participated in inpatient and outpatient cognitive rehabilitation over the course of a year.

Two months before returning to college, student 2 completed neuropsychological testing. The neuropsychologist's report indicated overall average intelligence, with relative strengths in visuospatial intelligence and relative weaknesses (below average scores) for higher-level verbal comprehension. His memory performance was low-average to low and his attention was high-average. A test of academic achievement showed average mathematical abilities but low-average reading scores. In general, the report summarized impairments in memory, recall of complex prose information, and reading, with "profound deficits in problem solving, particularly his ability to deal with novel or abstract information." He received accommodations through disability services that included extended examination times and a note taker.

### Preintervention measures

Supplemental testing was performed 2 weeks before coaching started (see Table 1). Student 2's preinjury verbal IQ was estimated within normal limits, whereas performance on the RBANS revealed low scores for memory, attention, and language. Immediate list learning, delayed list recall, semantic fluency, attention coding, and figure copy were 1.5 SD or more below the mean. His total RBANS scores placed him in the 5th percentile. The accuracy in his verbal reasoning was poor on the FAVRES, further indicating difficulty with these complex executive functions.

On the CSS-BI, student 2 identified 6 of 13 general symptoms listed: anger, depression, mood changes, physical impairment (arms), memory problems, and attention problems. However, he did not agree with any of the statements about academic challenges since his brain injury. When asked why he wanted to participate in the study, he stated that he wanted to take advantage of everything that was available to him. At that time, he was working 2 part-time jobs and living with 4 roommates. In high school, his grades were As and Bs. In college, he was majoring in a business-related field. His GPA goal for the first semester was to obtain a 4.0.

### Coaching intervention

During the first semester, student 2 participated in 7 weekly sessions that averaged 0.83 hours (SD = 0.22). In total, he received 7.5 hours of coaching support because he did not make his first appointment until several weeks into the semester. He enrolled in 13 credits that included 2 social science courses, a political writing course, and a course exploring different majors. Coaches advised him to reduce his workload and he declined. He also declined use of his accommodations.

To address studying and learning in the fall semester, coaches assisted student 2 with his political writing course. He was instructed in planning and organizing a lengthy paper that required a thesis statement and supporting evidence based on a self-selected book, which he was required to read. Writing instruction in sentence-level grammar and paragraph organization were also provided with multiple drafts. Coaches provided significant scaffolding for the student with this assignment, prompting him to plan ahead to read his chosen book, suggesting how to find and use resources about the author, providing extensive assistance with defining a thesis statement and supporting arguments, and finally assisting with proofreading.

Student 2 declined to identify specific goals for time management or relating to others in the first semester. He declined to use a planner of any sort. However, coaches continued to check with him at each meeting to identify upcoming assignments and discussed how to plan and prioritize studying. By the middle of the semester, he initiated the use of a computerized planner for his schedule. Self-advocacy support was provided by encouraging him to attend instructor and teaching assistant office hours, which he did, although he was not interested in meeting other students with brain injury.

In the second semester, at the request of student 2, coaches met with him every other week rather than every week. He completed 8 coaching sessions that averaged 0.81 hours (SD = 0.29) totaling 6.5 hours over the semester. He registered for 12 credits without input from coaches. Of the courses in advanced mathematics, writing, and public speaking, he indicated that he only wanted coaching support for the public speaking class. This was provided by assisting him in choosing topics, defining thesis statements, and organizing his speeches; he also practiced his speeches during coaching sessions. After receiving failing grades on quizzes in the advanced

mathematics course, student 2 requested that coaches instruct him on study strategies for relearning more basic mathematics. Subsequently, he received a passing grade in the next assignment, but decided to drop the course regardless, replacing it with a vocational course.

As in the first semester, student 2 identified no specific goals for time management or relating to others in the second semester. However, coaches continued to discuss upcoming assignments with him during coaching sessions. He continued to use the electronic calendar to keep track of his schedule and frequented TA and instructor office hours when he wanted feedback. He reduced his workload to 1 part time job, he applied for and acquired an internship, and he became an officer in a campus organization. His GPA goal for the second semester was to get a B average.

### Postintervention measures

Testing was performed 2 weeks after the last coaching session. Student 2 reported 4 general effects on the CSS-BI after intervention ended (physical impairments with his arms, memory problems, difficulty with academics, and depression); this was 2 fewer than he had reported in the fall. He endorsed no academic challenges with certainty, although he indicated that he was now "unsure" about forgetting what is said in class and having trouble prioritizing and making deadlines, both statements he had disagreed with in the fall. Student 2 provided additional explanations for his uncertainty or disagreement with the academic difficulties that were listed. He reported that under certain circumstances, he did indeed have some of these difficulties, but that he just did not agree that "it was a problem." Student 2 reported more strategies at the end of the academic year after intervention than in the first semester; however, more of these strategies were vague than specific at both time points (see Table 2).

In the first semester, his grades on writing assignments after receiving support went from Cs to Bs. He received a B on the final paper. Unfortunately, his grade in the course was a D due to problems with other unsupported assignments in that course.

Regarding time management, student 2 explicitly declined to reduce his course load or use a plan-do-review strategy, even though he often could not report the deadlines for his assignments. Instead, his poor planning led to many missed opportunities for him to receive instructor feedback on drafts of assignments. He denied turning assignments in late, although he admitted that he was too busy at the end of the first semester. Student 2 attempted and completed 13 credits in the first semester with a 2.27 GPA.

In the spring semester, improvement in the student's mathematics assignment after getting support provided evidence of the support's effectiveness, even though he dropped the class. Grades in his public speaking class were consistently in the B+ to A range and he received an A in that course. Using the organizational, planning, and editing support from the writing course in the first semester, student 2 independently made notes on early drafts of his second semester papers to help himself with organization in revisions. Subsequently, he received an A in the second semester writing course. Without prompting, he took papers to his instructor for feedback before submitting them. Furthermore, he gave 2 public speeches to high school students warning them about social drinking while in college, a positive advocacy outcome. Student 2 attempted 12 and completed 8 credits in the second semester, achieving a 3.67 GPA.

Table 1 displays the test scores from prior to the intervention, during the mid-year break and immediately after intervention ended at the end of the second semester. On the RBANS, steady improvement was observed in visuospatial abilities during the academic year, in both line orientation and figure copy; this resulted in performance that exceeded average. Semantic fluency improved substantially after the end of the first semester. Gains were observed in attention and figure copy after the first semester as well. Attention scores declined at the end of the second semester, but were slightly higher than attention scores prior to intervention in the fall. Figure recall performance declined at the mid-winter break. Overall, student 2's total score improved over the course of the academic year, but more so immediately following the first semester. On the FAVRES, the accuracy of his verbal reasoning and problem solving decreased, but this appears to be related to a speed/accuracy trade-off when timing is considered. Qualitatively, it should be noted that student 2 stated several times during the postintervention testing that he was not very motivated, that he really "didn't care." This may explain the variability in his scores.

Other notable changes occurred at the end of the second semester. Student 2 started a full-time job, and decided to have only 1 roommate. He declined coaches' offer to create a portfolio. He plans to change his major to one that would allow him to use social networking in business. He completed 2 community college courses in the summer, receiving A grades in both. Coaches referred him to VRS and with his follow through, some of his educational expenses were going to be reimbursed. Furthermore, he even referred a student with TBI to the return-to-college program, writing that he highly recommended it.

## DISCUSSION

The purpose of this study was to describe and determine whether it is feasible to provide educational

support to college students with TBI that integrates self-regulated learning with dynamic coaching. The background, intervention, and pre- and postintervention measures were described for 2 students with TBI who were enrolled in their first year of college after being injured. A secondary purpose was to identify outcomes that could provide evidence of the specific, individualized changes that occurred during the course of the year.

It appears that it is possible to deliver an integrated supported educational program[13,14] to college students with TBI using a coaching model that combines the principles and practices of self-regulated learning[17–19] with best practices in cognitive rehabilitation.[16,33,34] The program was tailored to students' individualized needs, goals and willingness to participate. Students were required to reassess their performance during regular coaching sessions, and were then supported by coaches to adjust their goals or strategies, creating what Ylvisaker and Feeney[28] consider "positive executive function routines." Thus feedback included not just grades, but self-generated feedback as students and coaches weighed the effectiveness of strategies with the amount of time and effort required to execute them.

In the current study, students were coached in self-regulated study and learning strategies, experienced the realities of using these strategies, received and provided tangible feedback on the usefulness of these strategies, had varying levels of awareness that changed over the year, varied in their use of accommodations, and learned to self-manage their schedules and plans. Persistence and resiliency were implicitly reinforced throughout the year as students were continually expected to provide feedback at each coaching session on the effectiveness of strategies during the week. This dynamic model was evident throughout the program, as coaches and students together modified goals and strategies based on performance on assignments and amount of effort. Coaches were flexible with the amount and type of support they provided, particularly with student 2.

Furthermore, it was demonstrated that this kind of intervention can facilitate a variety of positive outcomes. The intervention described here was organized around 3 previously identified themes (studying and learning, time management, and relating to others[4,12]) and coaches identified appropriate strategies on the basis of students' neurocognitive strengths and weaknesses. Improvement on graded assignments after strategies were implemented provided functional, realistic feedback to both students about the effectiveness of the strategies.

Students ultimately had to be willing to try the strategies and assess their usefulness. Student 1 participated in all aspects of the intervention whereas student 2 was less willing to do so. Nevertheless, both students reported the use of more strategies at the end of the year when the program had ended, compared to the beginning of the year before the program had started. Both students were in good academic standing and had made positive academic and lifestyle changes. Both students endorsed the coaching program, although in different ways. In addition, both students improved in some cognitive areas as measured on standardized, decontextualized tests. Working with these 2 students provided many useful demonstrations of individual differences, the range of experiences, and the variety of needs of college students with TBI.

Student 1 appeared to be "more aware" of the challenges that he faced even before returning to college than student 2. Student 1 had more college experience before being injured than did student 2. Compared to student 2, student 1 participated in more coaching sessions, spent more time being coached, identified more strategies with greater specificity by the end of year, and participated socially with other students with TBI. Anecdotally, student 1 had more contacts (e-mails, text messages) with coaches than student 2 did. Student 1 sought out coaching advice, eagerly implemented a wide variety of strategies, and regularly reported on the usefulness of the strategies so that adjustments could be made. Student 1 was also cautious in his academic goals and plans after his injury.

Student 2 took a "wait and see" approach before he was willing to adjust his goals and use recommended strategies; at times he appeared to be averse to admitting to his challenges at all. He reported to coaches that he was not "afraid of failing." Indeed, he did appear to learn from his mistakes by eventually adjusting his goals and using some strategies, despite his unwillingness to explicitly acknowledge that he had done so: he eventually lowered his GPA expectations, worked fewer hours outside of school, reduced the number of roommates, and even recommended the coaching program to another student with brain injury. So, while it is tempting to describe him as having poor insight, his eventual adjustments in goals and his persistence in seeking assistance (albeit less than student 1) indicate that for him actions may speak louder than words. What is unknown is whether or not additional improvement could have been made if he had been willing to more fully participate in the program.

A secondary purpose of this study was to identify appropriate outcomes for a program such as this. Both students identified more strategies at the end of the year, yet the specificity of the strategies did not change in the expected direction for student 2. This variable outcome warrants further investigation. Other functional and practical changes on graded assignments provided tangible evidence on the usefulness of strategies; whereas, decontextualized tests provided some evidence of generalization. In particular, it is intriguing that both students

made large gains in language after the first semester, during which they had spent several months working on reading, organizing, and writing lengthy papers. These gains disappeared after the end of the second semester, when these activities were not the focus of coaching sessions. However, functional gains in writing were maintained into the second semester when both students succeeded in writing intensive courses without coaching support. Visuospatial skills improved dramatically, and delayed recall improved somewhat for both students by the end of the second semester although the reasons for this are unclear. These improvements may reflect the students' intensive academic work over the 9-month school year, including practicing note taking (incorporating visuospatial skills) and memory strategies (for recall of vocabulary lists, etc). However, it is also possible that, given both students' relative strengths in visual processing, these processes were also more "stimulable," that is, more likely to respond to intervention because there was a foundation on which to build. What is apparent is that positive change was observed long after the spontaneous neurological recovery of 6 to 12 months postinjury. The variability in student 2's test performance reminds us that not all students are inherently motivated to "do their best" when tested.

### Limitations of the study

The case study design limits the extent to which these results can be generalized to other college students with TBI. Clearly more research is needed that can document changes in students with and without this kind of support. Although factors related to the postsecondary academic success of other disability groups may help explain the academic outcomes of students with TBI. These factors are related to self-determination and include having problem-solving skills, being self-aware, having study strategies available and knowing which ones work, creating campus support systems and seeking services, being able to self-manage (time, organization, planning), and getting to know instructors. Furthermore, it appears that students who are persistent and resilient are more likely to succeed in college.[42,43] The relative weight of these factors as predictors of eventual success of college students with TBI is currently unknown and it will take more than 2 cases to examine this.

A practical limitation was the lack of in-depth pre- and postintervention neuropsychological test results. Because neuropsychological testing is required for students to get standard accommodations through disability services, it was not possible to repeat these tests. This could have been managed, if the same neuropsychological tests had been used across students, but, unfortunately, this was not case. Furthermore, there are few tests with multiple versions available to the researchers, which had not already been used to document the need for accommodations.

It is also worth noting that the participating students were already registered with disability services. Only about 50% of adults with TBI have any contact with disability services.[4] The reasons for this are unclear, although students with TBI may lack initiation, self-advocacy skills, or full appreciation of the academic struggles they will face. However, this may also reflect a lack of awareness of the needs of students with TBI by disability specialists[44] or a lack of transition planning.[45]

Despite these limitations, the positive changes that students made with coaching support suggest that incorporating self-regulated learning principles with coaching could have positive outcomes for other students with TBI. It also appears that a variety of outcome measures are needed to fully capture the changes that such a heterogeneous group of students will make. Finally, because supported education programs are funded for college students with other disabilities (eg, Asperger's syndrome), funding agencies such as vocational rehabilitation services would be willing and indeed are willing to fund these kinds of services for students with TBI as well.

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