

# EMAIL INTERVENTION FOLLOWING TRAUMATIC BRAIN INJURY: TWO CASE REPORTS

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## ABSTRACT

An email intervention for two individuals with TBI was conducted to investigate if this electronic medium shows potential as a therapeutic delivery method. Specifically, this study measured participants' compliance with a plan that incorporated email and a reading assignment. Prior to the email intervention, the clinician and participants designed an intervention plan which included specific guidelines for scheduled email correspondence regarding a daily reading task. After reviewing the daily emails, the clinician provided therapeutic feedback. The participants' compliance with the plan was measured by the punctuality of email correspondence and completion of tasks as detailed in the plan. Over a 4-week intervention period, both participants demonstrated improvement in task completion and time adherence. Email proved to be a feasible option as a therapeutic delivery method for these individuals.

*Keywords: email intervention, individuals with TBI, task completion, time adherence*

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Executive function is a broad term which generally refers to a group of cognitive abilities involved in setting realistic goals, planning to achieve goals, executing those plans, and evaluating the outcome (Kim, Whyte, Hart, Vaccaro, Polansky, & Cosleft, 2005; Lezak, 1982). The cognitive domains of executive function do not work in isolation, however. Instead, these functions are highly integrated with other cognitive skills such as attention, memory, and self awareness (Mateer, 1999; Temple, 1997) all of which coordinate toward specific goal achievement (Elliott, 2003). Considering that such abilities are critical for social competency and productivity, the executive dysfunction often present in individuals who have sustained a TBI is problematic. Specifically, consequences of executive dysfunction have been associated with poor academic performance, low rate of employment, social isolation, and increased reliance on family for support.

Previous research has suggested that reliable measures and interventions for the abilities included in the broad realm of executive function should be addressed in the context of everyday routines. For instance, the typical testing environment (i.e., a quiet office without distraction) may not be optimum to elicit the deficits inherent in executive dysfunction (Manchester, Priestley, & Jackson, 2004). In the same vein, good performance during

educational, clinic-based intervention is not likely to guarantee successful executive functioning in the natural environment. Research has indicated that interventions for executive functions should be embedded in daily routines from the beginning of treatment, so that generalization can be achieved (Fish et al., 2007; McKinlay, 1992).

In a study that examined a specific goal setting treatment approach, Levine and colleagues (2000) conducted a randomized group trial to validate goal management training (GMT) for executive dysfunction following brain injury and neurologic disease. The GMT, developed by Robertson (1996), consisted of five stages for goal management such as orienting, defining goals, dividing into the sub-goals or steps, learning the steps, and monitoring the outcomes. In this experiment, 30 participants with TBI were randomly assigned to either GMT or motor skills training (MST). The GMT procedure involved defining five stages, discussing examples of goal management breakdown, and performing illustrative activities (e.g., create own catchphrase during orienting). On the other hand, the MST procedure was unrelated to goal management. The session consisted of repeated "mirror-reversed" reading and mirror-tracing tasks (e.g., tracing a star, 10 trials per hand). For each group, training was offered individually and lasted approximately one hour. Each day paper-and-pencil tasks (e.g. proofreading,

grouping, and room layout) which simulated common goal management tasks were administered at pre- and post-training sessions to assess the effects of each treatment. The study reported that the GMT group made significantly more improvements in accuracy on the pre- and post-training tasks than the MST group. However, task performance of the GMT group was slower relative to their own baseline and the MST group's post-training performance. The authors were perplexed by the overall slowing in the GMT group. Upon inspection of group performance, it was noted that the GMT group was slower than the MST group on neuropsychological tests, yet the GMT group performed faster on pre-training tasks than the MST group. Generally, insufficient methodological information on both GMT and MST was provided, which makes interpretation of results difficult. Moreover, a concern with this investigation was whether the GMT treatment method could be applied to individuals' daily lives (Fish et al., 2007).

In an effort to improve the ecological validity of intervention when addressing executive dysfunction, Ylvisaker and colleagues suggested interventions using Goal-Plan-Do-Review format (Ylvisaker & DeBonis, 2000; Ylvisaker & Feeney, 1998; Ylvisaker & Szekeres, 1989). This technique incorporates intervention in everyday routines and support by the network of people around the impaired person. Within a general Goal-Plan-Do-Review format, individuals set realistic goals, they make and carry out the plans to achieve those goals, and they review their performance with feedback from a clinician or significant other. A series of single-subject studies reported positive outcomes from an experimental intervention based on this model (Feeney & Ylvisaker, 1995, 2006). Feeney and Ylvisaker (1995) combined cognitive-behavioral supports to an executive intervention using a Goal-Plan-Do-Review routine. The participants, three adolescents with behavioral problems following TBI, demonstrated an increase in work completed and a decrease in aggressive behaviors through this intervention. Furthermore, each participant reported satisfactory achievement in post-secondary academics and the work place with long-term follow-up. The results of this supportive intervention were replicated in another single-subject experiment of two young children with TBI (Feeney & Ylvisaker, 2006). Two children who had growing behavioral concerns after TBI reduced frequency and intensity of challenging behaviors but increased amount of work done by engaging in this intervention. The Goal-Plan-Do-Review intervention seemed highly beneficial in that the participants applied the skills obtained from their routine-based intervention to real-life settings (Ylvisaker & DeBonis, 2000).

Recently, Fish and colleagues examined whether their intervention, conducted in a clinic could be generalized into a real-life setting (2007). More specifically, the study aimed to test the effects of an alerting strategy on executive functioning in a real-life setting, using a prospective memory (PM) task. Twenty participants

with non-progressive brain injury made phone calls to a voicemail service at four pre-selected times each day for two weeks. The study specifically examined whether the presence of a cue would facilitate success in making the required phone calls. Prior to the task, an executive review strategy using the text message ("STOP") was trained. The purpose of the message was to cue the participant that there was an activity for them to complete. The text did not include any other instruction or content. During the course of the two week intervention, five days were randomly selected for the cueing condition (eight text messages were sent which read "STOP"), and the other five days were not cued. The study reported that performance on the phone call task was significantly better on cued days compared to non-cued days. The findings provided convincing evidence that the effects of simple cueing could improve executive performance and perhaps just as important, the task was easily incorporated into a real life context for people with brain injury.

In spite of the promising evidence offered by these studies, research on ecologically valid intervention methods with this population continues to be lacking. Currently, with the exception of the Fish et al. study (2007), the feasibility of the intervention method in natural settings has been an inherent problem. With the wide range of communication technologies currently available (e.g. texting, email, etc), it would be of interest to further examine their potential utility for use as treatment delivery options. Many of these methods of communication are becoming an integral part of life that can be easily incorporated and available for use in most settings such as home, work, and school.

One such option, email, is an example of a highly integrated technology. Given the prevalence of electronic communication today, investigation of email as a method of delivery for therapy is warranted. Not only would email-based intervention be beneficial in allowing for extended care beyond the inpatient phase, it is also practical for community reintegration since it is a widely used tool for communicating in today's work settings and society in general. There are, however, drawbacks to email correspondence. One drawback is that the method is dependent on participation from both individuals involved in the interaction. Successful interaction calls for independent execution and follow-through on the part of each of the parties involved, abilities which fall under the realm of executive function. Therefore, the process of establishing and maintaining a schedule of email interaction would rely on these higher level cognitive skills. Consequently, before adopting email as a method of delivery for specific interventions, a feasibility study on the method itself is warranted.

In summary, the purpose of this study was to examine the feasibility of email correspondence as a therapeutic delivery method for individuals with executive dysfunction, in this case, traumatic brain injury. Wide spread use of

this technology makes it a highly available method for extending therapeutic interaction. Moreover, if proven effective, the method is one with high ecologic validity. Our primary interest was to determine if email is a medium that individuals with TBI would respond to. Specifically, the current study measured participants' general compliance to an email intervention based on an individualized intervention plan.

## METHOD

Two individuals who had sustained TBI participated in this study of approximately five weeks duration. The participants were recruited via recruitment flyers and a TBI support group meeting. At the first contact, participants showed their interest in receiving more information on the treatment project. The availability of Internet access at their home was checked at this time. An initial meeting was planned to formally explain the project and interview the participants. All pre-intervention sessions were offered at L.L. Schendel Speech and Hearing Clinic, Florida State University. For those participants who enrolled in the study, treatment sessions were conducted in the participants' home via internet.

## PARTICIPANTS

Participant 1 was a 25 year old male who had sustained a severe brain injury secondary to anoxia after a drug overdose in April 2008. He remained in a comatose state for approximately six weeks. Upon resolution of the coma, he required substantial assistance from his family. His mother assisted in activities of daily living, such as eating, dressing, bathing, etc. A speech and language evaluation at four months post-onset indicated a mild dysarthria of speech and moderate to severe cognitive deficits marked by visuospatial deficit, poor reasoning skills, and decreased executive function, along with impaired attention and memory. At the time of enrollment in the current investigation, he was 18 months post-onset. He was living with his family, and his mother provided care at their home. During the initial interview, he described his typical day as including several activities such as "eat meals," "feed dogs," "watch TV," "exercise," and "get on computer." He was receiving speech-language therapy at a local hospital twice a week and also attending a university speech and hearing clinic twice a week for cognitive rehabilitation. His clinician noted that his visuospatial skills had improved along with oral reading and reading comprehension. His mother mentioned that he usually stayed up very late at night and slept late in the day. He expressed his future goals as, "I want to go back to school."

Participant 2 was a 43 year old male. He suffered a TBI secondary to a motor vehicle accident in August

1981. According to the participant, the brain injury affected every aspect of his life. Specifically, he revealed moderate motor impairments which influenced his speaking, walking, and writing. His speech rate was slow and generally difficult to understand, which limited his ability to engage in functional communication and advance his social life. At the time of inclusion in the study, he was working part-time at a college library twice a week (~10 hours). He couldn't describe his daily routines in detail as requested but reported activities such as "lie down," "listen to music," or "occasionally work out." His social life only included attending church every Sunday. He was living by himself in an apartment setting for persons with disabilities. Although he was living independently, his parents were still supporting him (e.g., with transportation). Although this participant was several decades post-onset, he was included in the study because of his eagerness to obtain more structure in his life. He reported, "I am tired of living like a slob."

## PRE-INTERVENTION PROCEDURES

**Assessment.** Prior to initiating the email intervention, participants attended four sessions that lasted approximately 90 minutes each. During the first session, each participant reviewed and provided informed consent and participated in a short interview about their daily lives and future goals. At the end of the first session, they completed an executive function questionnaire (Schwartz, 2000-2007; Appendix). The questionnaire consisted of a series of specific statements addressing essential components of executive function (e.g., initiation, completion, execution, perseverance, future awareness and planning, organization, controlling emotional states etc.). The participants were asked to rate on a Likert-type scale from 0 (representing not at all) to 3 (representing very well) how accurately each statement described them. For example, the statement characterizing task completion was: "I have trouble completing things." The questionnaire was also provided to family members for verification.

Following completion of the questionnaire, portions of the Delis-Kaplan Executive Function System TM (D-KEFS; Delis, Kaplan, & Kramer, 2001) were administered. The D-KEFS is a nationally standardized set of tests with established norms for children and adults from 8-89 years of age. It consists of nine stand-alone tests designed to measure key components of executive function in verbal and nonverbal domains. Because execution of the intervention plan called for independent, goal-directed behavior, the D-KEFS was selected to get an idea of participants' abilities. The nine subtests of the D-KEFS and cognitive functions tested are listed in Table 1. During the second and third sessions, the remainder of the D-KEFS subtests was administered.

TABLE 1

Subtests of the Delis-Kaplan Executive Function System TM and Cognitive Functions Tested (D-KEFS; Delis, Kaplan, & Kramer, 2001)

Subtests of D-KEFS	Cognitive Functions Tested
1. Trail Making Test	▪ Think flexibly on a visual-motor sequencing task
2. Verbal Fluency Test	▪ Verbal knowledge, rapid and systematic retrieval of lexical items, and simultaneous processing and monitoring
3. Design Fluency Test	▪ Cognitive flexibility
4. Color-Word Interference Test	▪ Word-finding skills, verbal learning, and verbal inhibition
5. Sorting Test	▪ Non-verbal concept forming and abstract thinking
6. Twenty Question Test	▪ Categorization skills and problem solving
7. Word Context Test	▪ Basic receptive and expressive language skills, abstract thinking and deductive reasoning
8. Tower Test	▪ Visual attention and visual-spatial skills, spatial planning, rule learning, inhibition, etc.
9. Proverb Test	▪ Abstract thinking, semantic integration, and generalization

The assessment results of each participant are as follows:

- Participant 1: He and his family reported on the questionnaire that his most difficult problems appeared in execution of multi-tasks, memory, time management, prioritizing or planning, and attention. He demonstrated below average performance on each of the D-KEFS subtests except for average scores on the Twenty Questions and Proverb Tests.
- Participant 2: His most difficult problems were reported in initiation, execution of multi-tasks, perseverance and focus, organization, time management, prioritizing or planning, and sleep. D-KEFS results indicated below average performance in the majority of the subtests. His strengths were found on the Sorting Test, Twenty Question Test, Word Contest Test, and Tower Test.

During the fourth session, participants were instructed on the treatment tasks (email correspondence and reading task) and an intervention plan was developed. The investigator and participants chose specific times (a.m. & p.m.) for email interaction that fit within their typical routine. In addition, they chose one book of interest, which they planned to read and summarize as a focus of the intervention. Once the elements of the intervention plan had been designed, the participant and clinician ran a “test” email correspondence to ensure successful contact. Table 2 includes an example of an intervention plan developed by participants.

TABLE 2

A Sample Intervention Plan

INTERVENTION PLAN GUIDELINES
Participant ID #: Email address:
<b>A. Daily Email Correspondence</b> During four weeks, from _____ to _____ I will keep email correspondence with the investigator at <a href="mailto:emailtx@TBL.edu">emailtx@TBL.edu</a> three times a day, Monday through Friday. <ul style="list-style-type: none"> <li>○ In the morning, I will email my daily plans for completing my reading assignment to the investigator by/around _____ a.m. I will indicate a projected time to initiate and/or complete the assignment, the plans required for the reading task completion (e.g. number of pages), and a brief explanation about my schedule if applicable.</li> <li>○ In the evening, I will review my performance for the day and reading assignment. I will reflect on the completed tasks and send my thoughts to the investigator by/around _____ p.m.</li> </ul>
<b>B. Reading Task</b> <ul style="list-style-type: none"> <li>○ During the email intervention period, I will read <u>name_of_book, etc.</u> every day. In the morning, I will make a plan for a proper segment of reading, considering my daily schedule. I will summarize and reflect what I have read and will report it to the investigator.</li> <li>○ I will practice summarizing my reading during the email intervention, but I understand that the content/structure/grammar/spelling of my summary is not the focus of the intervention.</li> </ul>

## PROCEDURES FOR EMAIL INTERVENTION

One week before the email intervention, participants initiated pre-treatment interaction with the clinician by exchanging simple greetings. The clinician also reminded each participant one day before the email correspondence was scheduled to begin. During the treatment phase, each day of the week (excluding weekends) followed the same pattern.

- **Day 1:** at the pre-arranged time in the a.m., the participant emailed the clinician with a plan for completing their daily assignment.
  - Upon completion, they emailed a reading summary to the clinician.
  - At the arranged time in the p.m., the participant reflected or evaluated their performance on the assignment in an email to the clinician.
- **Day 2:** In the morning prior to the participants arranged time, the clinician sent an email providing feedback based on the emails from the previous day.
  - After reviewing the feedback, the participant designed their plan for the day.
  - The sequence continued for the four weeks. Specifically, the initial times planned for email correspondence were 11:00 a.m. and 11:00 p.m. for participant 1 and 8:40 a.m. and 10:00 p.m. for participant 2.

## MODIFICATIONS TO THE INTERVENTION PLAN.

**Participant 1.** After the first two weeks, the clinician requested a change in the morning email from 11:00 a.m. to 10:00 a.m., so that Participant 1 would wake up earlier and plan more activities in his daily life. Participant 1 agreed to the modification to his plan.

**Participant 2.** During the first week, Participant 2 demonstrated difficulty in carrying out three email tasks each day (plan, reading summary, evaluation). Thus, his intervention plan was modified to perform two email tasks, the morning email and the evening email which incorporated both the reading summary and daily evaluation. In addition, Participant 2 and the clinician revised the schedule to more convenient times for email tasks (7:00 a.m. for 8:40 a.m., 9:00 p.m. for 10:00 p.m.). This alteration was applied from Week 2 to the end of the intervention.

## OUTCOME MEASURES AND DATA COLLECTION

Compliance with the email intervention was measured by time adherence and assignment completion. Time adherence was indicated by the time the email was 'Received' on the email account, and it was considered as punctual when emails were received no more than 30 minutes past the pre-arranged time as laid out by the intervention plan. Task completion was indicated by whether or not each email included prearranged components such as the reading plan, reading summary and the evaluation of daily performance. Data were collected on a daily basis, excluding weekends, for a period of four weeks. In case of an early notification from the participants (e.g., sick in bed, scheduled trip), a missed email task was not counted as incomplete or untimely. Instead, it was excluded from the total number of weekly email tasks.

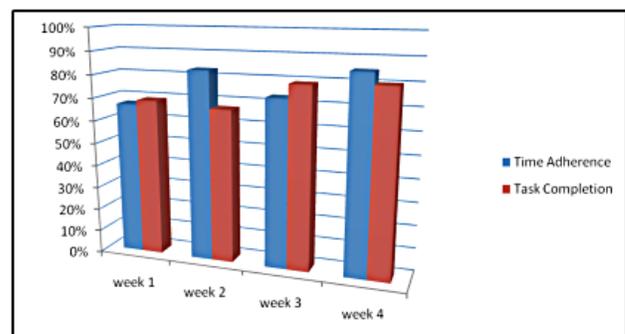
## RESULTS

Both participants demonstrated some level of compliance with their intervention plan that incorporated email and a daily assignment (with noted modifications). More importantly, both participants demonstrated improvement in task completion and time adherence over the four-week intervention period.

### CASE 1: PARTICIPANT 1

**Time Adherence.** Participant 1 demonstrated improvement in time adherence over four weeks. His time adherence to email correspondence improved as seen in 8 out of 12 attempts (66.7%) for Week 1; 5 out of 6 attempts (83.3%) for Week 2; 8 out of 11 attempts (72.7%) for Week 3; and 11 out of 13 attempts (84.6%) for Week 4. Participant 1 had a total of 15 email tasks per week (e.g., five morning emails, five reading summary emails, and five evening emails). During the four weeks, there were nine assignments in which time adherence was not measurable (2.5 in average per week) because the participant did not specify the exact times for a summary report in his morning plan. In addition, two email tasks were waived due to a scheduled family trip for Week 1; the participant was ill for two days (six email tasks) for Week 2; and one email notified about schedule conflicts in Week 3. Figure 1 shows the performance of Participant 1 related to punctuality on email tasks over the four weeks of treatment.

**Figure 1.** Time adherence and task completion: Performance of Participant 1 over four weeks



Participant 1	week 1	week 2	week 3	week 4
<b>Time Adherence</b>	66.7%	83.3%	72.7%	84.6%
<b>Task Completion</b>	69.2%	66.7%	78.6%	80.0%

**Task Completion.** Participant 1 increased overall task completion as measured by whether or not emails included the required components (i.e., the reading

plan, reading summary, and the evaluation of daily performance). Failure to complete the task was noted when he missed an email task due to forgetfulness (once per week on average except the final week). Also he frequently forgot to include a piece of required information. For example, he often did not indicate what portion of his reading material he planned to complete and what time he would send the reading report (two or three times in average per week; e.g., "I plan on reading 3 pages today. I will email you when I get my assignment done." Oct 14, 09 10:53 am). Of interest to note is that for the fourth week, Participant 1 clearly indicated the reporting times for his reading summary. Participant 1's performance regarding task completion is displayed in Figure 1.

**Anecdotal Information.** Participant 1's mother reported that she had no involvement and did not remind him to do his assignments over a period of four weeks. The participant utilized a timer on his phone ("I am sorry for being late. I forgot to set my phone for 3." Oct 15, 09 5:56 pm). During treatment, Participant 1 frequently demonstrated flexible thinking, reasoning, and problem solving skills. For instance, he notified in advance when he couldn't carry out his email tasks (e.g., illness, family trip) and he notified the clinician about missing tasks or for late completion ("Sorry I didn't email you this morning I have not felt good all day not been able to get out of bed until now." Oct 22, 09 4:33 pm). Also he emailed early if he couldn't meet the scheduled time ("hey I am emailing you early bc I read more cause i knew I wod not be able to email you at our normal time Im getting the h1n1 shot tom early." Nov 4, 09 4:21am).

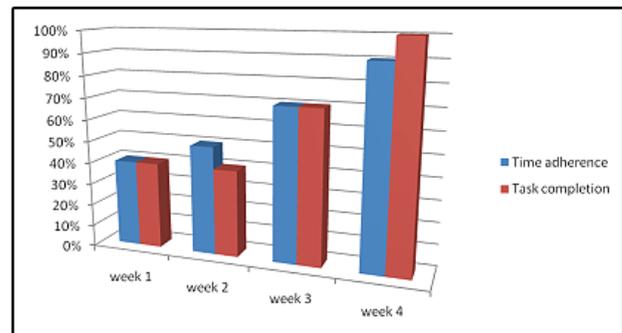
## CASE 2: PARTICIPANT 2

**Time Adherence.** Participant started with three email tasks a day in Week 1 and the plan was altered to twice a day for the remaining weeks (as noted in plan modifications). For the first week, Participant 2 demonstrated difficulty carrying out his intervention plan. For example, he sent a reading review in the morning (Day 1) and a daily plan at night (Day 2). In addition, he did not perform reading summaries, which called for the intervention plan change. However, he did send emails according to the intervention plan. Participant 2 was punctual for 4 out of 10 email tasks (40%) during Week 1 and for 5 out of 10 (50%) during Week 2. From Week 3, he demonstrated time adherence in 7 out of 10 emails (70%). During the final Week 4, he was punctual for 9 out of 10 emails (90%). Participant 2 required a significant amount of feedback from the investigator to be punctual for email tasks. Following the first week, Participant 2 made modifications to email tasks (from 8:40 a.m. to 7:00 a.m. and from 10:00 p.m. to 9:00 p.m.). During Week 2, however, the participant perseverated in sending an email at previous times for more than three email tasks.

At Weeks 3 and 4, he adjusted to the modifications and demonstrated time management by notifying the clinician in advance ("Instead of emailing you at 7 and 9, I will attempt to email you at 9 am since it is Home-Coming." Oct 29, 09 9:33 pm). Figure 2 displays time adherence for Participant 2 over four weeks.

**Task Completion.** Participant 2 demonstrated improvement in task completion with the modification to the intervention plan following the first week. Failure to complete the reading task was noted for two possible reasons. First, the original intervention plan appeared to be too challenging. The participant stated that he understood the plan but forgot what to do and he was confused with the many tasks (e.g., three different types of emails a day). Second, the participant did not check the email feedback from the clinician regularly. For instance, he responded to the clinician's emails a few days after they had been sent. During Week 2, in spite of simplification of his intervention plan into two email demands, the participant did not show an improvement in task completion. However, he demonstrated improvement on completion of tasks following Week 3 (70%). At Week 4, Participant 2 obtained 100% in task completed as seen in Figure 2.

**Figure 2.** Time adherence and task completion: Performance of Participant 2 over four weeks



Participant 2	week 1	week 2	week 3	week 4
<b>Time Adherence</b>	40%	50%	70%	90%
<b>Task Completion</b>	40%	40%	70%	100%

**Anecdotal Information.** Occasionally, Participant 2 attempted his own method for planning and laid out a detailed daily schedule. Although the clinician did not request a detailed daily plan and told him that it was not necessary, he continued to report it. This pattern appeared until the middle of Week 2 when he found implementing the schedule too difficult. He stated, "Having me lay out specific times for me to do specific things does make it hard for me. I commend you on making the executive decision and not require me to put

a specific time for each activity (Oct 21, 09 9:33 pm).” Participant 2 often expressed frustration due to his task failure (“I’m sorry because preplanning isn’t really my fortissimo,” “I know I haven’t performed up to your expectations but I am sorry that’s just the nature of the TBI Beast.” Nov 5, 09 9:00 pm).

## DISCUSSION

The primary aim of the current investigation was to examine the feasibility of email correspondence as a treatment modality. We found in these two case reports of adults with TBI, that compliance with email intervention resulted in positive gains for the behaviors measured. During treatment, participants successfully practiced utilized components of executive function based on a Goal-Plan-Do-Review format in their real-life setting (Ylvisaker & Feeney, 1998). In our study, the email treatment format was naturally implemented into their daily routines. To accomplish a targeted daily reading assignment, participants selected a goal and made plans in the morning email, they carried out those plans by completing the reading and doing the reading summary, and they reviewed their performance in the evening email. Based on the outcomes of our study, this format was beneficial for our participants with executive function impairment.

The previous study of 20 individuals with brain injury (Fish et al., 2007) demonstrated that cueing improved prospective memory performance (i.e., making phone calls) in the natural environment. Although they used an ecologically valid method (text message), it was a limited therapeutic application (one-directional, no content-bearing cueing). Although the current study only included two participants, we extended the therapeutic potential by providing some guidance on intervention tasks. As seen in improvement of task completion and time adherence, the feedback and focused attention from the clinician appeared effective in making positive change. In fact, the participants reported benefits beyond those explicitly measured in this study (direct comments are provided below).

The reading task which was incorporated as a target therapy task simulated an activity that participants might encounter at work (reading and summarizing reports) or at school (reading and summarizing text material). Incorporating such a highly utilized target activity ensured that participants were able to complete it easily (even if it was a few pages) in their home environment, making it highly practical as well as ecologically valid.

Although the participants enrolled in the current case reports demonstrated impaired executive functioning, email intervention proved to be both feasible and effective. It was easily incorporated into daily routines and even modified when it became necessary. The ability to interact with the clinician and carry out the tasks as

developed by the intervention plan demonstrated goal-directed behavior which improved throughout the course of treatment. At least for these two individuals, those gains suggest that email, as an intervention delivery method, has good potential for this clinical population. For our participants, intervention via email had merit in that it allowed for executive skill development (i.e., set a goal, plan, complete, and review) in a positive supported environment. For individuals who want to return to school or the work place, this approach, with the therapeutic feedback, could be implemented as a more gradual transition. Another benefit to the email intervention was that the clinician’s access to the client’s environment was feasible and feedback was delivered quickly (the following morning). Each of the participants responded positively to the clinician’s immediate feedback (e.g., sending supplemental information as requested by the clinician.). This medium of electronic correspondence provided both client and clinician an extended therapeutic environment beyond the traditional clinic setting. Finally, this intervention offers ecologic validity as it implemented familiar tasks that were built-in to participants’ daily routines.

A benefit to the tasks selected in these reports was that the reading segments, adopted as a focus of the intervention, could be verified by the clinician (based on their reading summaries). Therefore, even though target behaviors were not directly observed, the investigator was able to assess participants’ performance based on the content of email without the need of proxy, or caregiver involvement (Cusick, Gerhart, & Mellick, 2000). In addition, time adherence was objectively measurable by the received time.

It is likely that the process of incorporating email correspondence into their daily routine also enhanced prospective memory. The “planning” email in the morning in effect set up the notion for the tasks later in the day. Implementing the plan in general provided daily practice on setting goals, developing a plan, and executing the plan at a specific time in their daily routines, accounting for such things as scheduling conflicts etc. Similarly, everyday reviewing process could be addressing such abilities as retrospective memory, judgment and self-awareness.

The focused attention and encouragement offered by the clinician through email feedback appeared effective enough to elicit performance benefits on not only the target tasks, but also reading, typing, and spelling, in a “real life” context. The following statements from the participants provide convincing evidence that email correspondence has real potential as a treatment delivery method.

- “My typing skills and spelling are improving a lot thanks to you.”
- “This is longest I have read since my accident.. more than one page.. long time ago. You motivated me.”
- “Its also proving to myself my attention skills and reading skills are coming back as I am seeing now.”

- “It was challenging to submit emails on time”
- “I can’t fix things or get better if you don’t tell me what’s wrong...my point is that you tell me everything I can do to improve and I will do it.”
- “You have made it fun to interact with. I am looking forward to next week.”
- “When I started the program I didn’t know what to expect i got was more than i ever expected.”
- “I see the value in what you are doing; in-fact for a while I use to do this very thing myself. It helped me greatly!!”

In spite of the positive gains demonstrated by the current study, there were several limitations that should be addressed in further research. In these case reports, there was no method for reporting the reliability on the performance measures. While one participant lived alone, and the other lived with his parents who stated that they did not intervene, there was no validation of task performance. Incorporating technologies such as videoconferencing could address this issue. In addition, the original intervention plan was too challenging and had to be modified for one of the participants. While that could be considered a drawback, our results demonstrated the modification resulted in positive gains. It suggests that a clinician should carefully program individual clients’ own intervention plans allowing for their cognitive level and need. Clearly, email as a delivery method offers the flexibility to individualize plans to whatever extent is necessary. Since a feeling of achievement could be a big motivator and reward at the same time, realistically achievable tasks are recommended as a starting point. Future research direction includes variation of the frequency of email tasks (e.g., three times a week, one time per day) or incorporation to another type of activity as a focus of intervention (e.g., cooking, watching a movie).

## CONCLUSIONS

Email correspondence between individuals with TBI and a clinician offered a feasible therapeutic delivery method. The use of email is commonplace for most individuals even following a serious brain injury. The email intervention provided a supported environment to practice and establish strategies to assist with time management and task completion. A future research direction would be to extend the capabilities of this method utilizing other target tasks and perhaps additional clinical populations.

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## AUTHOR NOTE

This study was approved by Institutional Review Boards at Florida State University.

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## Scoring Key

Answer how well each statement describes you. Score each answer as follows:

- 0 - doesn't describe me at all
- 1 - describes me somewhat
- 2 - describes me pretty well
- 3 - describes me very well

	Score
<b>INITIATION</b>	
I have trouble getting started doing things.	
I procrastinate.	
<b>COMPLETION</b>	
I have trouble completing things.	
<b>EXECUTION</b>	
I don't do tasks efficiently (good job in short time).	
It is hard for me to do two or three tasks in a row.	
I don't always do what needs to be done.	
<b>DISTRACTION</b>	
I am easily distracted by things I hear or see even when I am trying to concentrate.	
<b>PERSEVERANCE AND FOCUS</b>	
I don't stick to tasks that are optional.	
I can't stick to a task even if I have to.	
I often switch from doing one thing to another.	
<b>INATTENTIVENESS</b>	
I don't pay attention when I should.	
I day dream/space out.	
I have trouble listening while others speak to me.	
I am absent minded.	
<b>MEMORY</b>	
I have trouble remembering things I want to do.	
I get so deeply into one thing that I forget others.	
I have trouble with my short term memory.	
I lose or misplace things.	
<b>TIME</b>	
I confuse appointment times.	
I forget appointments.	
I am often late for appointments.	

FUTURE AWARENESS AND PLANNING	Score
I have trouble making plans long in advance.	
I let my gas tank needle get close to empty.	
I rarely get to trains at least 10 minutes early.	
<b>ORGANIZATION</b>	
I get disorganized.	
My personal work area is messy.	
I put on my seat belt after the car has started moving.	
I don't prioritize or plan my day.	
I can't work well without structure or direction.	
I have difficulty taking command of my time.	
I waste a lot of time doing nothing.	
<b>PHYSICAL ACTIVITY (HYPERACTIVITY)</b>	
I need to keep walking, moving around.	
I have trouble sitting still, I fidget.	
<b>FRUSTRATION/IMPULSIVENESS</b>	
I get angry easily.	
I am easily frustrated.	
I get impatient easily.	
I interrupt when other people are talking.	
I am impulsive, do things without thinking.	
I don't express or communicate my anger constructively.	
<b>ANXIETY</b>	
I focus and concentrate better if I am somewhat anxious.	
<b>MULTI-TASKING (parallel)</b>	
I have trouble doing more than one thing at a time well.	
I often try to do more than one task at a time.	
I tend to make things more complicated than they need to be.	
<b>MULTI-TASKING (serial)</b>	
I dislike tasks that require a long series of steps.	
<b>SLEEP</b>	
I have trouble getting to sleep because my mind is going.	
<b>UNCATEGORIZED</b>	
I get so deeply into one thing that I forget other things I have to do.	
I believe that there is usually a quick solution to problems.	
I do not like to commit because I don't know how I will feel in the long term.	

Impressions/Comments:

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The newest version is available at <http://adultadd.info/evaluation/questionnaires/symptoms/>

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