

**Incorporating Cognitive Skills Training
in an Introductory Community College Course**



**Report of a Pilot of BrainWare SAFARI at Ivy Tech Muncie
September 2015 - December 2015**

Summary

BrainWare SAFARI cognitive skills development software was incorporated into a 3-credit-hour Student Success course.¹ Despite initial challenges in implementation, four of the ten students who completed the Student Success Course that incorporated BrainWare also completed a sufficient number of sessions and levels in BrainWare SAFARI to suggest measurable improvement in cognitive functioning. Pre- and post-test scores on the GAMA (cognitive test) are available for three of the four. Those three students improved their cognitive performance, increasing their IQ scores by 6, 12 and 21 points respectively, with each experiencing significant gains in one or more subtest areas.

Student comments at the end of the term were predominantly positive, with the exception of one student who also had a negative attitude about the course overall. Students found the program challenging and beneficial, with students observing improvements in attention, memory, visual processing, auditory processing, processing speed and logic/thinking skills. Several students also referred to improvements in motivation and ability to persist in the face of challenging tasks.

The results of the pilot suggest that, for students who understood the purpose of the program and engaged with sufficient frequency and intensity, using BrainWare SAFARI had a beneficial effect on cognitive processing. The experience reinforced the importance of appropriate staffing and training for instructors using BrainWare in their courses and demonstrated that BrainWare can be effectively included in a two credit-hour course. Developing graphics designed specifically for young adults would likely enhance engagement and compliance with the recommended usage, but the current program proved to be appropriately challenging for this population.

Background

Over half of students who enroll in 2-year colleges take remedial courses in English and/or math.² Almost 20% of those enrolling in 4-year colleges do so. The rates for low-income students are even higher – 68% and 39% respectively.³ With so many students taking remedial courses in college, there is concern regarding whether those remediation efforts are working. Of those enrolled in remedial courses in a 2-year college, 62% complete remediation, but less than 10% graduate within 3 years. For students taking remedial courses in 4-year colleges, almost 75% complete remediation, but only 35% graduate within 6 years. It has been reported that students who are recommended for remediation, but don't take it, do as well in entry-level college courses as students who completed the remediation.⁴

¹ A Student Success course is required of all degree-seeking students at Ivy Tech. Most of the Student Success courses are 1 credit hour. BrainWare SAFARI was incorporated into a 3 credit-hour version of the course to ensure that all course curricular goals could be met.

² Many Ivy Tech students also take remedial reading and/or math courses and at least some of the student involved in the pilot needed remedial work in reading and/or math.

³ "Remediation: Higher Education's Bridge to Nowhere," Complete College America, 2014

⁴ Ibid.

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Both 2-year and 4-year colleges continue to struggle with approaches to bringing students up to the level needed for college success. It has been suggested that development of cognitive, as well as academic skills, is an important prerequisite for success at the college level.⁵ BrainWare SAFARI is a cognitive skills training software program that has been used at the elementary through secondary levels of education to increase students' cognitive capacity with consequent improvements in academic performance. The program has also previously been used in an industrial setting with adults in a workforce training program, where both gains in cognitive measures and work-related training performance were seen.⁶

Encouraged by this earlier work, a decision was made to pilot BrainWare SAFARI at Ivy Tech Community College in Muncie, Indiana, in the fall of 2015. Use of the software was incorporated into a 3-credit-hour Student Success course (IVYT 186) The semester-long course was designed to help prepare students to be successful at the college level, and it was felt that BrainWare SAFARI would be a logical addition to the coursework.

In prior work with younger students, the recommended protocol for BrainWare SAFARI usage has been 3 to 5 times a week, 30 to 45 minutes per session, for 10-14 weeks. A similar target protocol was chosen for the Ivy Tech pilot, given the fact that students were expected to be behind normal college-level academically. The goal was for students to use the program 3 times a week for 30-45 minutes over the course of 12 weeks, yielding a total of 36 sessions. Because the class would meet once a week, one of the students' weekly sessions would take place during class, but students would be responsible for completing two sessions independently between class meetings.

Assessing the Impact

The primary measure of cognitive growth for the pilot was the General Adult Measure of Ability (GAMA), a 25-minute timed test designed to provide an estimate of a person's overall cognitive ability measured nonverbally. The nationally normed test has 4 types of questions: Matching, Sequences, Analogies, and Construction.

- Matching questions require examination of the shapes and colors to determine what is identical.
- Sequence questions require the analysis of interrelationships of designs as they move through space.
- Analogies involves the discovery of the relationships in a pair of abstract figures and the recognition of similar conceptual relationships in a different pair of figures.
- Construction involves the analysis, synthesis and rotation of spatial designs to construction a new figure.

⁵ <http://osse.dc.gov/service/what-does-college-and-career-readiness-mean>

⁶ www.mybrainware.com/safari/research

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In addition to scaled scores and a performance range on each of the subtest areas, the GAMA provides an estimate of the individual's IQ. The plan was to administer the GAMA on the second day of class, before the students started using BrainWare SAFARI and again 12 weeks later.

Implementation

Training sessions were provided for the course instructor and the supervisor of the course, and these individuals collaborated with staff from The BrainWare Company on how the program would be introduced and presented to the students. The instructor scheduled to teach the course became unavailable at the last minute and a replacement was identified. The new instructor was trained, but was not as knowledgeable in the areas of cognitive development and learning science as the original instructor had been, nor had she ever taught the Student Success course before. Nonetheless, the new instructor seemed committed to ensuring that students followed the planned protocol as well as completing the other curriculum in the course.

BrainWare staff attended the second day of class to help explain the program and to administer the GAMA pre-test. This was the new instructor's first day, so the class was led mostly by the course supervisor. The BrainWare SAFARI software and the testing software were installed on the classroom computers the day before. In addition, requests had been submitted by the course supervisor for the BrainWare SAFARI software to be installed on other computers in the building to which students would have regular access so that they would be able to complete sessions outside of class.

Fostering Student Motivation

Because cognitive skills development was a nontraditional element in a college-level course, it was anticipated that students might not easily grasp the connection between using BrainWare SAFARI and improving their ability to do college-level work. In addition, it was recognized that the graphics in the program can appear to be designed for younger students, even though the exercises in the program are challenging for almost all users, regardless of age.⁷ Student usage of the program was regularly monitored throughout the semester in an effort to identify and take appropriate actions to address problems that might interfere with students using the program according to the desired protocol of 3 times per week.

Issues were encountered in the first two weeks in ensuring that students had ample access to computers with BrainWare SAFARI installed on them. There was confusion in communications between the IT staff and the course instructor about the location of the computers with the program. Furthermore, it was discovered that some students' schedules did not accommodate multiple sessions per week on campus. Consequently, The BrainWare Company provided access and support to any student approved by the instructor to download the software on his/her personal computer to use at home.

⁷ BrainWare SAFARI is not generally recommended for users younger than 6 years of age.

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About three weeks after all of the students had been set up with BrainWare SAFARI on their home computers, the status of usage was checked. It was determined that many of the students were only using the program in class, once a week. When this was brought to the instructor's attention, it became apparent that she had not been emphasizing the program as much as she might have, having been ill and somewhat overwhelmed as a first-time instructor in the course. Based on the information provided, the instructor refreshed the instructions and clarified expectations for the students. In consultation with the course supervisor, it was also felt that a check-in with the students by BrainWare staff via an online web-enabled conference might help renew their energy and motivation. The CEO and COO of the company held a Q&A and motivational session during week 8 of the course.

Usage was again checked about two weeks later. There was significant variation in students' use of the program, but some students had improved their usage rate and seemed to be working more diligently in the program. BrainWare staff provided observations for the instructor regarding each individual students' progress, including areas of difficulty, how well the student was following the guidelines for usage, and specific recommendations for each student for the remainder of the semester. These recommendations were used by the instructor to encourage individual students.

Two weeks prior to the end of the semester, usage was again reviewed and BrainWare staff supported the instructor in determining grading criteria as a balance of sessions and levels of the program completed.

BrainWare Usage & Impact

- 12 students started the program.
- 2 students logged in 3 or fewer times, discontinuing usage before the end of September.⁸
- 10 students persisted in some level of usage into December, logging an average of 21 sessions over 13 weeks. 5 students completed 21 or more sessions.
- The 10 students who continued past September completed an average of 109 levels of the program.⁹ The 5 students who completed 21 or more sessions completed an average of 130 levels of the program.
- GAMA testing data is not available for the two students who discontinued the program in September and for two other students, one of whom completed 17 sessions and 138 levels and the other of whom completed 21 sessions and 143 levels.

Pre- and post-test information is available for three students who completed a combination of sessions and levels that would suggest that they had achieved the kind of frequency and intensity of use that could yield a measurable impact on cognitive functioning. The following

⁸ The course supervisor reports that these students stopped out of the course altogether.

⁹ There are a total of 168 levels in BrainWare SAFARI.

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discussion presents each of these student's results on the GAMA test as well as observations on their progress in BrainWare SAFARI.

Student 8 (Age 41, Female)

This student completed 34 sessions, the most of any student in the class. Completing 34 sessions against a target of 36 is highly commendable. The student worked steadily throughout the semester, working across different exercises, per the guidance provided. She completed 151 of the 168 levels in the program. It may be noted that this student struggled significantly with the early levels of some exercises, particularly those that involved visual-spatial skills, processing speed and visual working memory, requiring as many as 119 attempts at one level to successfully pass it. Thus her completion of 151 levels indicates significant perseverance and effort.

Student 8 experienced a gain of 6 points of IQ between the pre-test and the post-test, moving from the 45th to the 61st percentile (staying within the Average range). The significant change between the pre-test and the post-test was on the Matching subtest which moved from the Average to the Superior range.¹⁰ It seems reasonable that her improvement on the Matching subtest was affected by improved processing speed and visual pattern recognition.

Student 7 (Age 19, Female)

This student completed 29 sessions, the second most of any student in the class. She completed 112 levels in the program. She worked somewhat unevenly across the exercises, but did persist in a number of areas that were clearly challenging for her, including exercises involving directionality, timing and rhythm and visual representations. The total levels completed were somewhat lower than might be expected of a college-age student, but may possibly be understood in the context of her IQ score at the bottom of the Low Average range on pre-test.

Student 7 experienced a gain of 21 points of IQ between the pre-test and the post-test, moving from the 9th percentile to the 53rd percentile (from the Low Average to the Average range). Her Matching and Analogies subtest scores improved markedly from the Low Average to the High Average Range. While IQ is not necessarily predictive of college success, expectations of students with an IQ of 80, as this student score on the pre-test, are generally substantially less than for students with an average IQ of 101 (Student 7's post-test score).

Student 2 (Age 27, Male)

This student completed 166 levels in BrainWare SAFARI (all but 2 levels in the program) in 23 sessions. He worked consistently across all areas of the program and did not seem to experience a great deal of difficulty with any of them, until he reached the very highest levels of the exercises. Somewhat harder for him were exercises that involved timing and rhythm and directionality, as well as the integration of all skills at the very highest levels.

¹⁰ The ability classification levels on the GAMA subtests are, from lowest to highest, Well Below Average, Below Average, Low Average, Average, High Average, Superior, and Very Superior.

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Student 2 experienced a gain of 12 points of IQ between the pre-test and the post-test, moving from the 68th to the 90th percentile (from the Average to the High Average range of mental ability). The most dramatic gain was in the Sequences subtest where his score increased from the Average to the Superior Range. He also scored in the Superior Range on the Analogies subtest on post-test.

Two other students completed 21 or more sessions. One of them did not take the pre-test so no conclusions can be drawn for that student. Pre- and post-test scores are available for the second student (Student 6) and underscore the importance of both frequency and intensity of usage.

Student 6

While this student completed 23 sessions, she only completed 77 levels in the program. This number of levels is very low for a college-age student and suggests that she may not have been working with intensity during her sessions or that her sessions were shorter than recommended. It was also observed that the time spent performing exercises, as recorded within the program, was, in fact, significantly less than her classmates who completed a similar number of sessions and substantially more levels. Her pre- and post-test scores on the GAMA showed no change, as would be expected.

Student Feedback

Sample verbatim student comments are contained in Appendix A. Students commented that the program helped them with the following processing areas:

- Memory
- Focus
- Listening skills
- Motivation and persistence
- Speed and accuracy
- Dealing with frustration
- Sustained attention
- Critical thinking
- Eye-hand and ear-hand coordination
- Logic

Most of the students commented that they found BrainWare SAFARI to be challenging, and some found the program to be quite challenging. There had been some speculation prior to this pilot experience that college-age students might not find the program challenging enough and might complete the program within a relatively short number of weeks. Countering that speculation was the knowledge that many of these students were likely in a position of needing to take remedial coursework and that there were probably some underlying areas of weaker cognitive processing which had created barriers to their academic success in the past. The experience from this pilot suggests that the level of challenge in the program is appropriate for

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the range of students who used it as part of the course. As was anticipated, some students expressed that improvements in the graphics presentation would enhance the user experience for college-age students, but the exercises themselves proved to be appropriately challenging for the population.

It is also noteworthy that some students who did not complete enough sessions and levels for an impact on cognitive functioning on the GAMA to be expected still stated that they felt the program had helped them with various cognitive skills. This could suggest that subtle (but still detectable by them) changes had begun to take place for these students that might have continued to grow or grown faster had they continued or used the program more consistently.

Conclusions and Recommendations:

1. A 2 credit-hour Student Success course would enable the incorporation of BrainWare SAFARI. Since most of the Student Success Courses at Ivy Tech are now 1-credit-hour courses, offering a course that includes BrainWare SAFARI would necessitate rethinking that policy and/or considering whether cognitive skills development with BrainWare could be incorporated in other courses or programs.
2. Appropriate staffing of courses, as always, is important. The last-minute change of instructors was unavoidable in this case, but likely did impact the number of students who were motivated to persist and come closer to meeting the necessary frequency and intensity of use. It is recommended that instructors using BrainWare in a course receive additional training on cognitive skills and the science of learning, if they are not already somewhat knowledgeable in this area. Early feedback on initial successes in the program and ongoing encouragement should be provided by the instructor.
3. Developing graphics that are designed specifically for young adults would also likely help improve engagement and compliance with the protocol. However, the pilot results suggest that, for students who understood the purpose of the program and engaged in it with sufficient frequency and intensity, the current program is effective in enhancing students' cognitive ability. Additionally, the level of challenge was appropriate for the type of students who participated in the pilot.
4. The positive results and key learnings from the pilot should be further explored in a broader implementation which includes the ability to assess the impact on student persistence and success in their academic programs over a longer duration.

Acknowledgements

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Appendix A

Sample Verbatim Student Comments
Excerpts from Final Reviews of BrainWare SAFARI¹¹

Since participating in the different skill levels my perception has improved. I can see something once and remember, my performance on test taking has improved. My listening skills have sharpened. I now actually listen and focus on what is being said now. This has really helped me with school and home life. I have motivation to keep going no matter how hard the challenge is now. Safari gave me determination to finish until the end or just keep trying. Arrow Point Bridge is challenging but it helps me with direction and focus. Tic Tac Toe is also a bit of a challenge but I do find it fun and worth the effort to keep going until I get it. I am still trying to get the consistent beat to the last level of Rhythm Ribbet. I would like to defeat that but it will take total concentration. Bear Shuffle is very challenging for me. I will eventually get it.

The program helped me how to think in a timely manner and stay at the same time get the right answer as well. Brain Wire has also helped me manage time each day, what I mean by that is every day you have stuff to do. When I started this program I made time to do the lessons. The end result now is that I try to think ahead every day to make sure I can make room for everything that needs to be done. By saying the program help it did, but not just by doing the lessons it also helped me in everyday life. What I most like about the program is that it makes learning fun. Some people learn different, and some people are quick to give up sometimes if they get frustrated. In this program it's a game, and most of the time there are winners and losers in a game but on this certain game you can always redo it when you get it wrong, then when you get it right the game congratulates you. What I also like about the game is that it doesn't discourage you when you get something wrong the game encourages you to not give up and that you can do it.

Overall, I am still apathetic toward BrainWare. I'm not sure if it's just the color scheme or what, but it seems like visually it was designed for children. Perhaps the age group of 8-15 would enjoy the visuals, but adults not so much. Frustration is another factor the makers of BrainWare Should take into consideration. This is a normal human reaction if you cannot do something. A child or something with cognitive disabilities may be frustrated easily. The child may throw a fit and quit. Even I became frustrated after not passing a level. You will always remember frustration at a level more than the ones you passed. Even if you take a break and come back, you still have to go back to that dreaded level. One great benefit to this program is that it works. Personally I have seen a slight improvement in attention and memory. This game challenges you to think. It makes you think in ways you never would before.

It is nearly to the end of this semester, I realize my skills have been improved a lot. And the most important improvement is the rapid response capability, critical thinking and the ability to concentrate. All these things thank to Safari program. Before, I couldn't play some games included the beat, but I try my best to calm down, focus on listen the sound from the game and click the box "Click here" on the screen. The more I play it, the more patient I

¹¹ These comments are verbatim and spelling and grammar errors have not been corrected, as these give an indication of the issues some of the students are experiencing at the college level.

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become. Therefore, I don't hate these games anymore. I appreciate the creation and the real benefits of Safari. I hope it will be applied for all the college and university around the world to help improve students' skills.

When I had started BrainWare Safari at first I was very excited because I have always had a lot of trouble in school with learning and remembering what to do and how to figure out my homework assignments. I would just get so mad because I could not learn anything and I felt stupid at times. It would really stress me out when I couldn't figure out how to do my homework. Even though I was very excited about starting brain ware safari I wasn't sure if it was really going to help me or not. When I had started working on BrainWare I honestly didn't see anything change for me for a while but now that I have been getting on BrainWare Safari more I feel like it has helped me a little with some things. It has helped me by remembering things a little more and it has also helped me with staying focused a little more. Some of the games are very hard for me but I still keep trying them and eventually I complete the games. I like the encouragement on BrainWare SAFARI because it helps push me to keep going and trying by telling me things when I don't pass a level. Some of the things that I don't like about BrainWare SAFARI are how you can't see how many times you have logged in and I don't like that it's all a safari theme.