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Cognitive Assessment: An Analysis of Elderly Cognition in an Intergenerational Computing Program

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ABSTRACT *A cognitive assessment was given to older adults in an independent living setting, an assisted living facility, and a nursing home, prior to, and after the completion of a structured intergenerational computing program. The older adults were assisted by university students in overcoming their fears of technology, learning a new set of communication skills, being mentally challenged, and enhancing their overall quality of life. University student teams visited the elderly on a weekly basis. Through observations with the nursing staff, pre- and post- surveys, and the Montreal Cognitive Assessments the adoption of technology did show improved cognition for the older adults. This program, now in its fourth generation, continues with extreme success with approximately 100 students and older adults (ages 64 to 92) combined participating each semester. The program's analysis of pre- and post- Montreal Cognitive Assessments (MoCA) will be discussed.*

DESCRIPTION OF PROGRAM

An innovative multi-faceted gerontechnology joint research project is being led by an infusion of New York (NY) based agencies including higher education, government, and health care. In 2005, several New York agencies, Pace University, Westchester Community College (WCC), United Hebrew Geriatric Center (UHGC), Westchester County Department of Senior Programs and Services (WDSPS), and Westchester Public/ Private Partnership for Aging Services - SPEAK-UP joined together via the Westchester Alliance of Academic Institutions for Aging Related Studies and Workforce Development (ALLIANCE) in a timely intergenerational collaboration. A pilot project was carefully planned in Fall of 2005 and implemented in early 2006.

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LITERATURE REVIEW

Introduction: Literature shows older adults who are being taught technology, specifically, computer-based skills, by university students, report positive reflections on the process as well as an increase in cognitive skills. In the field of intergenerational studies, many researchers have commented on the paucity of evidence-based studies supporting intergenerational practices. While many intergenerational programs receive continuous support, there is very little conclusive research that confirms the benefits of these programs (Jones, Herrick, & York, 2004). Dr. Valerie Kuehne, in a recent report on intergenerational programming for the Annie E. Casey Foundation noted that though many programs are well intentioned, few are evidence-based. One factor affecting measurable outcomes in this area seems to be research methodology. There are some studies that compare pre- and post-program tests of attitudes, including control or comparison groups and use of relatively robust statistical or qualitative analyses. "However, a large amount of literature in this area still does not include even these relatively basic features" (Kuehne, 2006). Kuehne goes on to suggest that "random assignments of participants to program and control groups is very rare-a common weakness of many community-based initiatives" (Kuehne, 2006).

Recently published literature on intergenerational programs is shown to be conducted in a variety of settings including urban, suburban and rural, sites within institutions and community-based projects. Researchers in the area of intergenerational studies tend to use a mixture of both quantitative and qualitative methods. Benefits measured include older adult's self-perceptions and assessment, generativity, as defined by Erickson's stages of lifespan development and other measures of well-being. A review of the literature on intergenerational programming would not be complete without mentioning the work of Griff, Lambert, Dellman-Jenkins and Fruit (1996). The authors caution those working with older adults not to see them as a homogeneous population. A study completed by these authors in 1996 categorized older adults into three different populations: (1) Frail Elders: those cognitively intact but in need of assistance with a limited number of activities of daily living; (2) Community Elders: highly independent adults who were still maintaining their own residences and (3) Older Adults with Alzheimer's: those who have been diagnosed with the early or mid stages of Alzheimer's (Griff, et. al., 1996). The results of the study suggest that simple and largely unstructured activities were successfully utilized with all three groups of seniors. However, in order to "maintain dignity, comfort and safety, extra care and planning needed to be taken in structuring activities for frail adults and those adults with Alzheimer's disease" (Griff et. al., 1996).

Conclusion: Where intergenerational studies are concerned, it can be concluded that older adult's cognition status improves after interaction with students and a computer based program. However, Kuehne, 2006, approached the topic of the lack of evidence-based practice that goes into these programs, but goes on to suggest that participants of these community-based programs must be unsystematically dispersed. While many intergenerational programs receive continuous support, there is very little conclusive research that confirms the benefits of these programs (Jones, et. al., 2004). Through research, it is found that intergenerational programs are conducted in sites ranging from suburban to urban, and that researchers use both quantitative and qualitative methods to measure outcomes. Finally, it should be noted, according to Griff, et. al., 1996, studies should be careful when considering frail elders, community elders and older elders, as their activity levels are not equivalent. In conclusion, it can be stated that intergenerational programs, will frequently return positive and optimistic results, however, it must also be stated that careful thought must be taken into consideration with regards to age, population and methodology.

METHOD

Research Question and Hypotheses: Do senior's cognition status improve, decline, or remain indifferent through a service learning computing course? The hypothesis is that seniors will achieve an increase in their cognition after completion of the intergenerational service learning experience. Seniors are expected to see an improvement in their cognition and the ability to maintain that cognition through increased use of technology, taught to them by university students. Furthermore, it is anticipated that seniors will have high levels of improved memory, attention, and verbal communication.

Can the senior's cognition be enhanced after a gerontechnology course? The hypothesis is that older adults will improve their cognitive functions via individual instruction on a regular basis for an extended period of time with significant repetition of tasks and mastering mouse skills. A nursing student will administer the MoCAs to the senior participants before and after completion of the program. Analysis will then be conducted to determine if cognitive function has improved.

Data Collection and Description: Data collection for senior's cognitive assessments was obtained with the Montreal Cognitive Assessment (MoCA), a cognitive screening test used by health care professionals for detection of mild cognitive impairment. It assesses different cognitive domains: attention and concentration, executive functions, memory, language, visuoconstructional skills, conceptual thinking, calculations, and orientation. Time to administer the MoCA is approximately 10 minutes. The total possible score is 30 points; a score of 26 or above is considered normal. The following is an outline on administration, instruction, and scoring of the MoCA:

1. Alternating Trail Making:
Administration: The examiner instructs the subject: "Please draw a line, going from a number to a letter in ascending order. Begin here [point to (1)] and draw a line from 1 then to A then to 2 and so on. End here [point to (E)]."
Scoring: Allocate one point if the subject successfully draws the following pattern:
1 −A- 2- B- 3- C- 4- D- 5- E, without drawing any lines that cross. Any error that is not immediately self-corrected earns a score of 0.

2. Visuoconstructional Skills (Cube):
Administration: The examiner gives the following instructions, pointing to the **cube**: "Copy this drawing as accurately as you can, in the space below".
Scoring: One point is allocated for a correctly executed drawing.

- Drawing must be three-dimensional
- All lines are drawn
- No line is added
- Lines are relatively parallel and their length is similar (rectangular prisms are accepted)

A point is not assigned if any of the above-criteria are not met.

3. Visuoconstructional Skills (Clock):
Administration: Indicate the right third of the space and give the following instructions: "Draw a **clock**. Put in all the numbers and set the time to 10 after 11".
Scoring: One point is allocated for each of the following three criteria:

- Contour (1 pt.): the clock face must be a circle with only minor distortion acceptable (e.g., slight imperfection on closing the circle);
- Numbers (1 pt.): all clock numbers must be present with no additional numbers; numbers must be in the correct order and placed in the approximate quadrants on the clock face; Roman numerals are acceptable; numbers can be placed outside the circle contour;

- Hands (1 pt.): there must be two hands jointly indicating the correct time; the hour hand must be clearly shorter than the minute hand; hands must be centered within the clock face with their junction close to the clock centre.

A point is not assigned for a given element if any of the above-criteria are not met.

4. Naming:

Administration: Beginning on the left, point to each figure and say: "Tell me the name of this animal".
Scoring: One point each is given for the following responses: (1) camel or dromedary, (2) lion, (3) rhinoceros or rhino.

5. Memory:

Administration: The examiner reads a list of 5 words at a rate of one per second, giving the following instructions: "This is a memory test. I am going to read a list of words that you will have to remember now and later on. Listen carefully. When I am through, tell me as many words as you can remember. It doesn't matter in what order you say them". Mark a check in the allocated space for each word the subject produces on this first trial. When the subject indicates that (s)he has finished (has recalled all words), or can recall no more words, read the list a second time with the following instructions: "I am going to read the same list for a second time. Try to remember and tell me as many words as you can, including words you said the first time." Put a check in the allocated space for each word the subject recalls after the second trial.
At the end of the second trial, inform the subject that (s)he will be asked to recall these words again by saying, "I will ask you to recall those words again at the end of the test."
Scoring: No points are given for Trials One and Two.

6. Attention:

Forward Digit Span: Administration: Give the following instruction: "I am going to say some numbers and when I am through, repeat them to me exactly as I said them". Read the five number sequence at a rate of one digit per second.
Backward Digit Span: Administration: Give the following instruction: "Now I am going to say some more numbers, but when I am through you must repeat them to me in the backwards order." Read the three number sequence at a rate of one digit per second.
Scoring: Allocate one point for each sequence correctly repeated, (N.B.: the correct response for the backwards trial is 2-4-7).
Vigilance: Administration: The examiner reads the list of letters at a rate of one per second, after giving the following instruction: "I am going to read a sequence of letters. Every time I say the letter A, tap your hand once. If I say a different letter, do not tap your hand".
Scoring: Give one point if there is zero to one errors (an error is a tap on a wrong letter or a failure to tap on letter A).
Serial 7s: Administration: The examiner gives the following instruction: "Now, I will ask you to count by subtracting seven from 100, and then, keep subtracting seven from your answer until I tell you to stop." Give this instruction twice if necessary.
Scoring: This item is scored out of 3 points. Give no (0) points for no correct subtractions, 1 point for one correction subtraction, 2 points for two-to-three correct subtractions, and 3 points if the participant successfully makes four or five correct subtractions. Count each correct subtraction of 7 beginning at 100. Each subtraction is evaluated independently; that is, if the participant responds with an incorrect number but continues to correctly subtract 7 from it, give a point for each correct subtraction. For example, a participant may respond "92 – 85 – 78 – 71 – 64" where the "92" is incorrect, but all subsequent numbers are subtracted correctly. This is one error and the item would be given a score of 3.

7. Sentence repetition:
Administration: The examiner gives the following instructions: "I am going to read you a sentence. Repeat it after me, exactly as I say it [pause]: **I only know that John is the one to help today."** Following the response, say: "Now I am going to read you another sentence. Repeat it after me, exactly as I say it [pause]: **The cat always hid under the couch when dogs were in the room.**"
Scoring: Allocate 1 point for each sentence correctly repeated. Repetition must be exact. Be alert for errors that are omissions (e.g., omitting "only", "always") and substitutions/additions (e.g., "John is the one who helped today;" substituting "hides" for "hid", altering plurals, etc.).

8. Verbal fluency:
Administration: The examiner gives the following instruction: "Tell me as many words as you can think of that begin with a certain letter of the alphabet that I will tell you in a moment. You can say any kind of word you want, except for proper nouns (like Bob or Boston), numbers, or words that begin with the same sound but have a different suffix, for example, love, lover, loving. I will tell you to stop after one minute. Are you ready? [Pause] Now, tell me as many words as you can think of that begin with the letter F. [time for 60 sec]. Stop."
Scoring: Allocate one point if the subject generates 11 words or more in 60 sec. Record the subject's response in the bottom or side margins.

9. Abstraction:
Administration: The examiner asks the subject to explain what each pair of words has in common, starting with the example: "Tell me how an orange and a banana are alike". If the subject answers in a concrete manner, then say only one additional time: "Tell me another way in which those items are alike". If the subject does not give the appropriate response (fruit), say, "Yes, and they are also both fruit." Do not give any additional instructions or clarification.
After the practice trial, say: "Now, tell me how a train and a bicycle are alike". Following the response, administer the second trial, saying: "Now tell me how a ruler and a watch are alike". Do not give any additional instructions or prompts.
Scoring: Only the last two item pairs are scored. Give 1 point to each item pair correctly answered. The following responses are acceptable:
Train-bicycle = means of transportation, means of traveling, you take trips in both;
Ruler-watch = measuring instruments, used to measure.
The following responses are **not** acceptable: Train-bicycle = they have wheels; Ruler-watch = they have numbers.

10. Delayed recall:
Administration: The examiner gives the following instruction: "I read some words to you earlier, which I asked you to remember. Tell me as many of those words as you can remember. Make a check mark for each of the words correctly recalled spontaneously without any cues, in the allocated space.
Scoring: **Allocate 1 point for each word recalled freely without any cues**.

11. Orientation:
Administration: The examiner gives the following instructions: "Tell me the date today". If the subject does not give a complete answer, then prompt accordingly by saying: "Tell me the [year, month, exact date, and day of the week]." Then say: "Now, tell me the name of this place, and which city it is in."
Scoring: Give one point for each item correctly answered. The subject must tell the exact date and the exact place (name of hospital, clinic, office). No points are allocated if subject makes an error of one day for the day and date.

TOTAL SCORE: Sum all subscores listed on the right-hand side. Add one point for an individual who has 12 years or fewer of formal education, for a possible maximum of 30 points. A final total score of 26 and above is considered normal.

Seniors were selected from the Independent, Assisted Living, and Nursing Home population to be included in the study. This selection was made by the nurses at UHGC who worked with and knew the residents.

Analysis

Analysis of the data obtained was through the utilization of SPSS, a statistical-analysis and data-management system. SPSS employs the use of the data editor, a spread-like system for defining, entering, editing, and displaying data; the viewer, a format allowing the user to change the display order results, selectively show and hide output, and move presentation-quality tables and charts to and from other applications; multidimensional pivot tables, a layout allowing the user to explore tables by rearranging rows, columns, and layers; high-resolution graphics, an arrangement of full-color pie charts, bar charts, histograms, scatterplots, and 3-D graphics.

Frequencies

Statistics showed a n=9 for both the pre- and post- MoCAs with a mean of 16.8 for pres, 20.4 for posts; a median of 16.2 for pres and 19.0 for posts; a mode of 15.0 for pres and 18.0 for posts; a standard deviation of 3.9 for pres and 3.6 for posts; a variance of 15.4 for pres and 12.8 for posts; a minimum score of 10 for pres and 17 for posts and a maximum score of 22 for pres and 28 for posts leading to a sum of 151 for pres and 184 for posts.

In regards to percentiles, 10.8 for pres and 17.2 for posts, scored in the 10th percentile; 12.6 and 17.7, respectively, scored in the 20th percentile; 14.4 and 18.1 scored in the 30th percentile; 15.5 and 18.6 scored in the 40th percentile; 16.2 and 19.0 scored in the 50th percentile; 16.9 and 20.0 scored in the 60th percentile; 19.4 and 21.6 scored in the 70th percentile; 20.9 and 23.7 scored in the 80th percentile; none and 26.7 scored in the 90th percentile.

Frequency Bar Graphs

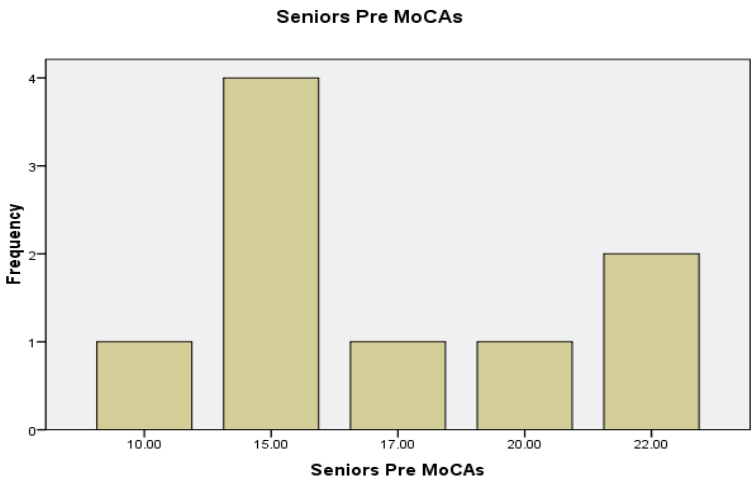

Figure 1

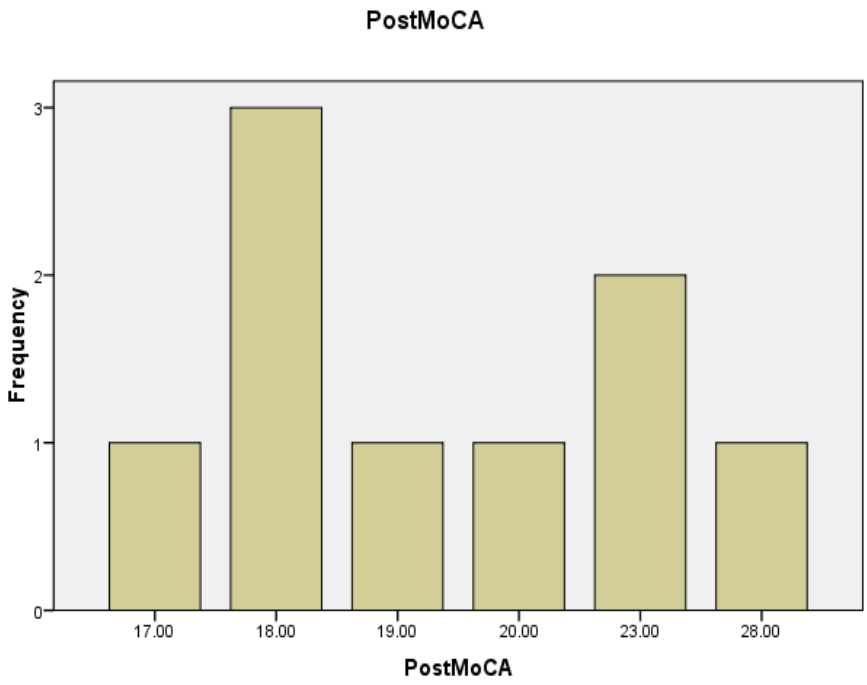

Figure 2

Findings

Findings will focus on the seniors' scores on the MoCA before and after the computer mentoring program. Findings found by the researchers and administrators of MoCA found, unequivocally, that seniors' cognition improved after completion of the intergenerational computing program. The project will be expanded during the upcoming semester while fielding possibilities of expanding the study to other local geriatric agencies and senior centers.

Limitations of Study

A weakness of the program is not having significant unrestricted funds to secure a large number of brain fitness software licensees. A longitudinal study would be appropriate with the elderly desiring to participate over the course of several semesters to measure cognitive functions.

Conclusions

Overall, the intergenerational computing program has provided a foundation for gaining a tremendous understanding of how one can be the most influential in effectively teaching seniors how to benefit from technology. In particular, the effect of an intergenerational computing program has consistently shown the older adults cognitive status to improve after completion of the program.
The needs in the community are great and it is our hope that more funding will become available to enable us to continue contributing to the elderly, diminish the digital divide, increase intergenerational respect and use technology to improve the quality of life for many. The authors, motivated by local educational and community outreach agencies queries, will be considering various locales for replication of this study.

Future Work

Future efforts involve integration of technology into nursing practices, brain exercises via computer, and between school semester lab coverage. One future agenda item includes working with the nursing staff at UHGC and assisting the nurses in embracing technology into their daily practice. This aspect of the project will need to move forward as UHGC's new technology-rich building is beginning construction. Moreover, "brain games" will be introduced in the next senior adult training session which is based on senior feedback. Another challenge is planning a strategy for off-semester coverage. This aspect of service will be evaluated at the end of the summer and will give insight as to the need for a continuous flow of support for the project.

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