

The Impact of Technology on the Developing Visual and/or Auditory Memory in School Aged Children

Cameron Mayer; Dr. Coles-White, PhD, CCC-SLP

Abstract:

This study aimed to determine whether time spent on technology impacts the developing auditory or visual memory in school-aged children. A survey was completed with the child participants to acquire a catalog of time spent on both technology devices and non-technological activities. Tests included a visual and auditory memory assessment adapted from the Preschool Language Scales Fifth Edition (PLS-5). The subtests were expanded upon in order to incorporate an auditory element. The results indicated that there was no significance between time spent on technology and visual and auditory memory scores. This was likely caused by the small sample size. However, the researchers did find that the auditory mean scores were significantly different from the visual mean scores across the participant's age range. Consequently, the researchers believe that this area of research could benefit from a similar study with a larger sample size, for specifically the technology element, that continues to assess how auditory and visual memory compare across this age range.

Questions and Hypotheses:

- Research Question 1: Is there a relationship between the participant's use of technology and performance on the visual and auditory memory tasks?
- Research Question 2: How does a child's visual memory compare to their auditory memory during their school aged years?
- Hypothesis 1: If the child spends more time on technology devices than on non-technology tasks, then the child will have increased visual memory skills as well as decreased auditory memory skills
- Hypothesis 2: The participants will present with better visual memory scores than auditory memory scores across this age range.

Methodology:

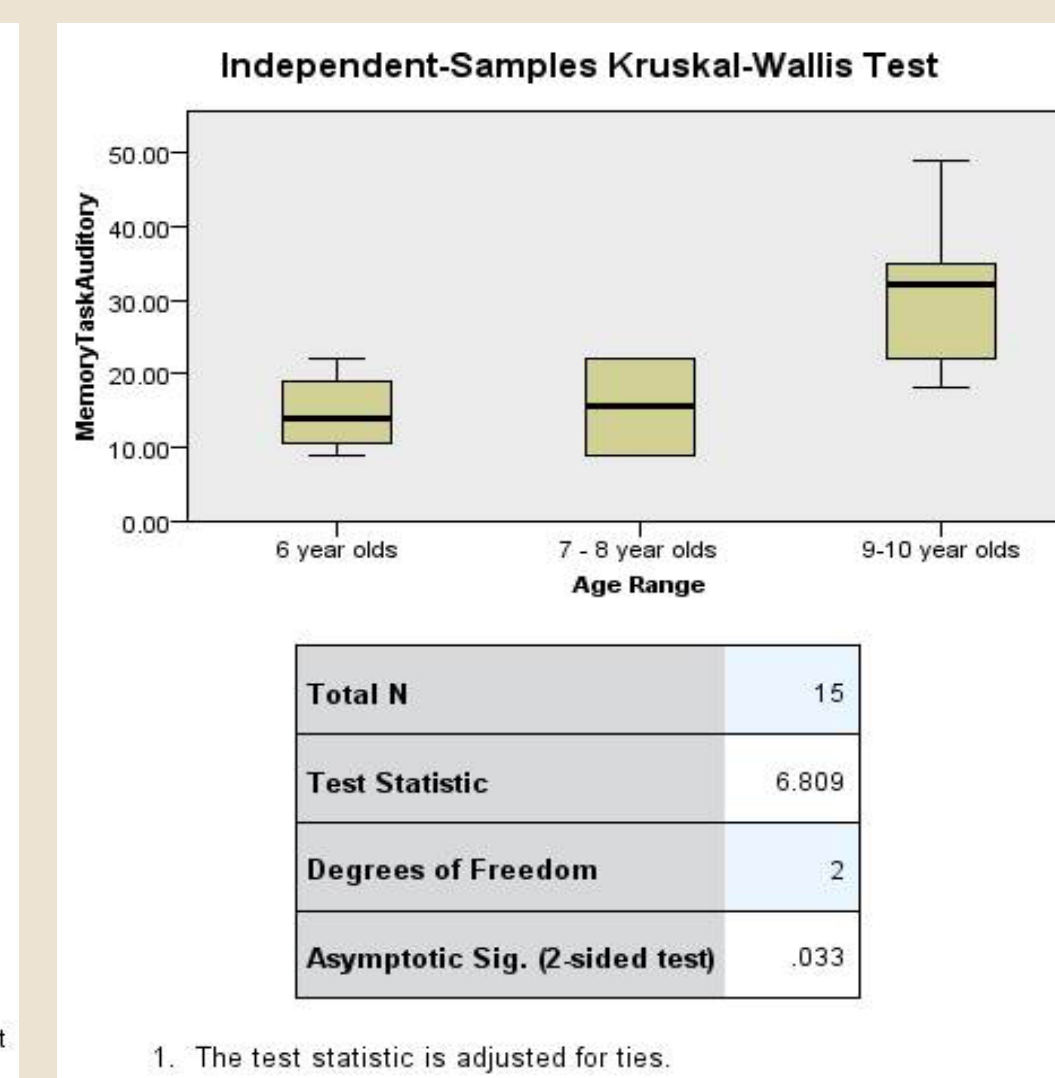
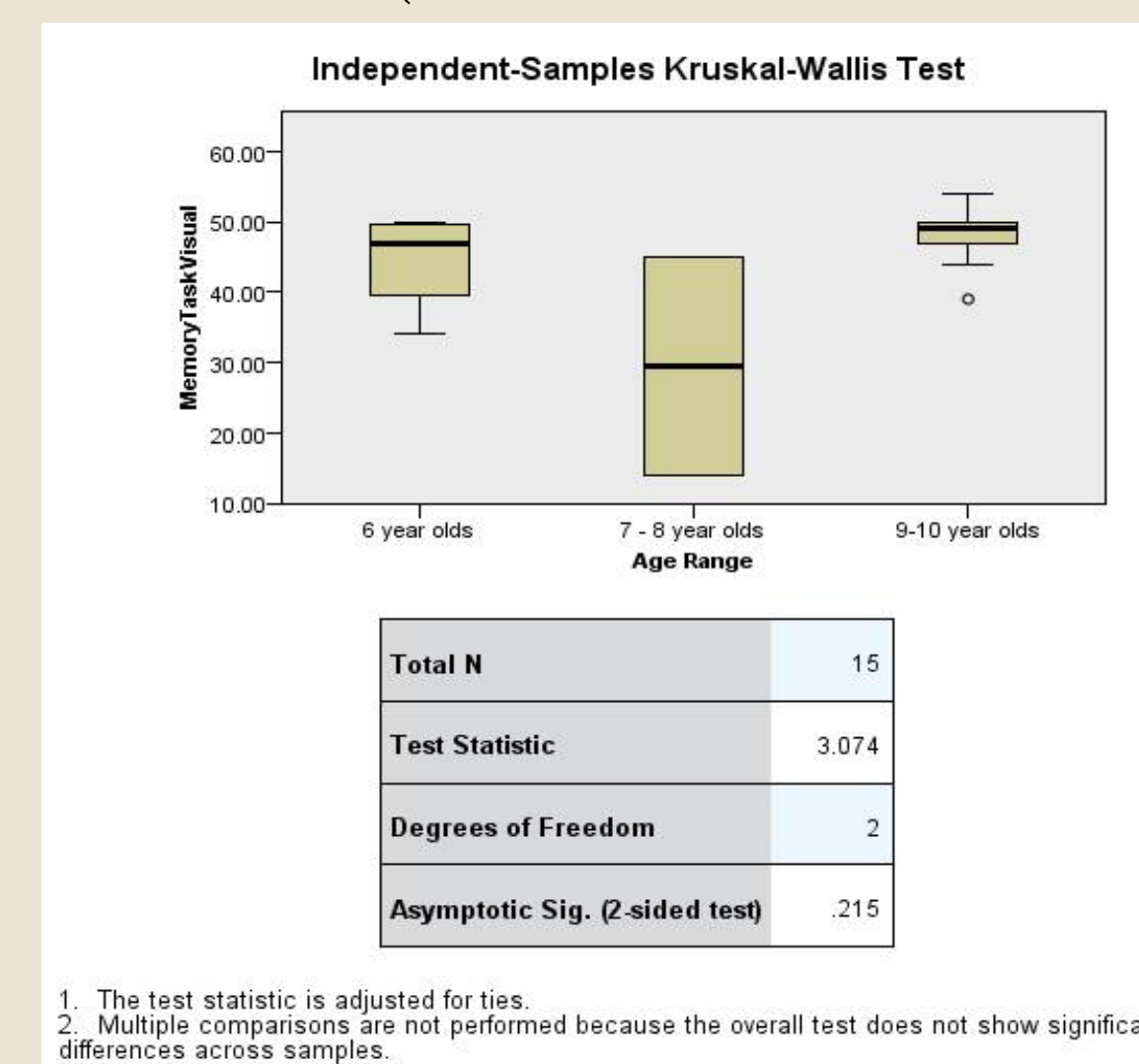
- **Population:** Children aged six to ten were asked to participate and did so only if they had a signed parent consent form, were able to acknowledge their own consent, and were not receiving special education services.
- **Survey:** A survey was completed with the child and asked questions involving the amount of time he or she spends on technology devices and non-technology activities. The results were quantified.
- **Visual Test:** The child was asked to look at a page with one picture. Next, they were shown a new page with the same picture and a new picture. The child was then asked to point to the picture that they saw previously. The test continued to increase incrementally until the child was unable to answer 50% or more correctly or they reached the end of the test, which was 10 images out of a field of 20. Practice trials were provided.
- **Auditory Test:** The child was asked to repeat a spoken word back to the researcher. Next, they were asked to repeat two words back to the researcher and so on. The test continued to increase incrementally until the child was unable to answer 50% or more correctly or they reached the end of the test, which was 10 words that must be repeated back to the researcher. Practice trials were provided.
- **Validation:** In these tests, participants completed tasks that were adapted and expanded upon from the Preschool Language Scales Fifth Edition (PLS-5). This standardized test is designed to examine preschooler's auditory comprehension ability and is used for identifying children who may need additional testing in their speech and language abilities. (Zimmerman, 2011).
- **Quantitative Analysis:** The amount of time spent on technology devices was correlated with the visual test scores and the auditory test scores using a Spearman Rank-Order Correlation Coefficient (rho) test. The visual and auditory scores were correlated with each other using an Independent-Samples Kruskal-Wallis test. Post-Hoc tests were conducted to analyze pairwise comparisons and further investigate age range differences and scores for both the auditory and visual tasks.

Results:

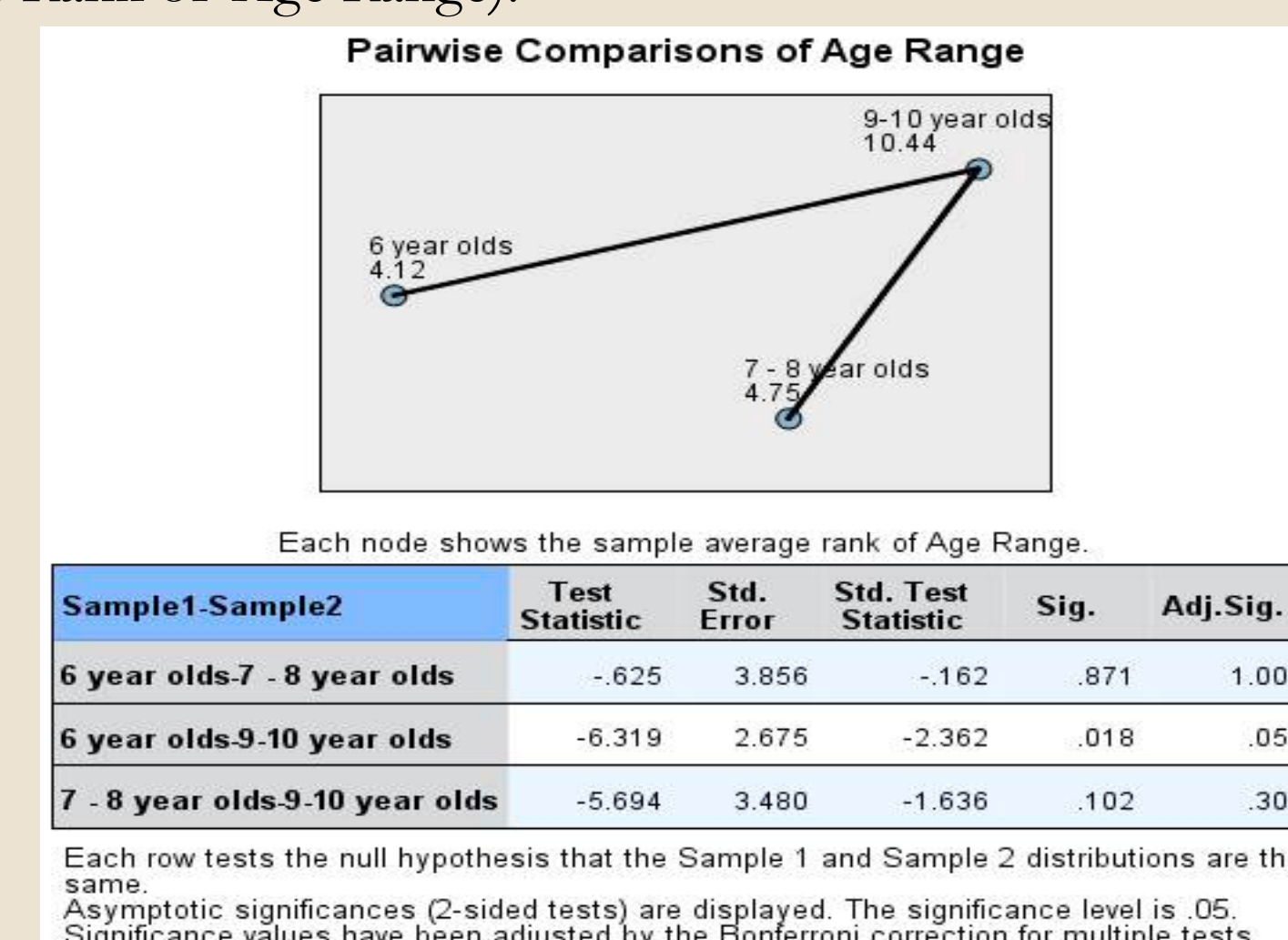
Question 1: A Spearman Rank-Order Correlation Coefficient (rho) test was conducted to show the relationship between time spent using technology and participants' performance on visual and auditory tasks. Based on the results, there was no association between the participants' time spent on technology and their performance on visual memory tasks, $r_s = .418$, $p = .121$, and their performance on auditory memory tasks, $r_s = -.042$, $p = .881$. See Table 1 (Spearman's rho Correlations).

		TimeSpent_Tech	CorrectV	CorrectA
TimeSpent_Tech	Correlation Coefficient	1.000	.418	-.042
	Sig. (2-tailed)	.	.121	.881
	N	15	15	15
CorrectV	Correlation Coefficient	.418	1.000	.331
	Sig. (2-tailed)	.121	.	.228
	N	15	15	15
CorrectA	Correlation Coefficient	-.042	.331	1.000
	Sig. (2-tailed)	.881	.228	.
	N	15	15	15

Question 2: An Independent-Samples Kruskal-Wallis test was conducted to show a difference in the participants' scores on the auditory and visual memory tasks by age. There was no significant difference of means on the visual memory task ($H = 3.074$, $p = .215$). However, there was a significant difference of means on the auditory memory task ($H = 6.809$, $p = .033$). See Figures 1 & 2 (Independent-Samples Kruskal-Wallis Test), Tables 2 & 3 (Kruskal-Wallis Test Statistics).



Post-Hoc tests were conducted to test pairwise comparisons. The findings showed that the youngest group's (6 years olds) performance on the auditory and visual memory tasks was significantly different from the oldest group's (9 and 10-year old) performance ($p = .018$). The youngest group (6-year old) and the young group (7 and 8-year old) were not significantly different ($p = 0.871$); nor was the young group to the oldest group significantly different ($p = .102$). See Figure 3 (Pairwise Comparisons of Age Range), Table 4 (Average Rank of Age Range).



Conclusions:

- For Questions 1 the results found in Table 1 (Spearman's rho Correlations) showed that technology had no impact on the scores of both the visual and auditory memory tasks. This could be because there is no association, the sample size was too small, or because the groups were unequal. Therefore, the researchers accept the null hypothesis for their first research question.
- For Question 2 the results found in Figure 1 and 2 (Independent-Samples Kruskal-Wallis Test) and Table 2 and 3 (Kruskal-Wallis Test Statistics) indicated that there was no significant difference between means for the visual test, but there was a significant difference between means for the auditory test. Thus, the researchers accept their hypothesis that visual scores will be better than auditory scores across this age range.
- The results found in Figure 3 (Pairwise Comparisons of Age Range) and Table 4 (Average Rank of Age Range), which attempted to further investigate age range differences and scores on both the auditory and visual tasks, demonstrated that there was a significant difference across this age range. The youngest group's (6-year-olds) scores were significantly different from the oldest group's (9 and 10-year-olds) scores. However, there was no significant difference between both the youngest group and the young group (7 and 8-year-olds) and the young group and the oldest group. This further suggests that the researchers hypothesis for their second research question should be accepted.
- Technology did not prove to have significance in this study, but the results indicated that age does have an influence on both auditory and visual memory. Therefore, the researchers believe that this area of research is important for understanding visual and auditory memory development at this age, and that technology could still remain a factor in childhood development.

Limitations:

- The sample size was small, from one location, and not a diverse population, in the sense of environment and upbringing.
- The child participant's understanding of time, when reporting how long they spend on technology, may not be accurate.
- Both the auditory and visual tests are not standardized and therefore their reliability and validity cannot be confirmed.
- More information could have been collected regarding English as a second language.
- The questions regarding the type of technology should be formatted to either include all types of technology or only focus on specific kinds of technology to ensure a better research methods design.

Selected References:

- IRB Protocol # 18-135
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