Research Notes

Cognitive Abilities of Academic Librarians and Their Patrons

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Levels of four cognitive abilities were measured in academic librarians and students. It was found that librarians had higher average logical and verbal comprehension abilities than students, and that students had higher average perceptual speed than librarians. Because these cognitive abilities affect information retrieval performance, these findings suggest that different approaches to information retrieval may be appropriate for librarians and students.

ntelligence or mental ability is a complex combination of factors called *cognitive abilities*. Examples of cognitive abilities are the ability to reason, remember, understand language, and locate and understand material that is presented visually. These cognitive abilities have been investigated in a wide variety of research studies. For instance, management research has shown that cognitive abilities are important indicators of how well people will perform in certain jobs. Library research has demonstrated that people with higher levels of certain cognitive abilities use information retrieval systems more effectively. In separate investigations, the authors assessed the influence of four cognitive abilities on how well academic librarians are suited to their jobs and how well academic library patrons perform in end-user searching.[1] Subsequently, the authors compared the cognitive abilities of librarians and their patrons. This article presents the results of that comparison and suggests that differences in the cognitive abilities of librarians and their patrons have implications for library service.

BACKGROUND AND HYPOTHESIS

Cognitive abilities have been used to predict a number of work outcomes in organizations. For example, John E. Hunter reviewed the evidence from hundreds of studies showing that relevant cognitive abilities predict the level of work performance.[2] In the library setting, a number of researchers have established firm links between cognitive abilities and perform- ance. Priscilla Teitelbaum-Kronish found that there is a positive relationship between logical reasoning ability and successful online searching.[3] Kim J. Vicente, Brian C. Hayes, and Robert C. Williges showed that vocabulary skills account for a significant portion of the

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variance in the time taken to find items when searching a hierarchical file system.[4] In a study done by Bryce Allen, perceptual speed was shown to have an effect on the quality of searches, while logical reasoning, vocabulary, and spatial scanning abilities affect the degree of success achieved in using search tactics.[5] The combined results from these and other studies led the authors to wonder if librarians have higher levels of important cognitive abilities than do their patrons. The authors thought it possible that people with the abilities necessary to become good information retrieval specialists would be more likely to become librarians. This idea is derived in part from Benjamin Schneider's attraction-selection-attrition framework.[6] According to that framework, librarians, and particularly those librarians who remain in the profession for an extended period of time, would be expected to display high levels of suitable abilities and competencies and have interests and values similar to other individuals employed in their profession or organizations. Similarly, the authors thought that library administrators, in selecting individuals to fill professional vacancies, would be likely to choose people with higher levels of important cognitive skills. Again, this idea was suggested by a body of management research that makes it clear that administrators seek to recruit individuals with certain skills into their organizations.[7] The authors, therefore, expected that people with higher levels of cognitive abilities would be likely to enter the profession of librarianship, and would be hired by employers who are trying to obtain the most suitable individuals to serve as librarians. Accordingly, the hypothesis for this investigation is that librarians would display higher levels of cognitive abilities (particularly those linked with information retrieval performance) than their patrons, as represented by a group of students randomly selected from the user community served by the librarians.

METHODOLOGY

This study analyzed data collected during 1991 in two independent research projects. The first project involved testing the cognitive abilities of eighty-four public service librarians in a large academic library. In the second project, fifty university students who were patrons of that academic library and represented a cross section of the university completed the same cognitive tests from the *Kit of Factor-Referenced Cognitive Tests* by Ruth B. Ekstrom, John W. French, Harry H. Harman, and Diran Dermen.[8] In both research projects, the participants had volunteered to be tested.

The study compared four cognitive abilities of librarians and library patrons. Those abilities were chosen because they were shown to predict successful performance in information retrieval tasks. They were, however, only four of the twenty-three cognitive abilities that had been isolated by the work of French and his colleagues.[9] Therefore, they should not be taken to be representative of all aspects of cognitive abilities or intelligence. The four tests used in this study were perceptual speed, logical reasoning, spatial scanning, and verbal comprehension. They are described below.

- *Perceptual Speed*: Perceptual speed tests measure speed in comparing figures or symbols, scanning to find figures or symbols, or carrying out other simple tasks involving visual perception. The test used to assess this ability was the Identical Pictures Test, wherein the participants checked which one of five numbered geometrical figures or pictures in a row was identical to a figure given at the end of the row.
- *Logical Reasoning*: Logical reasoning tests measure the ability to reason from premise to conclusion, or to evaluate the correctness of a conclusion. The test used to assess this ability was the Diagramming Relationships Test, wherein the participants were asked to select which one of five diagrams best illustrated the interrelationships among sets of objects.
- *Spatial Scanning*: Spatial scanning tests measure speed in visually exploring a wide or complicated spatial field. The test used to assess this ability was the Map Planning Test, wherein the partici-
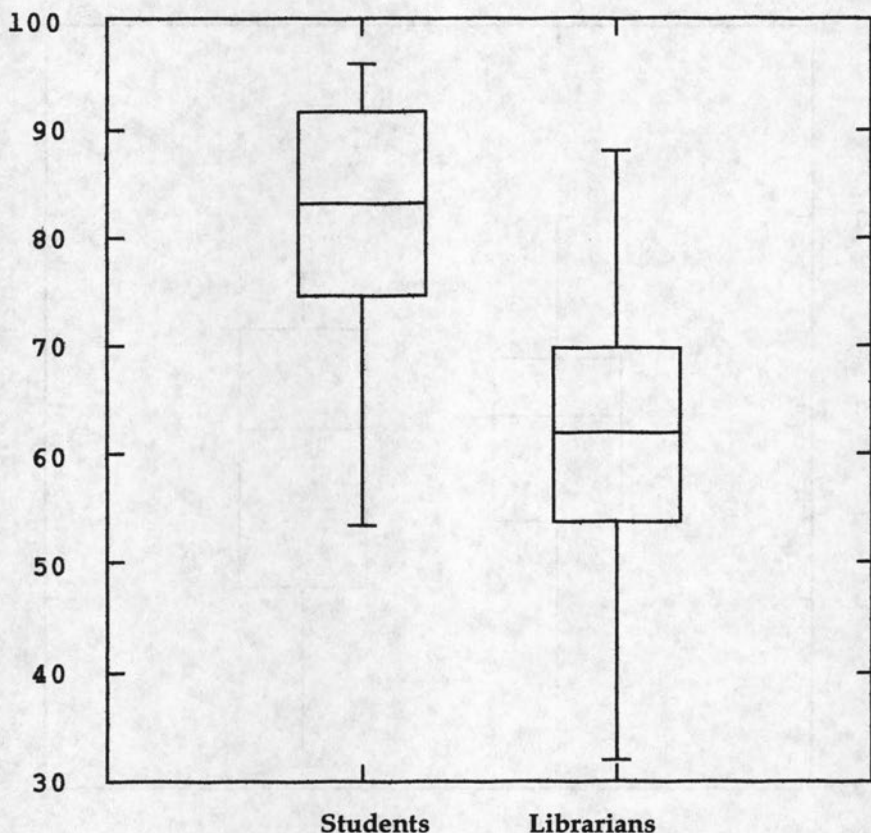
FIGURE 1
Perceptual Speed Scores (Range and Means) of Students and Librarians

pants were asked to plan the shortest route between two given points on diagrams representing city maps in such a way that roadblocks were avoided.

• *Verbal Comprehension*: Verbal comprehension tests measure the ability to understand the English language. The test used to assess this ability was the Advanced Vocabulary Test II, wherein the participants were asked to select words, from sets of four possible synonyms, that most closely matched the meaning of stimulus words.

In addition to obtaining measures on these four cognitive abilities of the librarians and their patrons, data were also obtained on the sex and age of each of the participants in the study. A test of homogeneity of slopes indicated that it was appropriate to use Analysis of Covariance (ANCOVA) to compare the measures of the four cognitive abilities with sex and age for the two groups of participants in the study.

FINDINGS

Perceptual Speed

Librarians were slower than students in carrying out a task involving visual perception. This difference is illustrated in Figure 1, which shows the range of scores and the average scores achieved by both groups. This finding was expected because the librarians were older than the students, and age has been shown to slow down perceptual processes.[10] In this
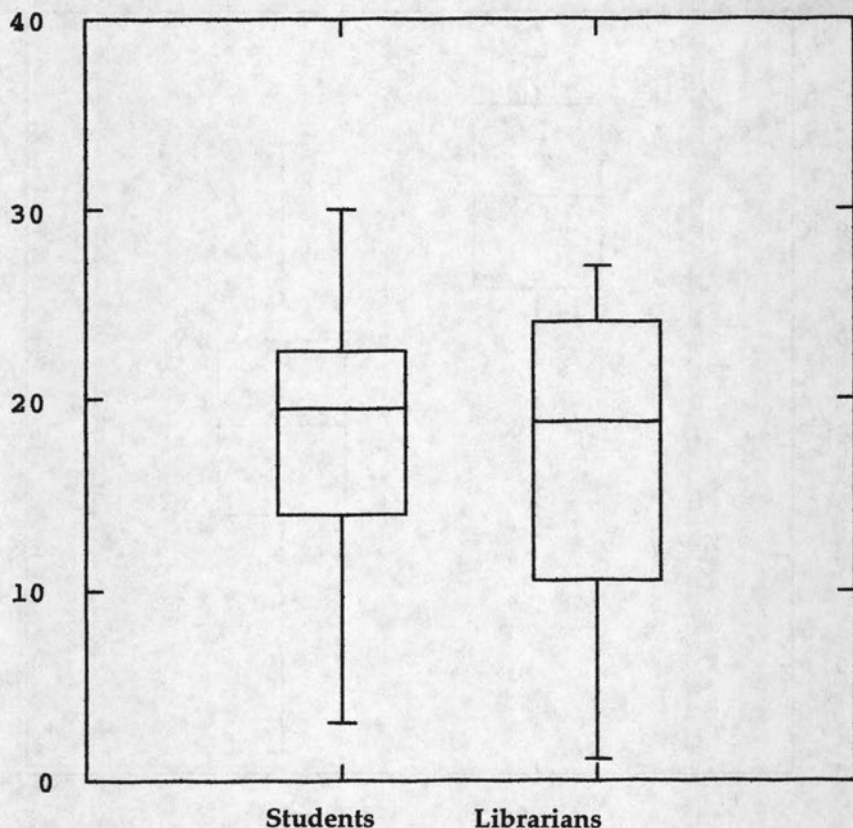
FIGURE 2
Logical Reasoning Scores (Ranges and Means) of Students and Librarians

research, age was negatively correlated with perceptual speed (r=-.664, p<.001). However, after the ANCOVA statistical analysis was used to adjust for the age difference, the authors found that the difference between librarians and their patrons was still significant (p<.04). With the test results corrected for age differences, the students scored an average of 73.4 out of a maximum of 96 on the test, while the librarians achieved an average of 66.7.

It was also found that gender had a significant effect on perceptual speed (p<.001). Females scored an average of 71.4 on the test, while males scored an average of 64.7. But there was no significant interaction between this effect and the difference already noted between librarians and students. In other words, regardless of age or gender, librarians had lower scores on the test of perceptual speed than students.

Logical Reasoning

When scores were adjusted for age differences, librarians outperformed students in logical reasoning. As figure 2 illustrates, there was little difference in the raw scores achieved by the two groups of participants. There was a significant correlation (r = -.341, p<.001) between age and scores on the test. In other words, as age increased, the scores on the test fell. Because the librarians were older than the students, age-adjusted scores were calculated for their logical reasoning tests, resulting in an
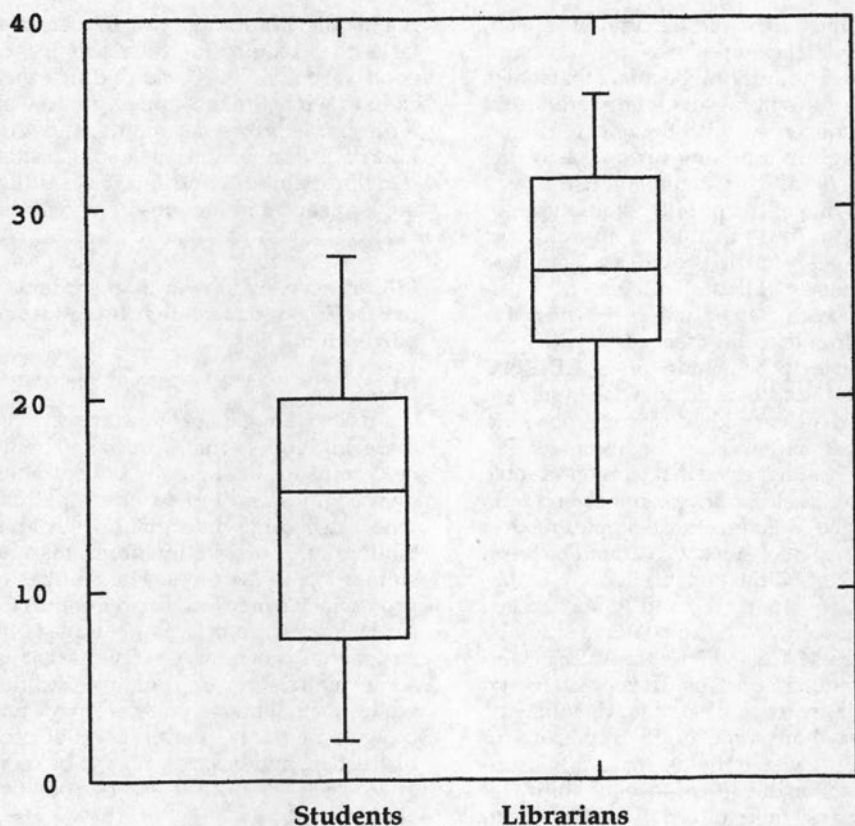
FIGURE 3
Verbal Comprehension Scores (Ranges and Means) of Students and Librarians

adjusted average score for librarians of 19.9 out of a maximum of 30 on the test. The average score for students was 13.4.

Spatial Scanning

No significant differences were found in the spatial scanning abilities of the librarians and the students.

Verbal Comprehension

The librarians achieved higher scores than the students on the verbal comprehension test (p<.001). This difference is illustrated in figure 3. Librarians averaged 25.6 out of 36 on the test, while students averaged 14.2 on the test. No significant age or gender effects were revealed in this analysis.

DISCUSSION

This study shows that the cognitive abilities of librarians in logical reasoning and verbal comprehension are better than the cognitive abilities of students, but that the perceptual speed of students is better than that of librarians.

Logical reasoning and verbal comprehension are extremely important and extensively used cognitive skills in librarianship. It is, therefore, understandable that in- dividuals with these abilities would choose to be librarians, be hired by discerning employers, and work to maintain their skills in these areas. With regard to these two skills, the authors' hypothesis was confirmed by the analysis.

In the area of perceptual speed, however, the hypothesis was not supported. The authors speculate that that is because the librarians who were tested were concerned with being careful and thorough in scanning for objects in the visual field. This explanation fits well with some of the popular stereotypes of librarians, but the authors are reluctant to suggest that it provides a complete explanation of this phenomenon.

Although perceptual speed has also been found to be associated with performance in searching on a CD-ROM index,[11] the authors do not wish to suggest that a deficiency in perceptual speed is a professional handicap for librarians. Research has suggested that workers are able to compensate for shortcomings in certain cognitive abilities. For example, modest inverse relationships were found between cognitive abilities and internal work motivation ($r=-.16$, $p<.05$) and organizational commitment ($r=-.17$, $p<.01$) in a study by Stephen M. Colarelli, Roger A. Dean, and Constantine Konstans.[12] It is possible that librarians, recognizing that they may be slower than some of their patrons in scanning visual fields, naturally compensate for this lower level of ability by increasing their internal motivation to succeed in their searches, or by becoming more committed to achieving expertise in their information retrieval work.

Although it is difficult to generalize from samples taken in one academic library setting, it seemed to the authors that there may be implications in these findings for how librarians interact with their patrons. One suggestion is that students are likely to be better at tasks that involve scanning large amounts of mate-rial, while librarians may be better at tasks that require logical reasoning or good verbal skills. These findings may explain why students appear to do well with simple browse searching, and why librarians prefer more sophisticated search capabilities and interfaces utilizing Boolean combinations of keywords.

Librarians were slower than students in carrying out a task involving visual perception.

Another suggestion that arises from these findings is that librarians should be careful to distinguish between their own abilities and those of their patrons when designing information systems, bibliographic instruction programs, and similar library services. The abilities of professionals may lead to preferences for sophisticated interfaces, complex instructional programs, or services that assume high levels of cognitive abilities, while their library patrons may find browse interfaces, simple point-of-need instruction, and basic services to be more appropriate to their levels of cognitive abilities.

As librarians interact with patrons, it is appropriate that the knowledge, skills, and abilities of each be used in meeting the information needs of users. This investigation shows that, in one area, librarians and patrons have different levels of abilities to bring to this interaction. It is important for those designing library services to ensure that the systems are appropriate to the different levels of cognitive abilities of both librarians and patrons.

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