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Wireless Networks in Medium-sized Academic Libraries: A National Survey

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This study focuses on the adoption and use of wireless technology by medium-sized academic libraries, based on responses from eighty-eight institutions. Results indicate that wireless networks are already available in many medium-sized academic libraries and that respondents from these institutions feel this technology is beneficial.

Wireless networking offers a way to meet the needs of an increasingly mobile, tech-savvy student population. While many research libraries offer wireless access to their patrons, academic libraries serving smaller populations must heavily weigh both the potential benefits and disadvantages of this new technology. Will wireless networks become essential components of the modern academic library, or is this new technology just a passing fad? Prompted by plans to implement a wireless network at the Houston Cole Library (HCL) (Jacksonville State University's [JSU's] library), which serves a student enrollment close to ten thousand, this study was conducted to gather information about whether libraries similar in size and mission to HCL have adopted wireless technology. The study also sought to find out what, if any, problems other libraries have encountered with wireless networks and how successful they have perceived those networks to be. Other questions addressed include level of technical support offered, planning, type of equipment used to access the network, and patron-use levels.

Review of Literature

A review of the literature on wireless networks revealed a number of articles on wireless networks and checkout programs for laptop computers at large research institutions. Seventy percent of major research libraries surveyed by Kwon and Soules in 2003 offered some degree of wireless access to their networks.¹ No articles, however, specifically addressed the use of wireless networks in medium-sized academic libraries. Many articles can also be found on wireless-network use in medical libraries and other institutions. Library instruction using wireless classrooms and laptops has been another subject of inquiry as well.

Breeding wrote that there are a number of successful uses for wireless technology in libraries, and a wireless Local Area Network (WLAN) can be a natural extension of existing networks. He added that since it is sometimes difficult to install wiring in library buildings, wireless is more cost effective.² A yearly survey conducted by the Campus Computing Project found that the number of schools planning for and deploying wireless networks rose dramatically from 2002 to 2003. "For example, the

portion of campuses reporting strategic plans for wireless networks rose to 45.5 percent in fall 2003, up from 34.7 percent in 2002 and 24.3 percent in 2001."³

The use of wireless access in academia is expected to keep growing. According to a summary of a study conducted by the EDUCAUSE Center for Applied Research (ECAR), the higher-education community will keep investing in the technology infrastructure, and institutions will continue to refine and update networks. The move toward wireless access "represents a user-centered shift, providing students and faculty with greater access than ever before."⁴

In an article on ubiquitous computing, Drew provides a straightforward look at how WLANs work, security issues, planning, and the uses and ramifications of wireless technology in libraries. He suggests, "Perhaps one of the most important reasons for implementing wireless networking across an entire campus or in a library is the highly mobile lifestyle of students and faculty." The use of wireless will only increase with the advent of new portable devices, he added. Wireless networking is the best and least expensive way for students, faculty, and staff to take their office with them wherever they go.⁵

The circulation of laptop computers is a frequent topic in the available literature. The 2003 study by Kwon and Soules primarily focused on laptop-lending services in academic-research libraries. Fifty percent of the institutions that responded to their survey provided laptops for checkout. The majority indicated moderate-to-high use of laptop services. Positive user response and improved "public reputation, image, and relations" were the greatest advantages reported with laptop circulation. The major disadvantages associated with these services were related to labor and cost.⁶

A study of laptop checkout service at the Mildred F. Sawyer Library at Suffolk University in Boston revealed that laptop usage was popular during the fall semester of 1999. Students checked out the computers to work on group projects. A laptop area was set aside on one library floor to provide wired Internet access for eight users. However, students wanted to use the laptops anywhere, not one designated place. The wired laptop areas were not popular, Dugan wrote, adding that "Few students used the wired area and the wires were repeatedly stolen or intentionally broken." An interim phase involved providing wireless network cards for checkout

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to encourage patrons to use their own laptops, and, when a wireless network was put into place in the fall of 2000, demand exceeded the number of available laptops for checkout.⁷

Method

A survey (see appendix) was designed to find out how many libraries similar in size and mission to HCL have adopted wireless networks, the experiences they have encountered in offering wireless access, and, most importantly, whether they felt the investment in wireless technology has been worth the effort.⁸ The National Center for Education Statistics' Academic Library Peer Comparison Tool, a database composed of statistical information on libraries throughout the United States, was used to select institutions for this study. A search on this database retrieved eighty-eight academic libraries that met two criteria: full-time enrollments of between five thousand and ten thousand, and classification by the Carnegie Classification of Higher Education as Master's Colleges and Universities I.⁹

The survey was administered to those thought most likely to be responsible for systems in the library; they were selected from staff listings on library Web sites (Library Systems Administrator, Information Technology [IT] staff). If such a person could not be identified, the survey was sent to the head of library systems or to the library director.

The survey was divided into the following sections: implementation of wireless network, planning and installation stages, user services, technical problems, and benefits specific to use of network. Surveys were mailed out in March 2004. An Internet address was provided in the cover letter if participants wished to take the survey online rather than return it by mail. An e-mail reminder with a link to the online survey was sent out three weeks after the initial survey was mailed. All letters and e-mails were personalized, and a self-addressed stamped envelope and a ballpoint pen with the JSU logo were included with the mail surveys. In the e-mail reminder, the authors offered to share the results of the project with anyone who was interested, and received several enthusiastic responses.

Results

A total of fifty-three completed surveys were returned, resulting in a response rate of 60 percent. The overwhelming majority (85 percent) responded that their library offered wireless-network access. Even if the thirty-five surveys that were not returned had reported

that wireless networks were not available, more than 50 percent would still have offered wireless networks. Survey results also pointed to the newness of the technology. Only four of the fifty-three institutions have had wireless networks for more than three years. The majority (73 percent) has implemented wireless networks just within the last two years.

When asked to identify the major reasons for offering wireless networks to their patrons, the three responses most chosen were: (1) to provide greater access to users; (2) the flexibility of a network unfettered by the limitations of tedious wiring; and (3) to keep up with technological innovation (see table 1). Least significant factors in the decision to implement wireless networks were cost; use by library faculty and staff; to aid in bibliographic instruction; and use for carrying out technical services (taking inventory). Somewhat to the authors' surprise, wireless use in bibliographic instruction was not high on the list of reasons for installing a wireless network, identified by only 9 percent of respondents. The benefits of wireless for library instruction was stressed in the literature by Mathias and Hesser and Patton.¹⁰ In addition to obtaining an instrument for gauging how many libraries similar in scope and size to HCL have implemented wireless networks and why they chose to do so, questions on the survey were also designed to gather information on planning and implementation, user services, technical problems, and perceived benefits.

Planning and Implementation

Although Tolson mentions that some schools have used committees composed of faculty, staff, and students to look into the adoption of wireless technology, responses from this survey indicated that the majority (60 percent) of the libraries did not form committees specifically for the planning of their wireless networks.¹¹ In addition, 49 percent of the libraries took fewer than six months to plan for implementation of a network, 37 percent required six months to one year, and 15 percent reported more than one to two years. Actual time spent on installation and configuration of wireless networks was relatively short, 98 percent indicating less than one year (see table 2 for specific times).

One of the most important issues to consider when planning to implement a wireless network is extent of coverage—where wireless access will be available. Survey responses revealed varying degrees of wireless coverage among institutions. Twenty percent had campus-wide access, 55 percent had some level of coverage throughout the entire library, 37 percent provided a limited range of coverage outside the building, and 20

Table 1. Main Reasons for Implementing a Wireless Network in Absolute Numbers and Percentages

Reasons for Implementing a Wireless Network	Total Number of Responses	Percent of Responses out of Total Number
Provide greater access to users	36	67
Flexibility (no wires, ease in setting up)	29	54
To keep up with or provide technological innovation	28	52
Campuswide initiative	21	39
Requests expressed by users	16	30
Provide greater online access due to shortage of computers-per-user in the library	15	28
Other	7	13
Offer network access outside the library building	6	11
Aid in bibliographic instruction	5	9
For use by library faculty and staff	5	9
Low cost	5	9
To carry out technical services (such as inventory)	4	7

percent offered access only in certain areas within the library. According to a bulletin published by ECAR, institutions vary in their approaches to networking depending on enrollment. Smaller colleges and universities with fewer than ten thousand students are “more likely to implement campuswide wireless networks from the start. Larger institutions are more likely to implement wireless technology in specific buildings, consistent with a desire to move forward at a modest pace, as resources and comfort with the technology grow.”¹² Questions on the survey also queried respondents about the popularity of spaces in the library where users access the library’s wireless network. Answers revealed that the most popular areas for wireless access are study carrels, tables, and study rooms. Nineteen percent indicated that accessing wireless networks in the stacks is popular.

Of particular concern to HCL, a thirteen-story building, was how the environment of the library would accommodate a wireless network. A thorough site survey is important to locate the best spots within the library to install access points and to determine whether there are architectural barriers in the building that might interfere with access. The majority of survey respondents indicated that the site survey conducted in their library for a wireless network was carried out by their academic institution’s IT staff (59 percent). While library staff conducted 35 percent of site surveys, only 17 percent were conducted by outside companies.

User Services

An issue to be addressed by libraries deciding to go wireless is whether laptop computers should also be provided for checkout in the library. After all, it might be hard to justify the usefulness of a wireless network if users do not have access to laptops or other hardware with wireless capabilities. While one individual reported working at a “laptop university” in which campuswide wireless networking exists and all students are required to own laptops, not all college students will have that luxury. In order to provide more equal access to students, checking out laptops has become an increasingly common service in academic

libraries. Seventy percent of this survey’s respondents whose institutions offered wireless access also made laptops available for checkout.

Comments made throughout the survey seemed to imply that while checking out laptops to patrons is an invaluable complement to offering wireless access, librarians should be prepared for a myriad of hassles that accompany laptop checkout. Wear and tear of laptops, massive battery use, cost of laptops, and maintenance were some of the biggest problems reported. One participant, whose institution decided to stop offering laptops for checkout to patrons in the library, wrote, “It required too much staff time to maintain and we decided the money was better spent elsewhere. The college now encourages students to purchase a laptop [instead of] a full-sized PC.” One participant worried that the rising use of laptops in his library would lead to the obsolescence of its more than one hundred wired desktops, writing, “Our desktops are very popular and we think having them is one of the reasons our gate count has increased in recent years. What happens when everyone has a laptop?”

The number of laptops checked out in the libraries varied. The majority of libraries had purchased between one and thirty laptops available for checkout (see table 3). Three institutions had more than forty-one laptops available for checkout. One library could boast that it had sixty laptops available for checkout with twelve pagers to notify students waiting in line to use laptops. When asked about the use of laptops in libraries, 46 percent

observed moderate use, while 32 percent reported heavy use of laptops. Only 3 percent indicated that they hardly ever noticed use of laptops in the library. For those students who chose to bring their own laptop to access the library's wireless network, half of the institutions surveyed required students to purchase their own network-interface cards for their laptops, while 19 percent allowed students to check them out from the library.

In addition to laptops, personal digital assistants, (PDAs) were listed by 37 percent of respondents as devices that may access wireless networks. One librarian indicated that cell phones could access the wireless network in his library. Fifty-six percent of respondents indicated that users are able to print to a central printer in the library from their wireless device.

An important consideration for implementing a wireless network is how users will authenticate. Authentication protocol is defined by the *Microsoft Encyclopedia of Networking* as "any protocol used for validating the identity of a user to determine whether to grant the user access to resources over a network."¹³ Authentication methods listed by the institutions surveyed varied greatly and the authors could not identify all of them. Methods mentioned were Lightweight Directory Access Protocol (LDAP), virtual private network (VPN), and Media Access Control (MAC) addresses, Bluesocket, Remote Authentication Dial in User Service (RADIUS), pluggable Graphical Identification and Authentication (pGINA), Protected Extensive Authentication Protocol (PEAP), and e-mail logins. Out of the thirty-nine responses to this question, seven individuals indicated that they do not require any type of authentication at the present. Although some individuals noted that they are planning to enable some type of authentication in the future, one participant suggested that there were ethical issues involved in requiring users to authenticate. This person argued that "anonymous access to information is

Table 2. Total Length of Time Taken to Completely Configure and Install the Wireless Network

Time to Install and Configure Wireless Network	Total Number of Responses	Percent of Responses out of Total Number
Less than one month	12	28
One to two months	11	26
More than two months to four months	10	23
More than four months to six months	4	9
More than six months to one year	5	12
More than one year	1	2

Table 3. Total Number of Laptops Available for Checkout in the Library

Total Laptops Available for Checkout	Total Number of Responses	Percent of Responses out of Total Number
One to five	8	26
Six to ten	5	16
Eleven to fifteen	1	3
Sixteen to twenty	5	16
Twenty-one to thirty	8	26
Thirty-one to forty	1	3
More than forty	3	10

valued" and praised his institution's current policy of allowing "anyone who can find the network" to use it.

A concern about offering wireless network access in the library is how library staff will be prepared to handle the flood of technical questions that are likely to ensue. The level of technical support offered to users varied among the institutions surveyed. More than half of the respondents indicated that users receive help specifically from IT staff or from the campus computer center. Thirty-nine percent of users received help from the reference desk, while 19 percent received help from circulation staff. Thirty-three percent of the responding institutions offered technical help from a Web site, while 7 percent indicated that they did not offer any type of technical support to users.

Technical Problems

The technical problems most often encountered with wireless networks centered on architectural barriers that cause black-outs or slow-spots where wireless access fails. This confirms the importance of carrying out thorough site sur-

veys and testing prior to installation of access points. Site surveys may be carried out by companies specially equipped and trained to determine where access points should be installed, the most appropriate type of antennae (directional or omnidirectional), and how many access points are needed to provide the greatest amount of coverage. Configuration of the network was the second most highly reported problem associated with installing wireless networks, seeming to suggest the need for librarians to coordinate their efforts and rely on the knowledge provided by the IT coordinator (or similar type of personnel) within their institution. Lack of technical support available to users, slow speed, and authentication were also indicated as technical problems most encountered (see table 4). Integrating the wireless network with the existing wired network was the least-mentioned problem associated with wireless networks.

Although security problems, particularly concerning Wired Equivalency Protocol (WEP) vulnerabilities, have been pointed out as one of the major drawbacks of a wireless network, the majority of users had not as yet experienced security problems. Although one participant wrote, "Don't be too casual about the security risks," another individual wrote, "Talk to your networking department," as many of them are overly worried about security.

Perceived Benefits

Respondents reported that the number-one benefit of offering wireless access was user satisfaction. Giving patrons the ability to use their laptops anywhere in the library and do multiple tasks from one machine is simply becoming what more and more users expect. The second-largest benefit revolved around flexibility and ease of use due to the lack of wires. Thirty-five percent indicated that allowing students to roam the stacks while accessing the network was a significant benefit. Although a few studies have suggested the promise of wireless networks for aiding bibliographic instruction, only 9 percent of respondents indicated this as a benefit of wireless technology.

Table 4. Technical Problems Encountered

Problems Encountered	Total Number of Responses	Percent of Responses out of Total Number
Architectural barriers	15	28
Configuration problems	12	22
Not enough technical help available to users when needed	10	19
Slow speed	10	19
Authentication problems	10	19
Blackouts	6	11
Problems installing drivers	6	11
Security problems	6	11
Difficulty signing on	6	11
Problems with operating systems	5	9
Other	3	6
Problems integrating the wireless network with an existing wired network	2	4

Use of wireless technology for instruction, it might be recalled, was not a significant factor noted by respondents in the decision to implement a wireless network. Likewise, use of this type of network to carry out technical services (such as inventory) was also low on the scale of benefits. Seventy-three percent of users claimed that wireless networks have thus far been worth the cost-benefit ratio. While 70 percent indicated moderate to heavy use of the wireless network, 27 percent reported low usage.

When asked what advice they would give to others considering adopting wireless networks in their libraries, the overwhelming majority of responses were positive, recommending that HCL take the plunge. As one individual wrote, "Offer it and they will come. It has really increased the usage of our library." Other individuals noted that it is simply necessary to offer wireless access to keep up with technological innovation, and that students expect it. The most significant warning, however, revolved around checkout and maintenance of laptops, which, from the results of this survey, seems to be both a big advantage and a headache. Several individuals echoed the importance of doing site surveys to test bandwidth limitations and access. One particularly energized participant, using multiple exclamations for emphasis, shared a plethora of advice. "Throttle connection speeds! Allow only http access! Block ports and unnecessary protocols! Secure your network and disallow unauthenticated users! Use access control lists! Establish policies that describe

[wireless fidelity] Wi-Fi risks and liabilities on your part!" Useful advice on wireless-access implementation gleaned from this survey fell under the following categories:

- Be aware of slower speed
- Create a policy and guide for users
- Do it because more users are going wireless, it is necessary to keep up with technological innovation, and because students love it
- Provide plenty of access points
- Install access points in appropriate places
- Ensure continuous connectivity by allowing overlap between access points
- Purchase battery chargers and heavy-duty laptops with extended warranties
- Get support from IT staff for planning and maintenance
- Offering wireless will increase library usage
- Perform or have an expert perform a careful site survey and do lots of testing to locate dead or slow spots in the library due to architectural barriers
- Enable some type of authorization
- Be aware of security concerns
- Although the majority of participants' networks (70 percent) support 802.11b (which allows for throughput up to 11 megabits per second), a few participants suggest using the 802.11g standard (up to 54 megabits per second) because it is "the fastest" and "backwards compatible to 802.11b"

Conclusion

Though it is a relatively new technology, this study found that a surprisingly large number of medium-sized academic libraries are already offering wireless access. Not only are they offering wireless access, but they are also providing patrons with laptops for checkout in the library. Although actual use of the network by patrons was not determined through survey responses (as individuals were only asked about their observations of network use), the comments and answers were overwhelmingly positive and enthusiastic about this new technology. Problems that have been encountered with wireless networks largely revolve around configuration, slow speed, and laptop checkout. Although much of the literature focuses on security issues that accompany wireless networking, few individuals reported problems with security.

College and university students, like the rest of society, are becoming increasingly mobile. More often, they want access to library networks and the Internet wher-

ever they happen to be studying or working on group projects, not merely in computer labs or designated study areas. The majority of the libraries in this study are accommodating these students' needs by offering wireless access. According to Breeding, wireless networking is a rapidly growing niche in the networking world, and mobile computer users will become a larger and larger part of any library's clientele.¹⁴ To encourage patrons to continue visiting them, academic libraries, large and small, should attempt to meet the demand for wireless access if at all possible.

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Appendix. Survey: Implementation of Wireless Networks

1. Has a wireless network been implemented in your library?
 Yes
 No
2. If your library has not adopted wireless networking, are you currently planning or seriously considering it for the near future?
 Yes (Please skip to question 4)
 No (Please fill out questions 2 and 3 only)
3. What are your primary concerns about implementing a wireless network? Check all that apply.
 The technology is still new
 Unsure of its benefits
 No need for one
 Questions regarding security
 Cost
 Would not be able to provide technical support that might be needed
 Funds must primarily support other types of technology at the moment
 Have not noticed many users with laptops in the library
 Slow speed of wireless networks
 Other
4. How long has a wireless network been implemented in your library?
 Fewer than 6 months
 6 months to 1 year
 More than 1 to 2 years
 More than 2 to 3 years
 More than 3 years
5. What were the main reasons for implementing a wireless network? Check all that apply.
 Provide greater access to users
 Campuswide initiative
 Offer network access outside the library building
 Provide greater online access due to shortage of computers per user in the library
 Flexibility (no wires, ease in setting up)
 Requests expressed by users
 Low cost
 To keep up with or provide technological innovation
 To carry out technical services (such as inventory)
 Aid in bibliographic instruction
 For use by library faculty and staff
 Other
6. Please describe the coverage of your network. Check all that apply.
 Campuswide
 Library building and limited range outside the library building
 Inside the library (all areas)
 Select areas within the library
7. What areas of the library are most popularly used for access to the wireless network? Check all that apply.
 Reference and computer media center areas
 In the stacks
 Librarians and staff offices
 Carrels, tables, reading or study rooms
 Area outside the library building
8. Please list standards your wireless network supports. Check all that apply.
 802.11b
 802.11a
 802.11g
 Bluetooth
 Other

Planning and Installation

1. Was a committee established to plan the implementation and service of the wireless network?
 Yes
 No
2. How long did it take to plan for implementation of the wireless network?
 Fewer than 6 months
 6 months to 1 year
 More than 1 to 2 years
 More than 2 years
3. How long did it take to install and configure the network?
 Less than a month
 1 to 2 months
 More than 2 to 4 months
 More than 4 to 6 months
 More than 6 months to 1 year
 More than 1 year
4. Who performed the site survey? Check all that apply.
 An outside company or contractor

- Institution's own information technology coordinator or computer staff
- Library staff with technical expertise
- No site survey was conducted

5. If the site surveyor was an outside company or contractor, please list their company name and whether you would recommend them.

User Services

1. How are users authenticated?

2. Does the library check out laptops to users (for either wired or wireless use)?
 Yes
 No
3. If laptops are available for checkout, do they have wireless capability?
 Yes
 No
4. How many laptops do you have for checkout?
 One to five
 Six to ten
 Eleven to fifteen
 Sixteen to twenty
 Twenty-one to thirty
 Thirty-one to forty
 More than forty
5. How would you describe use of laptops in your library on the average day?
 Heavy—very noticeable use of laptops
 Moderate use of laptops
 Low use of laptops
 Not sure
 Hardly even notice laptops are used
6. How do users obtain wireless cards for the network? Check all that apply.
 Check out from library
 Purchase from library
 Purchase from the campus computer center
 Must purchase on their own
7. If the library checks out wireless cards, how many were purchased for checkout?
 One to five
 Six to ten
 Eleven to fifteen

- Sixteen to twenty
- Twenty-one to twenty-five
- Twenty-six to thirty
- More than thirty

8. What type of technical support does the library provide to users? Check all that apply.

- Help from reference or help desk
- Help from the information technology staff or campus computer center
- Circulation staff
- Other library staff
- From a Web site
- No technical help is provided to users

9. Has the library created a policy for the use of wireless networks?

- Yes
- No

10. Are users able to print from the wireless network in the library?

- Yes
- No

11. Which of the following may access the wireless network? Check all that apply.

- Laptops
- Desktop computers
- PDAs
- Cell phones
- Other

Technical Problems

1. What technical problems have you or your users encountered? Check all that apply.

- Blackouts
- Architectural barriers
- Slow speed
- Problems integrating the wireless network with an existing wired network
- Configuration problems
- Security problems
- Authentication problems
- Problems with operating systems
- Difficulty signing on
- Not enough technical help available to users when needed
- Problems installing drivers
- Other

2. Have you experienced security problems with the network? Check all that apply.

- Have not experienced any security problems

-
- Problems with unauthorized people accessing the Internet through the wireless network
 - Problems with restricted parts of the network being accessed by unauthorized users
 - Other

3. How were security problems resolved?

Benefits of Use of Network

1. What have been the biggest benefits of wireless technology? Check all that apply.
 - User satisfaction
 - Increased access to the Internet and online sources
 - Flexibility and ease due to lack of wires
 - Has improved technical services (use for library functions)
 - Has aided in bibliographic instruction

- Provides access beyond the library building
- Allows students to roam the stacks while accessing the network
- Other

2. How would you describe current usage of the network?

- Heavy
- Moderate
- Low

3. In your opinion, has this technology been worth the benefit-cost ratio thus far?

- Yes
- No
- Not sure

4. What advice would you give to librarians considering this technology?

(Editorial continued from page 3)

design and implementation of complex systems to serve our users. Writing about that should not be solitary either.

I hope to publish think-pieces from leaders in our field.

I hope to publish more articles on the management of information technologies.

I hope to increase the number of manuscripts that provide retrospectives. Libraries have always been users of information technologies, often early adopters of leading-edge technologies that later become commonplace. We should, upon occasion, remember and reflect upon our development as an information-technology profession.

I hope to work with the editorial board, the LITA Publications Committee, and the LITA board to find a way, and soon, to facilitate the electronic publication of articles without endangering—but in fact enhancing—the absolutely essential financial contribution that the journal provides to the association.

In short, I want to make *ITAL* a destination journal of excellence for both readers and authors, and in doing so reaffirm the importance of LITA as a professional division of ALA.

To accomplish my goals, I need more than an excellent editorial board, more than first-class referees to provide quality control, and more than the support of the LITA officers. I need all LITA members to be prospective authors, prospective referees, and prospective literary agents acting on behalf of our profession to continue the almost forty-year tradition begun by Fred Kilgour and his colleagues, who were our predecessors in volume 1, number 1, March 1966, of our journal.

Reference

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