Students' Perceptions of Laboratory Science Careers: Changing Ideas with an Education Module

DANIEL HAUN, ARGIE LEACH, LOUANN LAWRENCE, PATSY JARREAU

OBJECTIVE: To assess the effectiveness of a Web-based education module in changing students' perceptions of laboratory science careers.

DESIGN: Perception was measured with a short examination and then a Web-based exercise was presented. Following the exercise, the test was administered again. Frequency data from the pre-test and post-test were compared for changes in perception. The correlated pre-test/post-test pairs were also examined for opinion changes and these were analyzed for significance.

SETTING: Large parochial high schools in New Orleans, Louisiana. A small team visited the schools during their appointed class times for biology.

PARTICIPANTS: Study participants were high school biology students in grades 9–10. Two-hundred-forty-five students participated (149 male and 96 female).

INTERVENTIONS: A Web-based exercise on blood film examination was presented to the students in a classroom setting (www.mclno.org/labpartners/index_03.htm). The exercise contained focused messages about: 1) the numbers of healthcare workers acquiring AIDS from on-the-job exposure and 2) common career paths available to the laboratory science workforce.

MAIN OUTCOME MEASURES: The shift in perception of:

- what medical service generates the most diagnostic data
- which professional group performs laboratory tests
- the risk of acquiring AIDS while working in the healthcare setting
- interest in a science-related career
- how much education is required to work in a science-related field

RESULTS: The intervention significantly shifted perception in all areas measured except that of interest in a science-related career.

CONCLUSIONS: Many students perceive that the risk of acquiring AIDS while working in the healthcare setting is "high". Web-based presentations and similar partnerships with science teachers can change perceptions that might lead to increased interest in clinical laboratory science careers.

ABBREVIATIONS: CCCLW = Coordinating Council on the Clinical Laboratory Workforce; CLS = clinical laboratory scientist; CLT = clinical laboratory technician.

INDEX TERMS: community outreach; community-institutional relations; career choice education; Internet education.

Clin Lab Sci 2005;18(4):226

Daniel Haun MT(ASCP)H *is Director of Client Services, Pathology Department, Medical Center of Louisiana at New Orleans LA.*

Argie P Leach MHS MT(ASCP) SH *is Competency and Safety Coordinator, Pathology Department, Medical Center of Louisiana at New Orleans LA.*

Louann W Lawrence DrPH CLS(NCA) *is Professor and Department Head, Department of Clinical Laboratory Sciences, LSU Health Sciences Center, New Orleans LA.*

Patsy Jarreau MHS CLS(NCA) *is Associate Professor, Department of Clinical Laboratory Sciences, LSU Health Sciences Center, New Orleans LA.*

Address for correspondence: *Daniel E Haun, Pathology Department, Medical Center of Louisiana, 1532 Tulane Ave, New Orleans LA 70112. (504) 903-7528, (504) 903-5634 (fax). dhaun@lsuhsc.edu*

Recruitment of qualified applicants is a high priority for clinical laboratory science (CLS) and clinical laboratory technician (CLT) educational programs in Louisiana and in most areas of the nation. Currently there is a national shortage of qualified laboratory personnel as evidenced by a current national vacancy rate of 7.0% for CLSs and 8.6% for CLTs.[1] Based on demographic information from the ASCP member database, more than 72% of the current laboratory workforce is older than 40 years of age.[1] It is predicted that attrition in the profession due to retirement will decrease the workforce dramatically during the next 10 to 20 years. The demand for certified CLSs

and CLTs will continue to increase as the nation ages and the proportion of elderly needing healthcare continues to increase.[2] The number of CLS programs in the nation has decreased 62% during the last 19 years.[3] The increasing demand and decreasing supply of qualified laboratorians make recruitment a problem that requires intensive effort.[4]

One of the reasons for lack of qualified applicants is lack of knowledge of the profession as a possible career path. It is often said that CLS is the "hidden profession". The Coordinating Council on the Clinical Laboratory Workforce (CCCLW) is comprised of representatives from various laboratory professional organizations, industry groups, and government agencies. It was established to develop a strategic plan to address the shortage of clinical laboratory personnel. One of the objectives of the CCCLW is to increase the awareness of the profession as a career choice by designing projects to facilitate a relationship with K–12 school systems, high school guidance counselors, and science teachers.[5]

In 2000 and 2001, two summit meetings of the CCCLW were held. In Summit I (June 2000), four breakout groups identified the "components of the problem". All four groups cited image and public recognition as components and three of four groups cited "danger" as a component of the problem, using the words "danger", "dangerous", and "dangerous working conditions" as component descriptors.[6] The report for Summit II cites the "risk of infectious disease" as one of the seemingly recognized reasons for instability in the clinical laboratory labor pool supply.[7]

The project described in this paper was designed to reveal the profession to prospective students by providing resources, lesson plans, and support from local laboratorians for middle school and high school science teachers. By giving teachers a resource that is easily accessible and providing an incentive for use in their classrooms, more students will be introduced to CLSs/CLTs earlier in their education. Many middle school and high school students who think they may be interested in a health career only know about doctors and nurses. This Web-based approach was also designed to dispel the myths that it is dangerous to work in a laboratory and that one must have many years of education to have a meaningful career in science and medicine. The Web-based nature of this resource makes it instantly available to science teachers and CLS/CLT educational programs nationwide.

PURPOSE

The purpose of the study is to assess the effectiveness of a Web-based education module in changing the students' perceptions. A pre-test and post-test were used to measure perception and to assess ideas for changing the perceptions of high school students about CLS careers. The tests sought to measure the student's awareness of the laboratory workforce, the perceived danger of contracting HIV while working in the healthcare setting, and general interest in and knowledge of science-based careers.

METHOD

A team of two technologists visited biology classrooms with a computer-based exercise on blood film examination. The entire exercise was conducted during the normal class period in a 50-minute time frame. A pre-test was administered consisting of six multiple-choice questions and four statements with Likert scales to assess perception. The exercise was then conducted and a post-test was administered. The post-test frequency data was then compared to the pre-test frequency data to assess the effectiveness of the interventions. The correlated (paired pre- and post-test) data were also examined to quantitate number of students who changed their perceptions following the intervention.

TEST DESIGN

The pre-test and post-test were identical in content and began with five multiple-choice questions covering the topical substance of the exercise. These five questions were not graded for the purpose of the study but were included to enhance the interest and participation of the students. To measure the perception of image and public recognition, we designed one multiple-choice question and one Likert scale item (Figure 1, numbers 6 and 7). To measure the perception that healthcare careers were dangerous, we used a Likert scale item on the probability of acquiring HIV/AIDS (Figure 1, number 8). We chose this because preliminary interviews with students indicated that HIV could be a feared consequence of working in healthcare. One Likert scale item asked about interests in science-related careers (number 9) and finally one Likert scale item addressed the availability of science-related careers without an advanced degree (number 10).

SAMPLE

Teams presented the intervention to eleven general biology classes at large parochial high schools, grades 9 and 10. A total of 245 students were surveyed (149 males and 96 females). The schools were chosen because of high teacher interest, which facilitated scheduling.

MATERIALS

The intervention consisted of a Web-based module that was delivered locally from a notebook computer and projected

to the class using a liquid crystal display projector.[8] The module contains many elements and teacher resources, e.g., image galleries and science project ideas, but only four elements (listed below) were presented to the class.

1. An overview presentation of the complete blood count and WBC differential – 10 minutes.
2. A short presentation on the risk of acquiring HIV in the healthcare setting – 2 minutes.
3. A short presentation on the career path for CLSs and CLTs – 2 minutes.
4. A blood film examination exercise that simulated a twenty-five cell differential on two patients – 35 minutes.

PROCEDURE

The team was introduced by name and university affiliation to the class by the teacher, and the team immediately distributed the pre-test. After approximately five minutes, the pre-tests were collected. One team member began the presentation with the introduction to the CBC and blood film examination. Next, the presenter initiated the blood film exercise on the first 'patient'. As the exercise was started, it was interrupted with a short 'commercial' explaining the risk of acquiring HIV while working in the healthcare setting (Figure 2). The exercise required students to identify common white blood cells, calculate percentages, and evaluate the results by comparison with reference ranges. Finally, the students were to determine the likely diagnosis from the numerical data using information presented in the introduction.

Then the presenter started the second 'patient' presentation that contained a second 'commercial' on the career paths for laboratory science (Figure 3). Career paths for technologist and technician were discussed along with salary expectations. 'Patient two' was then evaluated in the same manner as patient one. The class worked as a team with members calling out cell types and the presenters settling disputes by using the embedded help screens.

Figure 1. Student assessment - blood film examination exercise.

Pretest

6. Which statement best fits your idea of how medical diagnoses are made___
a. Most diagnostic data is generated by the doctors.
b. Most diagnostic data is generated by nurses.
c. Most diagnostic data is generated by the radiology (XRAY) department.
d. Most diagnostic data is generated by the lab.

For the statements below, circle the choice that best-fits your opinion.

7. Most blood tests are performed by doctors and nurses

Strongly agree	agree	No opinion	disagree	Strongly Disagree

8. I would rate the danger of catching AIDS in a health care career as extremely low.

Strongly agree	agree	No opinion	disagree	Strongly Disagree

9. I am very interested in a science-related career.

Strongly agree	agree	No opinion	disagree	Strongly Disagree

10. Most science careers require an advanced doctorate degree (for instance PhD. or M.D.)

Strongly agree	agree	No opinion	disagree	Strongly Disagree

RESULTS

Data are presented and discussed in two sets:

1. Frequencies of all responses expressed in percent: the pretest frequency data is presented in Table 1 and post-test frequency data is presented in Table 2. Only questions with answers were tallied for the frequency data and the number tallied varies by question.
2. Correlated data, expressed in number of students: individual pre and post responses are compared and evaluated using the McNemar test for correlated samples to assess the significance of the change in opinion.[9] These results are displayed in Table 3. Students who answered in one test but not in the other test were not included in the McNemar test. For the correlated data, values of $p < 0.05$ are considered to be significant.

Responses to specific items

Most diagnostic data is generated by the laboratory.

The frequency analysis showed that in the pre-test, 65% of students rec-

ognized that the laboratory generated the majority of diagnostic data and this increased to 90% in the post-test. The correlated data analysis showed that seventy students changed their perception toward the laboratory and only three changed in favor of other disciplines, which is a significant change. For the correlated analysis, eleven students did not answer the question, either in the pre-test or post-test and were excluded.

Most blood tests are performed by doctors and nurses.

The frequency analysis showed that initially 71% of students indicated that blood tests are performed by doctors and nurses but after the exercise this dropped to 33%. In the correlated analysis, 117 students changed their mind toward the laboratory position and only 11 changed toward the doctors and nurses, which is a significant change. For the correlated analysis, one student did not answer the question in the pre-test and was excluded.

I would rate the danger of catching AIDS in a healthcare career as extremely low.

Frequency analysis indicated that, before the exercise, only 29% agreed that the chance of catching AIDS in a healthcare career was 'extremely low' but after the exercise, this perception increased to 77%. The correlated analysis showed that 137 students changed their minds from 'disagree', while only 17 changed from 'agree', which is a significant change.

I am very interested in a science-related career.

Frequency analysis showed that, in the pre-test 57% of students indicated a high interest in a science-related career and this increased slightly to 60% post-intervention. The correlated data showed that 34 changed their mind from the 'disagree' position while 21 changed from the 'agree' opinion and this change is insignificant.

Most science careers require an advanced doctorate degree, e.g., PhD or MD.

Frequency data reveal that 72% agreed before the exercise; this decreased to 55% after the session. Most students in the post-test still thought that an advanced degree was necessary. The correlated analysis showed that 78 students changed their mind from the 'agree' position while only 22 changed from the 'disagree' position, which is significant.

Figure 2.

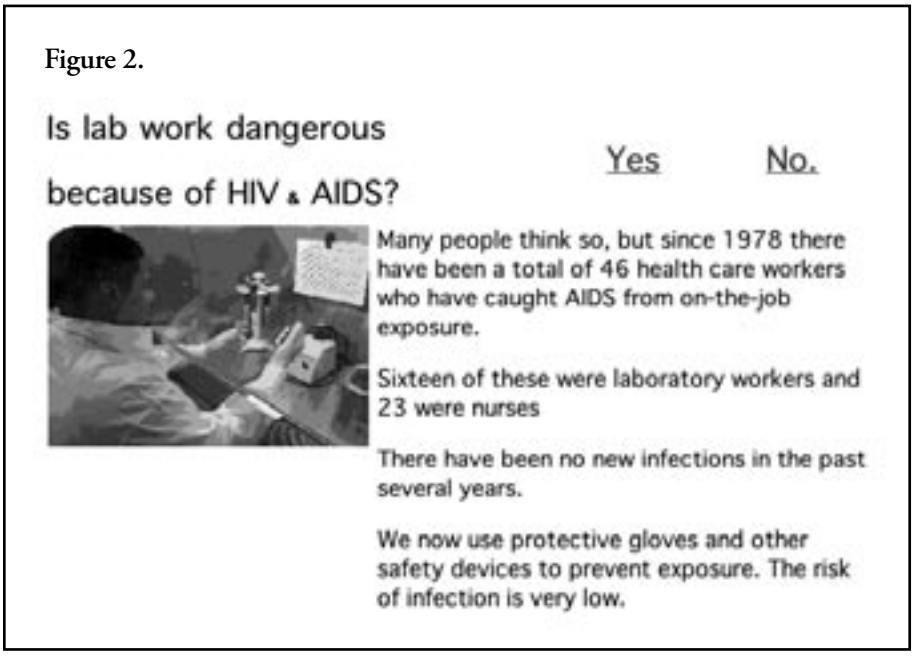

Figure 3.

DISCUSSION

The data suggest that while most students understand that the laboratory provides diagnostic data, they mostly perceive that laboratory tests are performed by doctors and nurses. The data further suggest that the intervention

Table 1. Pretest frequency data for all students in percentage of responses to each available choice

		Doctors	Nurses	Radiology	Laboratory	N*
Most diagnostic data is generated by the		17.5%	6.3%	9.6%	66.7%	240
	Strongly agree	**Agree**	**No opinion**	**Disagree**	**Strongly disagree**	
Most blood tests are performed by doctors and nurses	20.6%	52.3%	8.2%	16.5%	2.5%	243
I would rate the danger of catching AIDS in a healthcare career as extremely low	7.0%	21.9%	19.8%	38.4%	12.8%	242
I am very interested in a science-related career	21.2%	36.9%	22.0%	13.3%	6.6%	241
Most science careers require an advanced doctorate degree, e.g., PhD or MD	20.7%	53.5%	13.3%	10.8%	1.7%	241

* N varies by question because some students did not answer all questions

Table 2. Post-test frequency data for all students in percentage of responses to each available choice

		Doctors	Nurses	Radiology	Laboratory	N*
Most diagnostic data is generated by the		1.7%	2.9%	2.9%	92.5%	239
	Strongly agree	**Agree**	**No opinion**	**Disagree**	**Strongly disagree**	
Most blood tests are performed by doctors and nurses	10.2%	22.9%	7.3%	35.5%	24.1%	245
I would rate the danger of catching AIDS in a healthcare career as extremely low	42.9%	34.3%	7.3%	9.4%	6.1%	245
I am very interested in a science-related career	22.0%	38.4%	24.1%	9.8%	5.7%	245
Most science careers require an advanced doctorate degree, e.g., PhD or MD	13.1%	42.2%	13.9%	27.5%	3.3%	244

* N varies by question because some students did not answer all questions

both increased the awareness of the clinical laboratory and largely recalibrated the myth that doctors and nurses perform the 'blood tests'.

In the pre-test, a majority of students disagreed with the statement that the risk of catching AIDS in a healthcare career was 'extremely low'. This suggests that the perceived dangers of contracting an infectious disease could be a significant deterrent to choosing a career in healthcare. The short 'commercial' which simply presented the data on occupationally acquired AIDS cases was highly effective in changing this perception. The data suggest that all healthcare career information should contain the facts on workplace safety.

The exercise seemingly did not increase interest in science-related careers. This increase was hoped for and predicted by teachers on the module design team. The reasoning was that the exercise would demonstrate a practical science-based occupation, where one could practice without an advanced degree. The exercise did change ideas about the necessity of an advanced degree, which might increase interest in the field. However, a majority of students continued to believe that an advanced degree was necessary for a science-based career.

CONCLUSION

The two CCCLW meetings on the shortage of clinical laboratory personnel identified many important components of the problem and the workgroups offered an array of opportunities to intervene. Among the opportunities suggested was a Web-based education module for K–12 educators to improve the image and awareness of the profession. This study demonstrates that such a module could be effective in increasing awareness in high school students and in recalibrating false perceptions and fears that might discourage potential candidates. The study is limited because the module was not delivered via the Internet but was done in a live presentation to facilitate data collection. There is little doubt that the presenters added interest and emphasis that is otherwise absent when a student visits a Web page. However, as this Web-based exercise is available to laboratorians and educators alike, we offer that a grass-roots effort based on local partnerships (laboratorians working with science teachers) may significantly increase the number of students interested in laboratory careers.

The effect of the laboratorian/teachers partnership was not measured by this study but both groups reported a high level of satisfaction with the experience. Ideas for future collaborations are being discussed and a new project to help teachers obtain low cost digital microscopes has already been initiated.[10] Others seeking to mimic this study could take advantage of an updated and expanded version of the Website at http://www.mclno.org/labpartners/index.htm.

Table 3. Correlated test data for individual changes in opinion

	Changed opinion in favor of statement	Changed opinion against statement	N	Did not answer*	*p*
Most diagnostic data is generated by the lab	70	3	234	11	<0.0001
Most blood test are performed by doctors and nurses	11	117	244	1	<0.0001
I would rate the danger of catching AIDS in a healthcare career as extremely low	137	17	245	0	<0.0001
I am very interested in a science-related career	34	21	245	0	0.1056
Most science careers require an advanced doctorate degree, e.g., PhD or MD.	22	78	245	0	<0.0001

* Answered in one test but not in the other. Those who did not answer in both tests were counted as not changing answer (opinion).

This study was supported in part by a grant from the ASCLS Education and Research Foundation.

REFERENCES

1. Ward-Cook K, Chapman S, Tannar S. 2002 Wage and vacancy survey of medical laboratories. Lab Med 2003;34(10):702-7.
2. U.S. Department of Labor, Bureau of Labor Statistics. Occupational Outlook Handbook. 2002–03 Ed. http://www.bls.gov. Accessed May 10, 2003.
3. National Accrediting Agency for Clinical Laboratory Sciences (NAACLS); Chicago: Annual Report 2002.
4. Ward-Cook K, Daniels MG, Gueroguieva J. ASCP Board of Registry's 2001 Annual Survey of Medical Laboratory Science Programs. Lab Med 2002;33(11):831-6.
5. Coordinating Council on the Clinical Laboratory Workforce, The U.S. clinical laboratory workforce: strategic plan. ASCP; Chicago: July 1, 2002.
6. Summit on the Shortage of Clinical Laboratory Personnel, Summit I. http://www.ascls.org/ssclp/ssclp1_4.asp. Accessed 6/3/2004.
7. Summit on the Shortage of Clinical Laboratory Personnel, Summit II. http://www.ascls.org/ssclp/ssclp2.asp. Accessed 6/3/2004.
8. Your hospital laboratory. http://www.mclno.org/labpartners/index_03.htm. Accessed 7/18/04.
9. Portney LG, Watkins MP. Foundations of clinical research, applications to practice. McGraw Hill Appleton and Lange; Columbus OH: 1993. p 498-9.
10. Build your own digital microscope. www.mclno.org/labpartners/microscope/index.htm. Accessed July 25, 2005.