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A Usability Study of Users' Perceptions Toward a Multimedia Computer-Assisted Learning Tool for Neuroanatomy

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Abstract

This usability study evaluated users' perceptions of a multimedia prototype for a new e-learning tool: Anatomy of the Central Nervous System: A Multimedia Course. Usability testing is a collection of formative evaluation methods that inform the developmental design of e-learning tools to maximize user acceptance, satisfaction, and adoption. Sixty-two study participants piloted the prototype and completed a usability questionnaire designed to measure two usability properties: program need and program applicability. Statistical analyses were used to test the hypothesis that the multimedia prototype was well designed and highly usable, it was perceived as: 1) highly needed across a spectrum of educational contexts, 2) highly applicable in supporting the pedagogical processes of teaching and learning neuroanatomy, and 3) was highly usable by all types of users. Three independent variables represented user differences: level of expertise (faculty vs. student), age, and gender. Analysis of the results supports the research hypotheses that the prototype was designed well for different types of users in various educational contexts and for supporting the pedagogy of neuroanatomy. In addition, the results suggest that the multimedia program will be most useful as a neuroanatomy review tool for health-professions students preparing for licensing or board exams. This study demonstrates the importance of integrating quality properties of usability with principles of human learning during the instructional design process for multimedia products.

Keywords

usability study; neuroanatomy; e-learning; multimedia; computer assisted instruction

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INTRODUCTION

Computer-assisted instruction (CAI) is being used with increasing frequency by anatomy educators to supplement traditional classroom instruction (e.g. McNulty, et al., 2000; Foreman, et al., 2005; McNulty, et al., 2006). This increase is due to improved technologies and rising instructional needs, induced by changes in student characteristics, challenges facing instructors, and diminishing local resources and expertise. Contemporary students are becoming increasingly technology dependent and burdened by non-academic responsibilities and time commitments (Reidenberg and Laitman, 2002). Anatomy instructors are challenged by having to teach more clinically-relevant content using more active and learner-centered teaching methods (Terrell, 2006) while concomitantly facing a reduction in the curricular hours anatomy is taught in the basic sciences (Drake et al., 2002). Also, anatomy instruction is strained by a reduction in local resources and expertise as budgets are cut and well-experienced anatomists retire, resulting in a shortage of qualified anatomy faculty (McCuskey et al., 2005; Granger et al., 2006). Together, these instructional challenges create a strong need for an effective teaching and learning tool to enhance the traditional anatomy classroom experience.

The advent of multimedia CAI offers anatomy educators a means for addressing these instructional problems. Multimedia CAI is an integrated form of CAI that combines two or more components into an electronic learning environment, including text, audio narration, photographic images, graphics, video, animation, and 3-D visualization. This combined format makes information management faster, more efficient, more extensive, and in some cases, may enable activities that could not be performed any other way (Berner and Boulware, 1996; Gorman et al., 2000; Trelease and Rosset, 2008).

Numerous studies have analyzed the efficacy of multimedia CAI to health-sciences education by comparing differences in student performance between multimedia-based learning and traditional education methods. Although results vary, test performances with CAI were equal or superior to those obtained with traditional methods including lectures or textbooks (Mayer and Anderson 1992; Bachman et al. 1998; Lynch et al., 2001; Shomaker et al., 2002; Fleming et al., 2003; Seabra et al., 2004; Thatcher, 2006). Learning efficiency with CAI increased significantly, indicated from a reduction in study time by up to 70% (Kulik 1994; Jewitt 1998; Shomaker et al., 2002). Students perceived multimedia CAI as an interactive, useful, and beneficial learning tool (Lilienfield and Broering, 1994; Waugh et al., 1995; Chou, 2003; Maag, 2004; Foreman et al., 2006). Also, students preferred its cost effectiveness and ease of distribution, increasing student accessibility to content expertise and clinical applications regardless of geographic location or time of day (Gorman et al., 2000; Lieberman et al., 2002; Cheng et al., 2003). These studies suggest that multimedia CAI can be an effective learning tool.

Drs. Gould and Fleming began developing an interactive 3-D multimedia learning tool for neuroanatomy: Anatomy of the Central Nervous System: A Multimedia Course, which is divided into seven systems – limbic, motor, sensory, chemical, auditory/vestibular, visual and higher association. We began developing this program because the structure of the human central nervous system (CNS) has spatial and functional relationships between cells,

tissues, organs, and systems that are difficult for many students to visualize and learn. Spatial visualization ability requires a unique group of cognitive functions and aptitudes relevant to spatial tasks that are essential for learning anatomy and for achievement in medical surgery and engineering (Wang et al., 2007).

The latest multimedia technologies were incorporated into the program. These technologies include *Quicktime Virtual Reality (QTVR) Objects*, which gives a detailed view of the external features of a structure or region with 360 degree rotation, *Hot Spots with Labeling*, which highlights anatomical regions on QTVR Objects and displays corresponding labels, and *Component Dissection*, which allows the user to 'strip' away structures to perform virtual dissection and re-assembly tasks that are unachievable in the traditional laboratory. These technologies assist the program in serving as a stand-alone programmed-learning tutorial or simulating an in-class learning experience through its interactivity with course content, built-in self-testing features, response-based feedback, and sets of lesson plans. Students can follow the lesson plans in the same way they would be led through a particular topic by an instructor. The correct pathway and associated links are highlighted, making navigation through the lesson obvious to the user. Each lesson plan contains links to the appropriate 'dissection' using the Quicktime VR described above, as well as links to the program's testing element, which contains a laboratory practical exam, a written test with feedback, and three-dimensional reconstructions.

Development efforts of the Interactive 3-D Multimedia Learning Tool in Neuroanatomy included three major activities. First, a content-analysis study was conducted to identify and select content to be included in the complete program. Second, instructional strategies and multimedia elements were matched with the selected content. The third major activity was the production and evaluation of a prototype module of one of the content areas. Dr. Gould selected the limbic system to produce as the prototype module for evaluation because our initial information gathering indicated that this system was particularly difficult to teach, would lend itself well to multimedia enhancement as it is relatively well-compartmentalized, and it contained sufficient depth and difficulty so that the multimedia elements were representative of all multimedia elements to be contained in the final program.

The purpose of this study was to evaluate users' perceptions about the usability of a multimedia prototype for learning the limbic system in neuroanatomy in order to determine whether the multimedia design is effective or deficient in its usability properties. Usability testing is an important formative evaluation technique that is based on a detailed analysis of user perceptions and is used to guide the development and design process of an e-learning product or tool (Koohang and du Plessis, 2004). Usability is the degree to which users can easily and efficiently use an e-learning product or tool to satisfy the goals and needs of learners (Koohang 2004a). User perception is defined as the process by which individuals select, organize, and recognize their sensory impressions in order to interpret and understand their learning environment (Robins, 2001) and is influenced by the use of appropriate and necessary usability properties in designing an e-learning tool (Koohang and Ondracek, 2005). When an e-learning tool is well designed, user perception contributes to higher motivation for, positive attitudes toward, and greater interest in, using the e-learning tool,

which increases the probability for user satisfaction and successful learning experiences (Koohang, 2004b; Koohang, 2004c).

EXPERIMENTAL PROCEDURES

Research Questions and Hypotheses

This study examined whether users perceived that the prototype for the Interactive 3-D Multimedia Learning Tool in Neuroanatomy was highly usable. Two categorical dependent variables were selected to represent users' perceptions about the prototype's usability: 1) program *need* - users' perceived views regarding the need for the multimedia prototype across a wide range of educational contexts and 2) program *applicability* – users' perceived views about the role of the multimedia prototype in supporting the teaching and learning of neuroanatomy (Table 1).

In addition to determining whether users perceived that the multimedia prototype was usable, this study attempted to answer the following question: Does the perception of prototype usability vary between different types of users? Three categorical independent variables were selected to represent different types of prototype users: *expertise*, *age*, *gender*. These variables were selected because they may influence factors that affect user's perceptions toward the usability of the multimedia prototype (Koohang and Ondracek, 2005). Level of expertise (faculty versus student) was selected as a variable because users with different degrees of expertise in spatial ability are likely to hold different attitudes toward multimedia learning (Huk et al., 2003). Age was selected as a variable because older students ($X > 35$ yrs old) are less likely to have experience with CAI compared to younger students ($X < 35$ yrs old) who grew up in the information-technology age (Koohang, 1989). Since prior experience with e-learning has been shown to increase user acceptance of technology in general (Koohang, 1989; Koohang and Weiss, 2003), different age levels may have different perceptions toward the usability of our prototype. Gender was selected as a variable because male users may (Ong and Lai, 2004) or may not have (Koohang and Weiss, 2003) a slightly higher preference for e-learning compared with females. Therefore, the authors of this study hypothesize that the multimedia prototype was well designed and highly usable if it is perceived as being: 1) needed across a wide range of educational contexts, 2) applicable in supporting the processes of teaching and learning neuroanatomy, and 3) usable (needed and applicable) to a similar extent by different types of users.

Study design

The design of the usability study consisted of three major components incorporated into a usability questionnaire (Appendix A), administered after using the multimedia prototype. This usability questionnaire was adapted from designs by Reeves and Harmon (1994) and the Questionnaire for User Interface Satisfaction, Version 6.0 (Chin et al., 1988). The first component of the usability questionnaire consisted of a 15-item survey instrument that measured two properties of usability: program need and program applicability (Table 1). User perception of “program need” was measured by six questions concerning the need for the prototype in various educational contexts, arranged by increasing level of complexity. Responses to these questions were recorded using a Likert-scale such that: absolutely

needed = 5, highly needed = 4, modestly needed = 3, marginally needed = 2, and not needed = 1. User perception of “program applicability” was measured by nine positively-worded statements arranged into three categories of increasing applicability (Table 1). Items 1-4 measured user perception of the prototypes’ ability to *support learning* of neuroanatomy, items 5-7 measured the perception of the prototypes’ ability to *supplement teaching* of neuroanatomy, and items 8-9 measured the perception of the prototypes’ ability to *replace* traditional instructional methods for neuroanatomy. Responses to these nine positively-worded statements measuring applicability were dummy coded such that 1 = agree and 0 = disagree.

The second component of the usability questionnaire requested users to provide written comments to specific properties of usability, including visual presentation, simplicity (ease-of-use), and content (accuracy and relevancy). The third element of the usability questionnaire requested feedback on the perceived difficulty level of twenty potential topics to be included in the complete program and the opinions as to whether a computer program using advanced multimedia techniques would help in learning and/or teaching each topic.

Study participants

The survey instrument was administered to faculty and students from a host of institutions across the country (see results; N = 62; 35 students and 27 faculty). Faculty were initially contacted by an email, distributed using the American Association of Clinical Anatomists listserv, requesting for faculty volunteers to participate in the usability study. Participant selection criteria required that faculty be currently teaching or have previously taught professional-level neuroscience courses. The faculty participants signed the consent form, reviewed the Limbic System prototype, and completed the usability questionnaire. Student participants were enrolled in graduate-level neuroscience courses in Kentucky and Florida, volunteered to participate in the usability study, signed the consent form, reviewed the Limbic System prototype, and completed the usability questionnaire. All study participants were given the rationale for their involvement in the study and were assured that their responses would remain anonymous and confidential. An IRB exemption was granted by the University of Kentucky Internal Review Board for this study.

Data Analysis

Descriptive and inferential statistical analyses were used to analyze users’ characteristics (expertise, age, gender) and perceptions about the usability (need and applicability) of the multimedia prototype. Means of user responses to item statements in the usability questionnaire were computed. T-tests were used to identify differences between each independent variable (user expertise, age, and gender) when measured against each dependent variable (need and applicability). This statistical procedure tested the null hypothesis that all types of users perceive the multimedia prototype as equally usable. The predetermined alpha $P = 0.05$ was chosen as the level of significance for this study.

RESULTS

Evaluating the usability of a prototype for the Interactive 3-D Multimedia Learning Tool in Neuroanatomy was investigated through a detailed analysis of five selected variables: two dependent variables representing prototype usability (need and applicability) and three independent variables representing different types of users that varied on levels of expertise, age, and gender.

Respondents

The total number of respondents who returned the completed questionnaire was 62; 35 were students and 27 were faculty. The faculty response rate for returning completed questionnaires was 43%. States represented in the faculty sample included: Texas, New York, Michigan, Iowa, New Mexico, Massachusetts, Louisiana, Missouri, Hawaii, Kentucky, and Pennsylvania. A large majority of the faculty participants taught in medical schools (88%, N=22); while some faculty taught in allied-health professions schools (N=3), a dental school (N=1), and a graduate program (N=1). Concerning age, nearly all faculty participants (93%, N=25), were older than age 35, with over half of these faculty (N=13) exceeding age 50; only two faculty participants were younger than age 35. Concerning gender, most of the faculty participants were male (78%, N=21). Nearly all (95%) male faculty participants taught in medical schools. Of the female faculty participants (N=6), four taught at medical schools and the remaining two taught in allied-health professions schools.

Thirty-five students enrolled in graduate-level neuroscience courses in Kentucky and Florida returned completed the usability questionnaire. Most of the student participants (80%, N=28) were enrolled in medical schools, while the remaining students were enrolled in graduate programs (N=6) or other (N=1). Concerning age, nearly all student participants (94%, N=33) were less than age 35; only two student participants were older than age 35. Concerning gender, slightly more than half of the student participants (N=20) were male, the remaining were female (N=15).

Usability Study

Results from the descriptive analyses of users' views concerning the prototype's usability are shown in Tables 2 and 3. Six items in the usability questionnaire measuring users' perceptions of the prototype's *need* for use in various educational contexts had a total mean of 3.3 and ranged between 2.7 and 3.7 on a five-point Likert scale. The highest perceived need for the prototype was for it to serve as an anatomy review tool for university health-professions students preparing for professional licensing or board exams. The lowest perceived need for the prototype was for practicing health-care professionals. No mean scores measuring user perceptions concerning the need for the prototype for any educational context investigated fell below the midpoint of the five-point Likert scale (Table 2).

Nine items in usability questionnaire measured users' perceptions of the prototype's *applicability* in supporting the processes of learning and teaching neuroanatomy (Table 3). Nearly all users (92.1%) agreed with positively-worded statements about the prototype's applicability to support student learning of and to supplement the teaching of neuroanatomy

(Table 3, items 1-7). However, less than one-third of the users perceived that the multimedia prototype had the ability to replace a neuroanatomy textbook or a neuroanatomy course (Table 3, items 8-9).

Statistical results for the independent variables of expertise, age, and gender, each measured separately against the dependent variable “program need,” are shown in Table 4. There were no statistical differences between the means of responses from users of different levels of expertise (faculty versus student) concerning their views about the program's need in most educational settings, except for the need for the program in high schools (Table 4, item1). Faculty participants perceived a higher need for the program in high schools compared to student participants. Similarly, although there were no statistical differences between the means of responses from users of different age concerning the program's need in most educational settings, users above the age of 35 years perceived a higher need for the program in high schools (Table 4, item1). There were no statistical differences between the views of male and female users regarding the need for the program in any educational setting (Table 4).

Statistical results for the independent variables of expertise, age, and gender, each measured separately against the dependent variable “applicability of the program,” are shown in Table 4. There were no statistical differences between the means of responses from users of different levels of expertise (faculty versus student) concerning their perceptions about the prototype's applicability in supporting most pedagogical processes of teaching and learning neuroanatomy, except for the perception of the prototype's ability to help students with course-content integration (Table 4, item2). All student participants responded favorably about the ability of the prototype to help students integrate course materials with other aspects of the nervous system, compared to only 88% of faculty responding favorably. Similarly, although there were no statistical differences between the means of responses from users of different age concerning their perceptions about the program's applicability in supporting most pedagogical processes of teaching and learning neuroanatomy, users below the age of 35 years responded more favorably to the ability of the program to help students integrate course materials with other aspects of the nervous system and to the ability of the program to replace a neuroanatomy textbook for learning course content (Table 4, items 2 and 8). There were no statistical differences between male and female user perceptions toward the applicability of the program in supporting any pedagogical process of teaching and learning neuroanatomy (Table 4).

DISCUSSION

The purpose of this study was to measure users' perceptions toward the usability of the multimedia prototype giving special attention to users' level of expertise, age, and gender. The main hypothesis that the multimedia prototype is usable was supported by evidence from different *types of users* who consistently viewed the prototype as being highly *needed* across a wide range of educational contexts and *applicable* in supporting various pedagogical techniques associated with the teaching and learning of neuroanatomy.

The first hypothesis that the multimedia prototype was perceived as being highly needed across a wide range of educational contexts was supported by the descriptive analyses of the usability property “program need” (Table 2). The combined Likert-scale mean of 3.3 suggests that the overall user perception of the prototype was positioned between modestly needed to highly needed. The narrow range in mean Likert-scores in Table 2 suggests that only small differences in the perceived need for prototype exists between various educational contexts in which the prototype could be used. Also, the data in Table 2 suggests that the prototype would be highly needed and most useful as an anatomy review tool for health-professions students preparing for licensing or board exams; but, modestly needed or least useful for career-established practicing health-care professionals.

The second hypothesis that the multimedia prototype was perceived as highly applicable in supporting pedagogical techniques that supplement the teaching and learning of neuroanatomy was supported by the descriptive analyses of the usability property “program applicability” (Table 3). An average of 92% of the users perceived that the prototype was applicable to question items 1-7 in Table 3, suggesting that the prototype would support student learning of neuroanatomy and would supplemental well the teaching of neuroanatomy. However, the majority of the users (69%) did not perceive that the prototype was applicable to items 8-9 in Table 3, suggesting that the prototype's current design is inadequate in its capacity as a replacement tool for a neuroanatomy textbook or for an entire neuroanatomy course. Consequently, these results suggest that prototype is designed well as an adjunct to the teaching and learning of neuroanatomy, but is deficient to supersede traditional educational methods of neuroanatomy.

The third hypothesis that the multimedia prototype was similarly perceived as usable by different types of users was supported by the statistical analysis in Table 4. Concerning the usability property program need, male and female users had similar perceptions (Table 4) about the need for the prototype to all six educational contexts described in the usability questionnaire (Table 1). Faculty and student users and younger and older users had similar perceptions about the need for the prototype to five out of six educational contexts listed in the usability questionnaire. Although the overall need for the prototype for practicing health-care professionals was relatively low (Table 2), faculty and older users tended to perceive a greater need for the prototype for practicing health-care professionals compared to perceptions of student and younger users, respectively (Table 4, item 1). This finding reflects the inherent autocorrelation between the age of the user and the level of expertise – older users tended to be faculty, both of which tended to view the prototype as more applicable to practicing health-care professionals. This increased level of perception may be related to the experience faculty have regarding the need for continuing education or the need to cognitively maintain active anatomical knowledge for their careers.

Concerning the usability property program applicability, male and female users had similar perceptions (Table 4) about the applicability of the prototype to all nine pedagogical techniques described in the usability questionnaire (Table 1). Faculty and student users and young and older users shared similar perceptions about the prototype's applicability for eight out of nine pedagogical techniques listed in the usability questionnaire, suggesting a high degree of similarity between different types of users concerning prototype applicability. The

questionnaire item that differed significantly between faculty and student users and older and younger users was the applicability of the prototype to help students integrate course materials with other aspects of the nervous system. Student users and younger users tended to perceive the prototype as more useful compared to faculty and older users, respectively. This finding reflects the inherent autocorrelation between the age of the user and the level of expertise – younger users tended to be students, both of which tended to view the prototype as more applicable to integrating course content. This increased level of perceived applicability by younger users and student users may be related to their level of cognitive understanding of neuroanatomy – faculty are experts who already possess a deep understanding of neuroanatomy, whereas students are novices who are in the earlier phases of content integration, and thus perceive that they prototype will be of great assistance with neuroanatomy content integration.

This usability study demonstrates the importance of involving the inclusion of usability properties that are based on user involvement (Koohang, 2004b; Koohang, 2004c) and are connected with principles of learning (Koohand and du Plessis, 2004; Terrell, 2006) into the multimedia CAI development and design process. Incorporation of users' experiential and perceptual feedback to inform the multimedia development process will increase the probability of creating a successful multimedia CAI tool. As college student enrollments are predicted by the U.S. Department of Education to surpass 20 million by the year 2010 (Cardenas 1998), well-designed multimedia tools will play an increasingly important role in distance learning programs of higher education (Koohang and Weiss, 2003).

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Appendix

Appendix A

Usability Questionnaire

1. You are currently a ☐ faculty member OR a ☐ student in:

☐ Medicine
☐ Dentistry
☐ Allied Health
☐ Graduate School
☐ Other: _____

2. Your age range is:	3. Your gender is:	4. Your ethnicity is:
☐ 18-24 ☐ 25-34 ☐ 35-49 ☐ 50-64 ☐ 65+	☐ Male ☐ Female	☐ African American ☐ Asian ☐ Caucasian ☐ Hispanic ☐ Native American ☐ Other

5. **Student**
 I am taking or have completed a course in Anatomy. ☐ Yes ☐ No
 I am taking or have completed a course in Neuroscience. ☐ Yes ☐ No

6. **Faculty Member**
 I am teaching or have taught a course in Anatomy. ☐ Yes ☐ No
 I am teaching or have taught a course in Neuroscience. ☐ Yes ☐ No

How would you rate the <u>need</u> for this program for:	Not Needed	Marginally Need	Modestly Needed	Greatly Needed	Absolutely Needed
7. High school students?	1	2	3	4	5
8. University students without prior knowledge of anatomy?	1	2	3	4	5
9. University students currently enrolled in an anatomy course?	1	2	3	4	5
10. Health-professions students reviewing anatomy for professional licensing / board exams?	1	2	3	4	5
11. Faculty teaching anatomy courses?	1	2	3	4	5
12. Practicing health-care professionals	1	2	3	4	5

Please rate your thoughts with the following statements:

This program would be useful to:

13. Help students learn neuroanatomy course material. ☐ Agree ☐ Disagree

14. Help students integrate neuroanatomy course material with other aspects of neuroanatomy. ☐ Agree ☐ Disagree

15. Help students improve exam performance in a neuroscience course. ☐ Agree ☐ Disagree

16. Supplement to a neuroanatomy textbook. ☐ Agree ☐ Disagree

17. Supplement to a lab. ☐ Agree ☐ Disagree

18. Supplement to a neuroanatomy course. ☐ Agree ☐ Disagree

19. Supplement the teaching of neuroanatomy over traditional methods of teaching neuroanatomy. ☐ Agree ☐ Disagree

20. Adequately replace a neuroanatomy textbook when learning course content. ☐ Agree ☐ Disagree

21. Adequately replace a neuroanatomy course as a stand-alone program. ☐ Agree ☐ Disagree

Additional Questions:

22. Would you require this program for use in your course(s)? ☐ Yes ☐ No

23. Would you purchase this program? ☐ Yes ☐ No

24. What is your favorite part of this program?

25. What was the worst feature in this program?

26. As you worked through the program, did you discover any errors that should be fixed? Describe.

27. What fields of study could benefit from this program?

28. How could the clarity and navigational features of the program be improved?

29. Who else could benefit from this program?

30. Please provide any additional comments regarding the program that you would like the development team to know.

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Table 1

Instrument Items from the Usability Questionnaire (Appendix) that Measure the Neuroanatomy Prototype's Usability Properties of Need and Applicability.

<p><i>Need for Prototype in Various Educational Contexts:</i></p> <p>How would you rate the need of this program for:</p> <p>1. High school students?</p> <p>2. University students without prior knowledge of anatomy?</p> <p>3. University students currently enrolled in an anatomy course?</p> <p>4. University Health professions students reviewing anatomy for professional licensing exams?</p> <p>5. Faculty teaching anatomy courses?</p> <p>6. Practicing health-care providers?</p>
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<p><i>Applicability of Prototype to Pedagogical Processes of Neuroanatomy:</i></p> <p>This program would be useful to:</p> <p>1. help students learn the course material.</p> <p>2. help students integrate course material with other aspects of the nervous system.</p> <p>3. help students improve exam performance in a neuroscience course.</p> <p>4. supplement a textbook.</p> <p>5. supplement a lab.</p> <p>6. supplement a course.</p> <p>7. supplement the teaching of neuroanatomy over traditional methods of teaching.</p> <p>8. replace a neuroanatomy textbook when learning course content.</p> <p>9. replace a neuroanatomy course as a stand-alone program.</p>

Rating Scale: 1=not needed, 2=marginally need, 3=modestly needed, 4=greatly needed, 5 =absolutely needed

Rating Scale: Agree or Disagree

Table 2

Descriptive Statistics of User Perceptions Toward the Need For the Neuroanatomy Multimedia Prototype in Various Educational Contexts.

How would you rate the need of this program for?	N	Mean	Std dev.
1. High School Students?	56	3.1	1.13
2. University students without prior knowledge of anatomy?	51	3.6	1.32
3. University students currently enrolled in an anatomy course?	52	3.3	1.14
4. University Health professions students reviewing anatomy for professional licensing exams?	56	3.7	1.02
5. Faculty teaching anatomy courses?	58	3.5	1.02
6. Practicing Health Care Professionals?	57	2.7	1.06
Combined Average Mean of Need for Prototype	---	3.3	---

Rating Scale: 1=not needed, 2=marginally need, 3=modestly needed, 4=greatly needed, 5 =absolutely needed

Table 3

Descriptive Statistics of User Perceptions Toward the Applicability of the Multimedia Prototype to Pedagogical Processes of Teaching and Learning Neuroanatomy.

This program would be useful to:	N	% who agreed w/ the statement
1. help students learn the course material.	57	93.0%
2. help students integrate course material with other aspects of the N.S.	56	94.6%
3. help students improve exam performance in a neuroscience course.	56	85.7%
4. supplement to a textbook.	57	93.0%
5. supplement to a lab.	57	89.5%
6. supplement to a course.	57	91.2%
7. supplement the teaching of neuroanatomy over traditional methods.	56	97.5%
Mean % who agreed with statements 1-7	---	92.1%
8. replace a neuroanatomy textbook when learning course content.	57	29.8%
9. replace a neuroanatomy course as a stand-alone program?	57	31.6%
Mean % who agreed with statements 8-9	---	30.6%
Mean % who agreed with all statements (1-9)	---	78.4%

Rating Scale: Agree or Disagree

Table 4

Students' T-tests comparing differences between different types of users groups of expertise, age, and gender as independent variables against dependent variables of need and applicability, all considered separately.

Dep. Variables		Independent Variables																		
		Expertise						Age												
		Faculty		student		t-test		<35		>35		t-test		Male		Fem		t-test		
* Survey Item #	N	x ⁻	N	x ⁻	N	x ⁻	Sig.	N	x ⁻	N	x ⁻	Sig.	N	x ⁻	N	x ⁻	N	x ⁻	Sig.	
Need	1	21	2.90	35	2.17	0.022		0.007	36	2.14	20	3.00		41	2.15	21	2.20	21	2.20	0.899
	2	17	3.35	34	3.91	0.149		0.077	35	3.94	16	3.25		40	4.26	21	3.47	21	3.47	0.056
	3	17	3.35	35	3.14	0.527		0.712	36	3.25	16	3.12		41	3.35	21	2.87	21	2.87	0.186
	4	21	3.67	35	3.74	0.786		0.725	36	3.75	20	3.65		41	3.75	21	3.73	21	3.73	0.961
	5	23	3.26	35	3.69	0.119		0.152	36	3.67	22	3.27		41	3.75	21	3.60	21	3.60	0.633
	6	22	2.82	35	2.51	0.297		0.339	36	2.53	21	2.81		41	2.65	21	2.33	21	2.33	0.393
Applicability		N	%Y	N	%Y	Sig.			N	%Y	N	%Y	Sig.		N	%Y	N	%Y	Sig.	
	1	25	92	34	94	0.754			35	94	24	92	0.700		40	100	21	93	0.107	
	2	24	88	34	100	0.035			35	100	23	87	0.028		40	100	21	100	---	
	3	25	80	33	91	0.240			34	91	24	79	0.198		40	90	21	93	0.748	
	4	25	88	34	97	0.177			35	94	24	92	0.700		40	95	21	100	0.382	
	5	25	88	34	91	0.696			35	91	24	88	0.631		40	90	21	93	0.704	
	6	25	92	33	91	0.886			35	91	24	92	0.975		40	90	21	93	0.704	
	7	23	83	35	91	0.322			36	92	22	82	0.272		41	90	21	93	0.737	
	8	24	21	35	37	0.188			36	42	23	13	0.020		41	45	21	27	0.280	
9	25	40	34	29	0.405			35	31	24	38	0.634		40	32	21	27	0.764		

* Refer to Table 1 for the worded item statements in the Usability Questionnaire.