

Christian Brothers University
650 East Parkway S, Memphis, TN 38104

MAESC CONFERENCE – 2005

Web-Based Surveys

Brent Ellis

Francisco Zurita

John Ventura

Web-Based Surveys

Abstract

This project surveys software systems that are available on the market and the design and implementation of survey software for Christian Brothers University (CBU). Many current survey methods are slow, costly, and inefficient. Most surveys at CBU are still administered on paper. Online surveys can be created as Web pages; however, at Christian Brothers University, they require creation and maintenance from an individual that has many other responsibilities as well. This project is an attempt to put the control of surveys into the hands of those that need them. This paper demonstrates how to implement, administer, and view the results of this type of survey. Technologies like *hypertext preprocessor* (PHP) and *structured query language* (SQL) are examined. In addition, the ethical and moral implications, as well as privacy and security issues, of an electronic survey are discussed as they are encountered.

Table of Contents

Introduction.....	1
Discussion.....	2
A) Analysis.....	2
B) Technologies Used.....	3
C) Database Implementation.....	3
D) User Interface Description.....	4
E) User Interface for Survey Creators.....	5
F) User Interface for Survey Takers.....	6
G) Data Analysis.....	6
H) Software Theory.....	7
Conclusion and Recommendations.....	8
Appendices	
A) Analysis of Existing Software.....	9
B) User Interface Diagram (Flow Chart).....	10
C) Sample Faculty Menu Page.....	11
D) Sample Online Survey.....	12
References.....	13

Introduction

Educational institutions have always relied in part on the opinions of students, alumni and other “publics” to make changes for the betterment of the school. Surveys in Ontario, Canada are helping officials to determine the future of the education system. Over 77,000 responses are helping parents get their opinions to the people that make decisions. Officials report "This is an important opportunity for parents to tell us what's working and what improvements they want to see in the education system" [1]. Surveys can have far-reaching effects, such as those occurring in Ontario.

At Christian Brothers University (CBU), surveys are given for a variety of reasons. Surveys can range from students’ opinions of the food available to them on campus to teacher evaluations at the end of each semester. In the past most of these surveys have been paper based. However, paper surveys can be quite difficult to manage. Some of the difficulties associated with paper surveys include time constraints and human error. Many paper surveys require manual tabulation, generally a slow process. Data may be hard to interpret and mistakes can be made when processing results. Smudge marks can make it much more difficult for the person reading the survey to understand what was meant by the person taking the survey. For example, the 2000 presidential elections were covered in controversy when “hanging chads” were used to determine the intent of the voter [2].

All of these problems can be remedied by using an electronic survey. All tabulation is handled “behind the curtain.” There is no longer a need to analyze the data manually since the computer would do it automatically. A computer may easily generate visual aides to help people interpret the results, such as pie charts and bar graphs. With an electronic survey, there is also no longer a risk for incorrect analysis because of human error. The client may only select one option, and a computer is unable to misinterpret the selection. This enables one to obtain results that are more accurate.

The Accreditation Board for Engineering and Technology (ABET) is an organization that oversees the specific requirements that an academic institution must achieve to maintain its accreditation. ABET attempts to assure the quality of academic engineering programs and inspire innovation in areas including applied science, computing, engineering, and technology [3]. New accreditation processes have required an expansion of the methods used to measure the assessment and achievement of outcomes and objectives of the engineering programs. By granting the faculty and staff the tools to easily gather information from students, alumni and employers, the school may better achieve the ABET requirements to maintain accreditation.

With the growing availability of technology at an institution such as CBU, as well as the necessity to maintain accreditation, there is a demand for applications such as survey software to shift from paper to electronic means. Current methods require the skills of a single programmer to compile a survey based on the needs of a particular group. A programmer may be overwhelmed with work, and survey creations may take a lot of time. The programmer would have to code a web page to handle the abilities of a survey and type the questions and responses into the web page. A web-based survey creator can place the control into the hands of those that need the survey so that it can be designed and administered in a timely and user-friendly fashion. Faculty members with very little, knowledge of computer programming will be able to easily create and

distribute surveys to a large group through the internet. Creating a survey requires no programming by the user, but merely typing questions and answers and pressing buttons. The implementation of this software must accomplish four goals:

- Create, edit, and administer surveys from a web site.
- Export and import information to and from a personal computer.
- Manage users and groups, with user names and passwords.
- Analyze results with different types of tables and graphs, and compare information for a single survey over several terms.

Several constraints were taken into account prior to the design and implementation of this project. The first and most important constraint was the budget. A \$200 budget was granted to purchase a software package that would accomplish all of the goals required by the school. Another important constraint was the implementation of this software. For this software, a programming language was needed that would be easy to code and easy for the faculty, students and alumni to use. The final product would also have to be one that could be successfully implemented on the CBU local servers. Maintainability was also another important constraint. This software was designed with the intent that it could be used over several semesters. The programming languages, user interfaces, and databases had to be implemented with no errors and no broken links. There were several ethical constraints that had to be addressed in the creation of this software, including using the results of surveys in an appropriate manner and protecting the privacy of the students and alumni. Several social and political constraints also had to be assessed. The results from the surveys can have far-reaching effects. Some surveys may be trivial, whereas others may lead to great changes within the school. It is important to note, however, that the surveys and results should not be used against the faculty, students and alumni.

Discussion

Analysis

An analysis of existing products on the market was first performed to determine the best course of action. Many survey software packages exist for purchase; however, not all software packages accomplish the specific goals required for the implementation of this project. Four professional survey utilities were compared. With a limited budget of approximately \$200 for a professional product, cost became the deciding factor.

Product A's cost for the complete software package was \$3000. Product B's cost required \$3 per completed survey. For one survey and a class size of twenty students, the cost to complete the survey would be \$60 in one semester. After three semesters, the cost to complete this survey would be \$180. This cost is right at the original budget set aside to purchase a product. CBU has many faculty members who may also teach many classes. If each teacher created one survey for each class, these costs could add up to a very large amount over time. Product C's cost for the complete software package was \$1799. Product D's cost was estimated at \$3000 for the goals that the software would need to accomplish.

The costs of these products exceeded the provided budget. Based on the cost, professional software packages were ruled out of the picture. However, many other important features of these products were also analyzed including setup process, setup

environment, data presentation and program usage, which helped clarify some of the applications that would be necessary in the design of a survey system suitable for an accredited institution. Results of this analysis are available in Appendix A.

Many open source products are also available for reference on the internet. An open source product is a program in which the source code is available to the public for use and/or modification from its original design free of charge [4]. The software package that will be implemented for CBU references some open source products; however, it does not directly use a particular program. The open source products used in this software are addressed in the following implementation discussion.

Technologies Used

For implementing the software project *hypertext preprocessor* language (PHP for short), *structured query language* (SQL for short), and the relational database management system (RDBMS) called MySQL are being used. According to an online dictionary, “Hypertext Preprocessor, an open source, server-side, HTML embedded scripting language used to create dynamic Web pages. In an HTML document, PHP script (similar syntax to that of Perl or C) is enclosed within special PHP tags. Because PHP is embedded within tags, the author can jump between HTML and PHP (similar to ASP and Cold Fusion) instead of having to rely on heavy amounts of code to output HTML. In addition, because PHP is executed on the server, the client cannot view the PHP code. PHP can perform any task that any CGI (common gateway interface) program can do, but its strength lies in its compatibility with many types of databases” [5]. This means users will not be able to see the actual programming code, only the web page that is generated by the code.

SQL is a standardized query language for requesting information from a database; and MySQL, according to RustyBrick [6], is an open source RDBMS that relies on SQL for processing the data in the database. MySQL provides application program interfaces (API) for the languages C, C++, Eiffel, Java, Perl, PHP and Python. “MySQL is most commonly used for Web applications and for embedded applications and has become a popular alternative to proprietary database systems because of its speed and reliability” [7]. PHP and MySQL allow this program to work very efficiently within the school environment. They are also the best technologies available for implementing this software project at CBU. PHP and MySQL are both free to use, so these two technologies do not factor into costs

Database Implementation

The database is composed of thirteen tables. The reason for this database and these tables is the need to be able to organize data in an efficient and manageable way. The types of data that these tables manage are the questions, the responses to these questions, possible choices for each question, archived results, users and passwords, groups, and the surveys that are available to which users and groups. The tables include:

- *choice_descriptions* – used to store a certain id for a response set, a description of the response set, whether it is qualitative or quantitative, if it is hidden, if it’s in use and its creator.

- *choices_qualitative* – stores a certain choice id, the response set id for which it corresponds to, the order in which it should be listed, and the description of the choice.
- *choices_quantitative* – stores a certain choice id, the response set id for which it corresponds to, a choice description, the order in which it should be listed, and the choice's associated value.
- *final_responses* – used to store survey results, including fields for the question id, choice id, the number of responses for that choice id, and the term.
- *group_members* – used to store who belongs to which group. It includes a user id and a group id.
- *groups* – used to store a group id, a description of the group, and who created the group.
- *questions* – stores a question id, a description for the question, which response set it uses, the order in which it should be listed and the survey id.
- *responses_comments* – used to store comments, including a question id, a comment, and a term for which this comment belongs.
- *surveys* – stores the survey id, a description for the survey, the creator of the survey, the term id for the current term, if the survey is set to anonymous and if this survey is currently available or not.
- *survey_users* – stores which individual users can take which surveys. It stores a user id and survey id, and whether the user has taken the survey or not.
- *survey_groups* – this table stores the groups can take the surveys. It consists of a group id and a survey id.
- *terms* - this table stores a term id, the survey to which it belongs, a description of the term, and the order in which it's listed.
- *users* - stores a user id, a user name, a password for the user encrypted using the MD5 algorithm, and the user level. The user levels are 1-Administrator, 2-User Manager, 3-Faculty, 4-Student, 5-Survey Password.

MD5 is a cryptographic hash function that utilizes 128-bit encryption [8]. The MD5 algorithm prevents anyone from actually seeing the password of a user in the database. This algorithm is currently in place at CBU for storing passwords.

User Interface Description

Survey creators and survey takers are able to access the software through two different user interfaces. Survey creators can either create surveys or take surveys, while survey takers can only take surveys. The difference between a survey creator and a survey taker is the difference between an administrator or faculty login and a student or guest login. The login screen will look the same for all users but different options will be made available based on what kind of user logs in. A database of clients indicates which users are classified as faculty or administrators and which users are classified as students or guests. The interface for alumni or guests is the same as the interface of a student. An

administrator or a faculty member may create a new user if the student is not currently in the system.

User Interface for Survey Creators

The survey creator will begin by going to the software systems main login page. Once there, the creator must enter a user name and password. Many options then become available for selection, including: the option to view available surveys; the option to create, edit and delete surveys; the option to analyze survey results; the option to create new response sets; the option to manage groups of users; and the option to import and export data. During the survey creation process, the creator selects the form of answer to be displayed in the survey. This option may be one of the provided template response sets or a custom response set created specifically for a particular question. Some sample response sets may include:

- True/False, Qualitative: true or false.
- 1 through 5, Quantitative; five numerical options: 1, 2, 3, 4 or 5.
- 1 through 5, Qualitative values: agree, somewhat agree, neutral, somewhat disagree, or disagree.
- 1 through 3, Quantitative: three numerical options: 1, 2 or 3.
- 1 through 3, Qualitative: yes, maybe or no.

The survey creator will have the ability to create new response sets, similar to the creation method of a new survey. The creator may add a new response, edit an existing response, or save the response set for usage in a created survey. These response sets will be dependant on the faculty member using them and will not be available for all users to include in a survey. Each new response set will be added to the list of available choices when creating questions so that the creator will not have to recreate the response format for each new question. Response sets may be quantitative or qualitative. A quantitative response set has numerical values associated with each answer, such as 1, 2 or 3. A qualitative response set has word values associated with each answer, such as true, false, yes or no.

Another option is to include a comments section on a survey. This is similar to adding a question with the response set called “Comment.” With this, a text box will appear on the survey so that the survey taker will be able to type in any additional information regarding the topic of the survey. For example, in the current teacher evaluation surveys at CBU, students are asked to write comments on the back of the survey concerning the class, the classroom environment or the teacher of the course. These comments will be made available in the results at the completion of the survey.

Once the survey creator chooses to create a survey, the survey creator will also have the option of making the survey a monitored survey. A monitored survey is one in which all students must attend a computer lab, wherein they will be given a link for the web server and a username and password to take that survey. The username and password will not be available for the students prior to meeting in the classroom; therefore, they will be able to take the survey only at that time. Once the survey is completed, the instructor can then deactivate the username and password so that nobody else can take it. The monitored surveys will utilize cookies to ensure that a survey is only taken once per computer. A cookie is a collection of information, such as a username and the current date and time, stored on the local computer of a person using the internet.

Cookies are used to tell when a user visited a particular site [9]. Surveys may be taken again if cookies are deleted from the computer; however, this cannot be avoided for an anonymous survey.

While a new survey is being made, the survey creator can add new questions and choose a response set, such as “1 through 5” or “True/False,” that corresponds to a particular question. Once all of the questions have been added, the survey must be activated to appear on the list of available surveys. Once the survey has been completed, several options become available. The survey creator may edit an existing survey, delete a survey, archive and reactivate a survey, change the ownership of a survey and change permissions of who may take a survey. Deleting a survey will remove the survey as well as all associated results from the database. Archiving a survey will end the current term of a survey. To begin a new term, the survey must be reactivated. This can be used to repeat a survey over several terms, for example, once every semester. The survey creator may also transfer ownership of an existing survey to another faculty member.

Survey permissions are used to determine which students may take which surveys. An administrator or a faculty member has the ability to add new users and groups to the system. Existing members may be added to a group, such as a class. From the survey permissions page, individual users or groups of users may be added to a survey. If a user has permission to take a particular survey, it will appear in the list of available surveys. Any user may be given permission to take a survey. For example, a group of faculty members, not students, may be able to take a particular survey. A group may be created containing any users that are in the system.

At CBU, a faculty member may request a list of students from the I.T.S. Department. This file will be a text document containing several student usernames separated by new line characters. This file can be imported into the survey system. Each username will be added into the system, and a randomly generated password will be emailed to the CBU email account for each user. This will prevent anyone from ever seeing the student’s password. Once the student username has been created, they may change their password at any time.

User Interface for Survey Takers

Survey takers will be given a link to the web server. Once the client follows the link, they will have to type in a username and password. The client will then be shown what surveys are available to take. A student can potentially have several surveys to complete by the end of the year, such as teacher evaluations. Once the student chooses which survey to take, they will be shown a survey with their appropriate answers. The survey taker will answer all questions and submit the results.

Data Analysis

When the survey creator chooses the option to view results in the survey creator user interface, a list of available surveys is presented. Once the selection is made, data analysis is done on the spot. The first thing that is shown is the list of all the questions. The survey creator may choose a question for a graphical representation of the results. Pie charts, bar charts or numerical values may be displayed. The survey creator may also be able to calculate average values for all of the answers. The data may also be exported to a spreadsheet file for further analysis.

The algorithm used to display the various graphical representations of the data is the only open source software product that was used in this project. The open source program that is being used to create the images for data analysis is done by a program called PHPLOT. This program was originally created by Afan Ottenheimer and modified to fit our software demands [10]. Information from the database is analyzed by the software. An algorithm will then take the data and create a pie chart or a bar chart.

Software Theory

This software package will have many useful applications within the CBU community. Two of the most used surveys, previously mentioned, include those for food services and teacher evaluations; however, there are other applications for this software. Faculty members are able to create a survey and create response sets for particular questions. Surveys are available for students and alumni to take from the CBU website. Results are accessed with a link on the main page. This link may include such options as pie charts and bar graphs. Faculty will also be able to export data to their own machine and import results that may have been taken as paper surveys.

There will be five levels of access for users to log in to this system. The highest level is the administrator. This user will have access to all of the software options and will be able to view, edit or delete any survey. The next level is the faculty and staff. These users will be able to do the same tasks as the administrator, but only for their user identification. They will not be able to view or edit surveys and results for other faculty members. The third level of access is for the students of CBU. These users will simply be able to log in to the system and take the surveys that are available to them. They will not be able to create surveys or view results. The fourth level of access is for alumni and guests. These users will not have usernames and passwords and will be allowed to complete surveys by invitation only. A survey for these users is created and a link is generated so that no username or password is required. The link may then be emailed to the target audience. The final level of user access will be an id for a monitored survey.

All surveys administered from this software will remain anonymous. If the identity of a student is required, the survey becomes a test and this software was not designed with the intent to maintain tests. The survey creator may include a comment box for the name of the survey taker, but this will be optional. No student is required to take a survey against his or her will. Since the surveys will all be anonymous, no user information will be recorded upon submission of a survey. User identifications will be used to show which surveys are available to particular students, and will in no way be connected with results stored in the database. However, the database will keep records on which surveys were completed by the student. The user identification will only be used to provide a student with a list of available surveys as well as indicate which surveys have already been completed.

Conclusions and Recommendations

No longer will people be troubled by hand counting numerous surveys and adding the results on their own. Getting surveys out to the students becomes a matter of sending out an email to inform them that a survey is available to take. All survey results, except for comments, are concise and clear to a computer. Instant results are available at the push of a button. There is no doubt that the calculating speed of a computer is much faster and accurate than that of a human. Of course, people will no longer be plagued by paper cuts obtained from shuffling countless paper surveys, unless they are quite unlucky when printing out the results of an electronic survey.

Administering a survey throughout CBU is now much faster and much more efficient. Any faculty member will now have the ability to create and administer a survey, rather than wait for someone else to do it. Electronic based surveys save time, money, and effort and allow survey makers to get the detailed results required in a timely fashion.

Many survey applications that are currently in use may easily be transferred over to this system. Christian Brothers University administers paper-based teacher evaluation forms at the end of each class semester. With this electronic system, evaluations can be compared based on teacher, class and many other factors much more quickly than the paper methods. Surveys are often emailed out to all students to inquire about the food services on campus. These surveys can also be easily adopted into this software. This software will allow any necessary survey to be easily administered to the public. The opinions of students at a university can spark many important changes to help the institution grow to new levels.

All of the goals outlined in the design of this project have been achieved. Users have an online user interface with which to create, edit and administer surveys. Faculty members may export results to a personal computer to save or further analyze. They may also import results into the system to include results for surveys taken by hand. Faculty members may add students to the system and organize them into groups, such as a class or a major. A login system restricts the usage of the software. Finally, results from surveys can be analyzed with numerical comparisons, bar charts and pie charts over many different terms. This software is currently being used in the engineering department at Christian Brothers University.

Appendix A

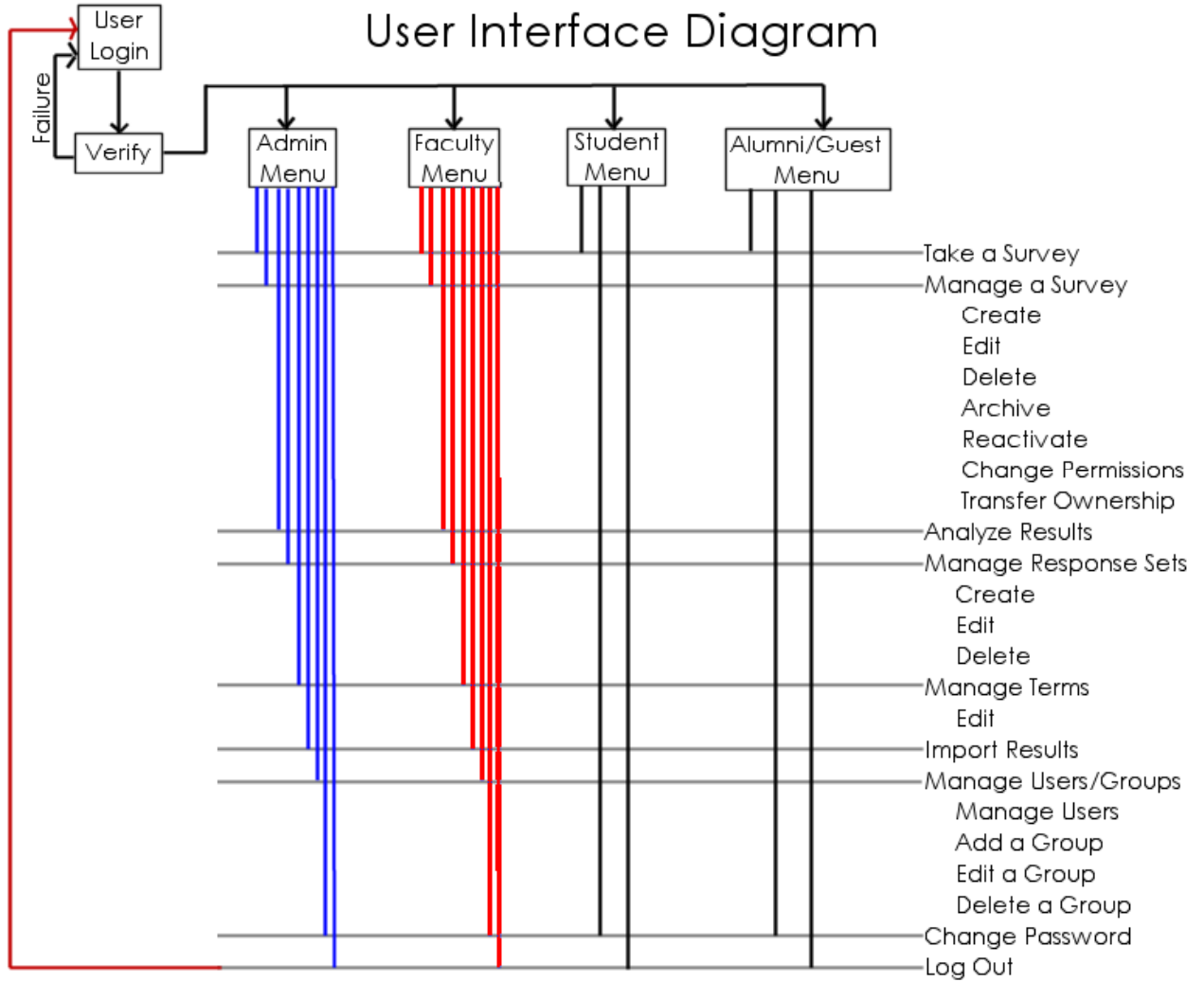
Analysis of Existing Products

	A	B	C	D	E
web based setup	X	X			X
program based setup			X	X	
custom look and feel	X	X		X	
multiple response sets	X	X		X	X
limit number of times survey can be taken	X	X	X	X	X
uses customer server			X		X
uses vendor server	X	X		X	
pie charts	X		X	X	X
bar charts		X		X	X
numerical values	X	X	X	X	X
examine surveys over time intervals			X	X	X
export and import data	X	X	X	X	X

Product E represents our product

Appendix B

User Interface Diagram (Flow Chart)



Appendix C

Christian Brothers University

CBU Online Survey System

Take a Survey
Choose from a list of available surveys.

Survey Options
Create, edit, and delete surveys.

Analyze Results
Produce detailed graphical reports.


Response Sets
Custom responses for your surveys.

Import Results
Input data for a survey.

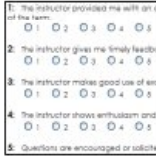
Manage Terms
Edit term information.

Users and Groups
Manage users and groups.

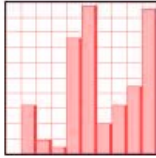
Welcome to the Christian Brothers University Online Survey System. You are currently logged in as bellis. Please choose from the list of options below.



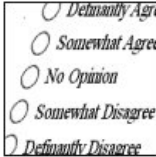
Take a Survey



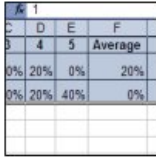
Surveys




Analyze Results



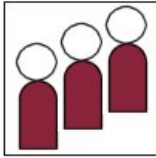
Response Sets




Import Results




Manage Terms



Users and Groups



Change Password



Log Out

Christian Brothers University
 650 East Parkway South
 Memphis, TN 38104
 (901) 321 - 3000
 (877) 321 - 4CBU

This is a sample menu system. It will appear on a web site for a faculty member. The user may choose from several selections.

Appendix D

Christian Brothers University

CBU Online Survey System

Survey Title
Teacher Evaluation Form

Survey ID#
15

Survey Created By
fzurita

Thank you for participating in this survey. Please make sure all questions have an answer marked before pressing the "Submit" button located at the bottom of the survey. You may also "Clear" all of your answers if you wish to start over. Results will not be saved or submitted unless the "Submit" button is pressed.

1: The instructor is consistently well-prepared for class.

4
 1
 5
 2
 3

2: The instructor respects students as individuals.

4
 1
 5
 2
 3

3: The subject is presented clearly

4
 1
 5
 2
 3

[\[Return to Main Menu\]](#)

Christian Brothers University 650 East Parkway South Memphis, TN 38104 (901) 321 - 3000 (877) 321 - 4CBU

This is a sample survey, as it will appear on the web site. This is what students, alumni and faculty would see when they login and choose to take a particular survey that is available to them.

References

- [1] “More than 77,000 parent surveys received by Ontario government,” <http://www.edu.gov.on.ca/eng/document/nr/02.01/nr0128.html>, Accessed February 5, 2005.
- [2] “‘Hanging chads’ often viewed by courts as sign of voter intent,” *CNN.com*, <http://archives.cnn.com/2000/ALLPOLITICS/stories/11/16/recount.chads/>, Accessed March 28, 2005.
- [3] “About ABET,” ABET, <http://www.abet.org/>, Accessed March 1, 2005.
- [4] Definition from Webopedia Online, *Webopedia*, http://www.webopedia.com/TERM/o/open_source.html, Accessed January 8, 2005.
- [5] Montecino, Virginia, *Introduction to Internet Terminology*, <http://mason.gmu.edu/~montecin/netterms.htm>, Accessed January 8, 2005.
- [6] G. Merrall, “PHP/MySQL Tutorial,” *Webmonkey*, <http://webmonkey.wired.com/webmonkey/99/21/index3a.html>, Accessed January 15, 2005.
- [7] Definition from RustyBrick Online, *RustyBrick*, <http://www.rustybrick.com/definitions.php>, Accessed January 8, 2005.
- [8] Definition from Wikipedia Online, *Wikipedia*, <http://en.wikipedia.org/wiki/MD5>. Accessed March 28, 2005.
- [9] Definition from Dictionary.com, *Dictionary.com - Cookies* <http://www.dictionary.com>, Accessed March 1, 2005.
- [10] Ottenheimer, Afan, PHPLOT, <http://www.phplot.com/>, Accessed February 16, 2005.

Sources

- M. Achour, F. Betz, and others, “PHP Manual,” *PHP*, <http://us2.php.net/manual/en/index.php>, Accessed January 15, 2005
- J. Greenspan, “Your First Database: Overview,” *Webmonkey*, <http://webmonkey.wired.com/webmonkey/backend/databases/tutorials/tutorial3.html>, Accessed January 15, 2005.