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ABSTRACT

This study first examined the motivation construct with personal goals, agency beliefs, and emotions in a World Wide Web assisted learning environment. It also investigated the influence of personal goals, agency beliefs, and emotions on the students' learning achievement from fundamental biology courses assisted with Web pages. Finally, it examined the relationships among personal goals, agency beliefs, and emotions. Participants were 356 students who took undergraduate fundamental biology classes in which the instructors used Web pages as supplemental tools to assist student learning. After the final exam, the students filled out an online questionnaire in order to measure their personal goals, agency beliefs, and emotions in using Web pages to assist learning. Students' course grades were used to measure their learning achievement. Data indicated that there were significant and direct causal links from students' personal goals to their course grades, from personal goals to emotions, and from emotions to personal agency beliefs. The questionnaire is appended. (MES)

MOTIVATION: GOALS, AGENCY BELIEFS, AND EMOTIONS IN WEB ASSISTED LEARNING

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Abstract

This study first examined the motivation construct with personal goals, agency beliefs, and emotions in a web assisted learning environment. It also investigated the influence of personal goals, agency beliefs, and emotions on the students' learning achievement from fundamental biology courses assisted with web pages. Finally, it examined the relationships among personal goals, agency beliefs, and emotions. A survey questionnaire was designed to measure goals, agency beliefs, and emotions (Appendix A). Learning achievement was measured by the course grades.

Three research questions were addressed: (1) Are the responses to the questionnaire for measuring personal goals, agency beliefs, and emotions consistent with the three-component motivation model proposed by Ford? (2) Do students' personal goals, agency beliefs, and the emotions of using the web pages relate to their learning achievement? (3) Do students' personal goals, agency beliefs, and emotions relate to each other?

Three hundred and fifty six students have participated in the study. These students have taken undergraduate fundamental biology classes in which the instructors used web pages as supplemental tools to assist student learning. After the final exam, the students filled out an on-line questionnaire in order to measure their personal goals, agency beliefs, and emotions in using web pages to assist learning. Students' course grades were used to measure their learning achievement.

A confirmatory factor analysis with Lisrel VI was used to examine the construct validity of the questionnaire (Question 1). Cronbach Alpha reliability values on personal goals, agency beliefs, and emotions were calculated with SPSS 8.0 to indicate the internal consistency of the questionnaire (Question 1). The causal paths among the personal goals, agency beliefs, emotions, and learning achievement were examined using structural equation modeling with Lisrel VI (Question 2 and Question 3).

The Cronbach alpha reliability coefficients on 12 selected items of the motivation instrument for students' personal goals, agency beliefs, and emotions were 0.84, 0.85, and 0.89, respectively. The confirmatory factory analysis on 12 selected items of the motivation instrument showed a fairly good fit of the theoretical model of motivation proposed by Ford (1992). These indicated that the motivation instrument with 12 selected items has moderate reliability and fairly good construct validity.

The data from the structural equation modeling analysis supported that there were significant and direct causal links from students' personal goals to their course grades, from personal goals to emotions, and from emotions to personal agency beliefs.

Introduction

Classroom use of the World Wide Web (WWW) is seen as a new learning tool to reach students (Quinlan, 1996). The Computer Center at a northeastern university has initiated a web-based learning resource, the Virtual Classroom. The Virtual Classroom is a listing of courses that use web pages as a supplemental tool to enhance students' learning. Instructors who join the Virtual Classroom have created their own instructional web pages. The pages usually include class syllabi, practice exams, and related instructional materials, displayed the form of text, graphics, and hyperlinks. In or out of class, students are able to browse and download the web pages from any location with an Internet connection at their convenience.

Some important issues in such web assisted learning environment are: (1) whether the web pages motivate students to learn; and (2) how much motivation factors contribute to learning achievement. The theoretical model of motivation in this study is based on Motivational System Theory (MST), proposed by Ford (1992).

Theoretical Background

Motivational systems theory

On the basis of Motivational Systems Theory (MST), the concept of motivation is defined as the organized pattern of an individual's personal goals, personal beliefs, and emotions" (Ford, 1992). It is implied that motivation represents an integrated construct that provides the direction a person is striving for, emotional energy to support or inhibit behavior change toward the direction, and expectancies a person has about whether he or she is able to reach the destination.

According to Ford (1992), personal goals have two properties, content and direction. A personal goal's content represents the consequences a person is aiming to achieve. Goal direction guides a person to produce the expected consequences. A goal also provides "the regulatory process with criteria for evaluating the effectiveness of the person's activity" (Ford, 1992, p. 73). In addition, personal goals work with personal evaluation criteria to identify and prioritize goal options within and across behavior episodes. Goals are always within a person and are often constructed from the context. Because a goal cannot be imposed on a person (Ford & Lerner, 1992), it must be adopted as a personal goal for someone to perform a desired behavior.

Personal agency beliefs are "evaluative thoughts involving a comparison between a desired consequence and an anticipated consequence" (Ford, 1992, p. 125). According to Ford, there are two types of personal agency beliefs, capability beliefs and context beliefs. Capability beliefs are evaluative expectancies about whether a person has the necessary skills to achieve the goal; context beliefs are evaluative expectancies about whether the person's context will support or facilitate the process of goal achievement. According to Ford (1992), four elements are needed to ensure optimal responsive environment: (1) the environment is congruent with an individual's agenda of personal goals; (2) the environment is congruent with the person's biological, transactional, and cognitive capabilities; (2) the environment has the material and informational resources needed for goal achievement; (4) the environment provides an emotional climate to support or facilitate effective functioning. Directed by a personal goal, capability beliefs, and context beliefs "together provide the person with the information needed to decide whether to initiate, maintain, amplify, or inhibit some pattern of goal-directed activity" (Ford, 1992, p. 74). Personal agency beliefs play a crucial role in reaching those goals that are challenging but reachable.

Agency beliefs can be measured by people's self-reports concerning their confidence in a certain behavior. When they have strong confidence in doing something, they will have higher expectations about whether they can do it and whether they will have a supportive context.

In Ford's view (1992), emotions consist of three integrated components, an affective component, a physiological component, and a transactional component. Emotions influence behaviors that are important to the individual's goals. They are major influences on initiating and shaping goals and personal belief patterns. They provide energy to increase ongoing behavior patterns related to the goal.

A person's interest in doing something reflects an affective component of a person's emotions. An aroused interest toward a specific behavior will be accompanied with physical satisfaction while it triggers the transactional component of emotions. Therefore, emotions can be measured through how much interest a person has in doing a certain behavior.

Based on Ford (1992), personal goals, personal agency beliefs, and emotions are interdependent, and their relationships are complex and nonlinear. "Each component is necessary, but none are sufficient for the activation of strong motivational patterns" (Ford, 1992, p. 80).

Stated by Ford (1992), human effective functioning is represented by achievement and competence in a specific context. Achievement is defined as "the attainment of a personally or socially valued goal in a particular context" (Ford, 1992, p.66). The concept of competence is defined as "the attainment of relevant goals in specified environments, using appropriate means and resulting in positive developmental outcomes" (Ford, 1992, p. 67). To ensure effective functioning, a person must be motivated, have relevant skills to attain the goals and the competence, and supportive biological and behavioral capabilities used to interact with an environment that has the relevant resources to facilitate goal attainment.

In this study, the three components of motivation, personal goals, agency beliefs, and emotions will be tested. The relationships among the three components and the learning achievement will be examined.

Overview of MST application and research

The MST has been applied to several educational domains, such as competence development (Ford, 1995), social intelligence development (Ford, 1983), adoption of microcomputers in early childhood education (Ford, 1988), and infant attachment (Ford & Thompson, 1985).

For competence development in special and remedial education, 17 principles were used for motivating students (Ford, 1995). The goal-directness and perception of control have been studied in developing social intelligence (Ford, 1983). The motivational factors involved in decision making were examined in adoption of microcomputers for administrative and instructional use in early childhood education. A study has been conducted

to investigate the nature and implications of individual differences in perceptions of personal agency and infant attachment (Ford & Thompson, 1985).

Although the MST has been applied in educational fields by its proponents, there is not sufficient evidence to support the validity of the theory in motivating human behaviors. More research needs to be done in various educational contexts to provide theoretical and empirical evidence about the validity of the model.

Overview of on-line resources application and research

Since the World Wide Web (WWW) was developed, educators have used such resources to serve as learning tools in many educational settings. On-line Writing Labs have been used to provide sources and personal contacts for college students to practice writing skills in composition classes (Bergland, 1996). Science and math skills instruction have been supported by scientific labs on the WWW (Friedman et al., 1996). Simulation software provided on the WWW has been developed to support collaborative learning across institutions (Neilson & Thomas, 1996). The WWW has been used by special educators to discuss current issues about practices, policies, and research in special education (Kerr & Dworet, 1996).

Even though WWW on-line resources have been used in many educational settings to enhance learning, little research has been done in terms of effectiveness of these resources in facilitating learning or regarding how motivational factors such as goals, agency beliefs, and emotions, function in such a rich learning environment.

Rationale for employing confirmatory factor analysis and structural equation modeling

As stated in the *Standards for Educational and Psychology Tests*, the validity of an instrument refers to the appropriateness, meaningfulness, and usefulness of the specific inferences made from the test scores. Arguments for instrument validity are based on judgmental evidence and empirical evidence (Gable &Wolf, 1993). According to Gable and Wolf (1993), judgmental evidence is acquired before the administration of the instrument to the target group through examining the adequacy of the operational definition of the construct. Empirical evidence is obtained after the instrument has been administered to the target group. Evidence is provided by relationships among items within the instrument as well as the relationships to instruments measuring similar and different constructs.

Three commonly identified types of validity include content, construct, and criterion-related. According to Cronbach (1971), content validity answers the question: To what extent do the items on the instrument adequately sample from the intended universe of content? The evidence of content validity is generally judgmental and is mostly gathered before the administration of the instrument. The conceptual and the operational definitions of the affective characteristics are the focus of the evidence of content validity. The theoretical basis for the conceptual definitions is provided through a comprehensive review of literature done by the instrument developer. It is also suggested that content experts review the adequacy of the conceptual definition of the instrument. Operational definition is the design of items based on the content specified by the conceptual definition. It is essential that the operational definitions be reviewed by the same five content experts. Their assessments provide evidence that the sampling of items adequately reflects the intended universe of content (Gable &Wolf, 1993).

Construct validity addresses the question: To what extent do concepts or constructs explain covariation in the responses to the items on the instrument? The construct validity argument focuses on response data variation among items to provide evidence that the proposed content categories actually reflect constructs (Gable &Wolf, 1993). Evidence of construct validity is obtained from administering the instrument to a representative sample of respondents for which the instrument was designed. Many statistical techniques can be conducted to provide evidence of construct validity. One of the analysis techniques is confirmatory factor analysis.

In a confirmatory factor analysis, the researcher postulates a theoretical model that the data are expected to fit. The model describes the number of factors to be derived and which variables are related to each factor. The results of the analysis indicate how well the empirical data fit the proposed model. The advantages of CFA over Exploratory Factor Analysis (EFA) include: (1) yields unique factorial solutions, (2) defines a testable model, (3) indicates the extent to which a hypothesized model fits the data, (4) specifies data on the model parameters to aid in improvement of the model, and (5) can test factorial invariance across groups (Marsh & Hocevar, 1983). For these reasons, the study has used CFA to examine whether the data fit the theoretical motivation model proposed by Ford (1992)

Structural equation modeling (SEM) analysis provides evidence for causal relationships among different constructs by disconfirming causal paths. It may be applied to demonstrate the relational paths with directions among variables, the inter-correlations among independent variables, and the amount of contributions independent variables to dependent variables (Kenny, 1979). Although a multiple regression analysis is commonly used to find out contributions of independent variables to dependent variables, it does not postulate the causal paths among independent variables and dependent variables. Additionally, the results of a multiple regression analysis are trustworthy when there are strong multicollinearity (correlations) among independent variables (Tabachnick & Fidell, 1989). Better than a multiple regression, a SEM is robust to multicollinearity (Kenny, 1979). In this study, we attempted to find out the hypothesized causal paths and to minimize errors caused by the strong multicollinearity

among independent variables. Therefore, in this study, a SEM was employed to examine contributions of personal goals, agency beliefs, and emotions to students' learning achievement.

Statement of the problem

This study addresses both theoretical and empirical concerns in three aspects. First, from an instrument development perspective, measuring motivation in the context of web-assisted learning has not been done in the past. In addition, although some instruments to measure motivation have developed (Ford, 1995), no one has employed confirmatory factor analysis to examine the structure of motivation instruments. This study endeavors to test how the students' responses regarding their personal goals, agency beliefs, and emotions will fit into the three-component model proposed by Ford.

Second, from a theoretical aspect, since MST was proposed, no research has been conducted to examine the model using Structural Equation Modeling (SEM). This study is intended to test the relationships among, personal goals, agency beliefs, emotions, and learning achievement in order to test the theoretical model of MST.

Third, from an empirical aspect, the verification and justification of a motivation instrument will lead other researchers to conduct future studies in regard to measuring motivation in the web-assisted learning environment. The instrument may also be used by instructional designers or instructors to assess motivation factors in web-assisted learning. The evidence on contributions of three motivation factors on students' learning achievement will provide instructional designers or instructors with guidance in the process of designing effective web-assisted learning materials.

Therefore, the problems addressed in this study are to provide both necessary theoretical and empirical evidence for the people who are willing to apply the MST in assisting learning through on-line resources.

The literature review of this study has three sections: theoretical framework of MST, an overview of research on MST and on web based learning, and the statistical rationale of using confirmatory factor analysis (CFA) to verify motivation instruments and using SEM to examine the MST model proposed by Ford (1992).

Research questions

Three research questions are addressed for the motivation concept and Motivation System Theory in web assisted learning. The first question focuses on the construct validity of the motivation. The last two questions are pertinent to test the theoretical model of MST, finding out how three motivation factors relate to the learning achievement and how much the factors relate to each other. The questions are stated as follows:

1. Are the responses to the questionnaire for measuring personal goals, agency beliefs, and emotions consistent with the Motivation System Theory proposed by Ford?
2. Do students' personal goals, agency beliefs, and emotions of using the web materials relate to learning achievement?
3. Do students' personal goals, agency beliefs, and emotions relate to each other?

Methods and procedures

An instrument was designed to measure three components of motivation: personal goals, agency beliefs, and emotions (Appendix A). The instrument has ten items with three parallel responses. The three responses measure personal goals, agency beliefs, and emotions, respectively. Personal goals are directly questioned in the instruction. Personal beliefs are indicated by the confidence students have in using the web materials in assisting their learning. Emotions are represented by how much interest students have in using the web materials to study the course. Learning achievement is measured by the course grade.

To ensure content validity of the motivation instrument, five content experts were invited to screen instrument items. Two of them have expertise in instrument development. Another two experts have experience in designing web pages to assist students' learning. One has expertise in instructional design theory relating to use of on-line resources to enhance learning. The finalized instrument was put on-line to allow students to fill it out at their convenience (Appendix B). By writing their full name, students granted their permission for the researcher to look at their course grades.

Three hundred and fifty six students have participated in the study. These students have attended undergraduate fundamental biology classes in which the designed web pages have the following features: (1) there are class syllabi to announce requirement and on-going status of the course; (2) there are hyperlinks to additional on-line resources in order to enhance understanding of biology concepts; (3) there are on-line interactive exams for students to practice before the semester quizzes and final exams (Appendix C). After the final exam, students filled out the on-line questionnaire linked right before the exam grade page. The questionnaire data were sent directly to the researcher's e-mail account.

Cronbach (1951) alpha reliability values for three components of the motivation were obtained by SPSS 8.0 to analyze the internal consistency of the instrument. A confirmatory factor analysis with Lisrel VI was used to examine the construct validity of the motivation instrument (Question 1). The causal paths among the personal

goals, agency beliefs, emotions, and learning achievement were tested using the structural equation modeling analysis (Question 2 and Question 3).

In this study, for judging whether the data model is consistent with the theoretical model, we used three indexes, X^2 goodness of fit, Tucker Lewis index, and Bentler Bonett index. The closer to 1 of these indexes, the better the data model would fit the theoretical model (Kenny, 1979).

Results

Initial data screening

The SPSS 8.0 statistical package was used to conduct the screening of data. For 30 items, there were 351 complete cases out of 365 participants. Two hundred and forty-nine students gave permission to the researcher to look at their course grades. First, the normality of the data was checked. The N: P ratio for the 30 items was 11:1. Twenty-five out of 30 instrument items and the course grades had good normality. Data transformation (Tabachnick & Fidell, 1989) was then conducted on items with poor normality. After the transformation, all items had good normality.

Cronbach alpha reliability analysis on 30 items was conducted with SPSS 8.0 on personal goals, agency beliefs, and emotions and resulted in 0.85, 0.89, and 0.91 respectively.

A confirmatory factor analysis with Lisrel VI was initially conducted on 30 items, but the data model did not fit regardless of specifications. A structural equation modeling with Lisrel VI was done on 30 items and the course grades. The original data model did not converge. These indicated that the designed motivation instrument and the empirical data did not match or correspond. We then carefully examined all 30 items on the instrument by comparing them with features of the web pages in all four courses. We found out that some features of the web pages in the four courses did not reflect a few items on the instrument. For instance, the web pages of three courses did not promote collaborative work as indicated on item 2, "collaborate with other students". We then selected 12 items for further analysis, four each for personal goals, agency beliefs, and emotions (Appendix D). These 12 items reflect common features on the web pages of all four courses.

Reliability of the motivation instrument

Cronbach alpha reliability analysis was conducted on 12 selected items for personal goals, agency beliefs, and emotions. It resulted in 0.84, 0.85, and 0.89 accordingly (Table 1).

Table 1 Factor Loadings in Confirmatory Factor Analysis

	Personal Goals	Agency Beliefs	Emotions
1. Know the key points.	0.832	0.848	0.773
3. Better understand concepts.	0.863	0.834	0.873
8. Prepare for exams.	0.633	0.760	0.663
10. Get a better grade.	0.695	1.036	0.653

Note.
N = 345
All loadings are significant at 0.01 level.
F1: Personal Goals, Cronbach Alpha Reliability Coefficient = .84
F2: Agency Beliefs, Cronbach Alpha Reliability Coefficient = .85
F3: Emotions, Cronbach Alpha Reliability Coefficient = .89

Construct validity of the motivation instrument

The confirmatory factor analysis with Lisrel VI was conducted on 12 items (n = 345). As shown on Table 2, the original model had poor fit (significance of X^2 (66) = 0.00, adjusted X^2 (66) goodness of fit was 0.69). After correlated errors were considered among items, the model had good fit. X^2 was not significant (p=. 22). The adjusted X^2 goodness of fit index was 0.95, Tucker Lewis index was .99, and Bentler Bonett index was .99 (Table 2). The factor loadings are from .63 to 1.03 and they were all significant (Table 1)

Table 2 Confirmatory Factor Analysis Indexes

	X^2	Significance of X^2	Degree of Freedom	Adjusted X^2 Goodness of fit
Null Model	2748.84	0.000	66	0.122
Original Model	381.73	0.000	51	0.692
Final Model	18.93	0.22	15	0.952

Note:
Tucker Lewis Index = .99
Bentler Bonett Index = .99

Causal paths among personal goals, agency beliefs, and emotions

The structural equation modeling analysis was then performed with Lisrel VI on the 12 selected items of the motivation instrument and the course grade (n = 245). As shown on Table 4, the original model did not fit (significance of X^2 (78) = 0.00, adjusted X^2 (78) goodness of fit = 0.15). After the paths were respecified by deleting the non-significant paths and the measurement model was considered with correlated errors, the model had good fit (significance of X^2 (38) = 0.06, adjusted X^2 (38) goodness of fit = 0.923). The Tucker Lewis index was 0.98, and the Bentler Bonett index was 0.97 (see Table 4). The factor loadings are from .64 to .87, and they were all significant (Table 3). As the path diagram shows (Figure 1), the Beta from personal goals to course grade was 0.30, the Beta from personal goals to emotions was 0.78, the Beta from emotions to agency beliefs was 0.82. These three paths were significant at 0.01 level.

Table 3 Factor Loadings in Structural Equation Modeling Analysis

	Personal Goals	Agency Beliefs	Emotions
1. Know the key points.	0.813	0.832	0.802
3. Better understand concepts	0.827	0.844	0.874
8. Prepare for exams.	0.644	0.766	0.700
10. Get a better grade.	0.660	0.742	0.665

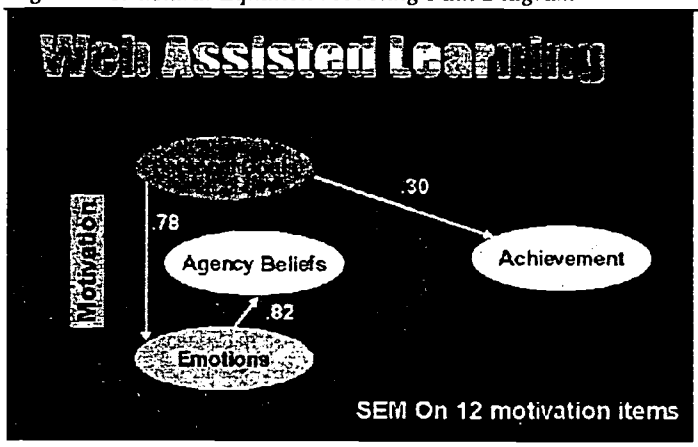
Note:
All loadings are significant at 0.01 level.

Table 4 Structural Equation Modeling Indexes

	X^2	Significance of X^2	Degree of Freedom	Adjusted X^2 Goodness of fit
Null Model	1992.91	0.000	78	0.146
Original Model	284.22	0.000	63	0.724
Final Model	53.02	0.06	38	0.923

Note:
N = 245
Tucker Lewis Index = .98
Bentler Bonett Index = .97

Figure 1. Structural Equation Modeling Path Diagram



Relationships among personal goals, agency beliefs, and emotions

As shown on Table 5, the correlation coefficient between personal goals and agency beliefs was 0.55 (p=0.00). The correlation coefficient between agency beliefs and emotions was 0.73 (p=0.00). The correlation coefficient between personal goals and emotions was 0.61 (p=0.00). All the correlation coefficients were significant at 0.01 level. The correlation coefficients were correspondent with the results of the structural equation modeling analysis.

Table 5 Correlation's Among Personal Goals, Agency Beliefs, and Emotions

	Personal Goals	Agency Beliefs
Agency Beliefs	0.614 **	
Emotions	0.546 **	0.729 **

Note:
** Correlation is significant at 0.01 level.

Discussion

The Cronbach alpha reliability coefficients indicated that the motivation instrument with 12 selected items was moderately reliable. The results of the confirmatory factor analysis on the 12 selected items of the motivation instrument implied that the responses to the 12 items were fairly consistent with the theoretical motivation construct proposed by Ford. Therefore, from a theoretical perspective, Ford's concept of motivation with three factors, personal goals, agency beliefs, and emotions was supported.

Empirically, it is suggested that the motivational instrument with 12 selected items may be used by other researchers when there are common features on the web pages used in their studies. It is not recommended that the initial motivation instrument with items that were not selected for the data analysis be adopted for further studies.

The data through structural equation modeling analysis supported that there were significant and direct causal links between students' personal goals and their course grades, between personal goals and emotions, and between emotions and personal agency beliefs. These findings demonstrated that students' personal goals were the major contributor to their personal interests, their confidence, and their learning achievement in such a web assisted learning environment. Additionally, students' interests influenced by their learning goals directly impact their confidence regarding use of the web pages as learning tools.

The SEM results demonstrated a gap between the empirical data and Ford's theoretical motivational model. The empirical data model did not show significant causal paths between students' interests and their course grades and between their agency beliefs and their course grades. Several reasons might cause these findings. It might be due to the validity of the course grades in measuring students' learning achievement. The course grades might not truly reflect the students' learning achievement assisted by the web pages. As we went back to examine the course grades provided by the instructor, we found that the course grades included semester exams and the lab performance. The web pages used in four courses provided little help in improving students' lab performance. Therefore, it is more likely that the contributions of interests and agency beliefs in web assisted learning were minimized when the lab performance was considered to be part of students' learning achievement. If we had used solely the exam grades to measure students' learning achievement mainly assisted by web pages, we might have found different results. In

future studies, it is recommended that the validity of learning achievement should be carefully examined before the data analysis.

Another reason might be the reliability of the motivation instrument with the 12 selected items. As the reliability coefficients are around 0.85 for N:P ratio of 11:1, it showed relatively good reliability of the motivation instrument but not high reliability. The higher the reliability, the more accurate the results would be.

Finally, there was a lack of empirical support for Ford's MST in such a web assisted learning environment. It might be questionable that three components, personal goals, agency beliefs, and emotions, all worked together and contributed to learning achievement (Ford, 1992). It might be true that only the component of personal goals not agency beliefs or emotions is the major direct contributor to learning achievement.

Based on the evidence provided from this study, we are confident in saying that at least students' personal goals in web assisted learning were the major contributors to their learning achievement. Therefore, when they design web pages to assist students' learning, instructors or web designers should mainly focus on designing the features of the pages that would help students to achieve their specific learning goals. These learning goals are stated as, knowing the key points, better understanding concepts, preparing for exams, and getting better grades.

As the research study was conducted on four biology courses assisted by web pages, the results were not generalizable to other courses assisted by web pages or similar biology courses with different features from those in our study. To generalize the research findings to different courses, we would like to continue this study with the 12-item motivation instrument by recruiting more students from variety of courses, in which the assisted web pages have the common features of this study.

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Appendix A

Student Survey

This survey is designed to study your opinions about using **the web materials to assist your study.** For each of the behaviors, three questions are asked. Circle the responses that best describe your opinions. There are no right or wrong answers to these questions. Your responses are strictly anonymous. The data will be summarized so that no individual can be identified.

Please do not circle here.

1. How strongly do you think the following possible **goals** apply to you?

1 2 3 4 5

not strong<----------> very strong

2. How **interested** are you in using the web materials to help you do the following?

1 2 3 4 5

no interest<----------> high interest

3. How **confident** are you that you use the web materials to do the following?

1 2 3 4 5

not confident<----------> very confident

Please circle the following responses.

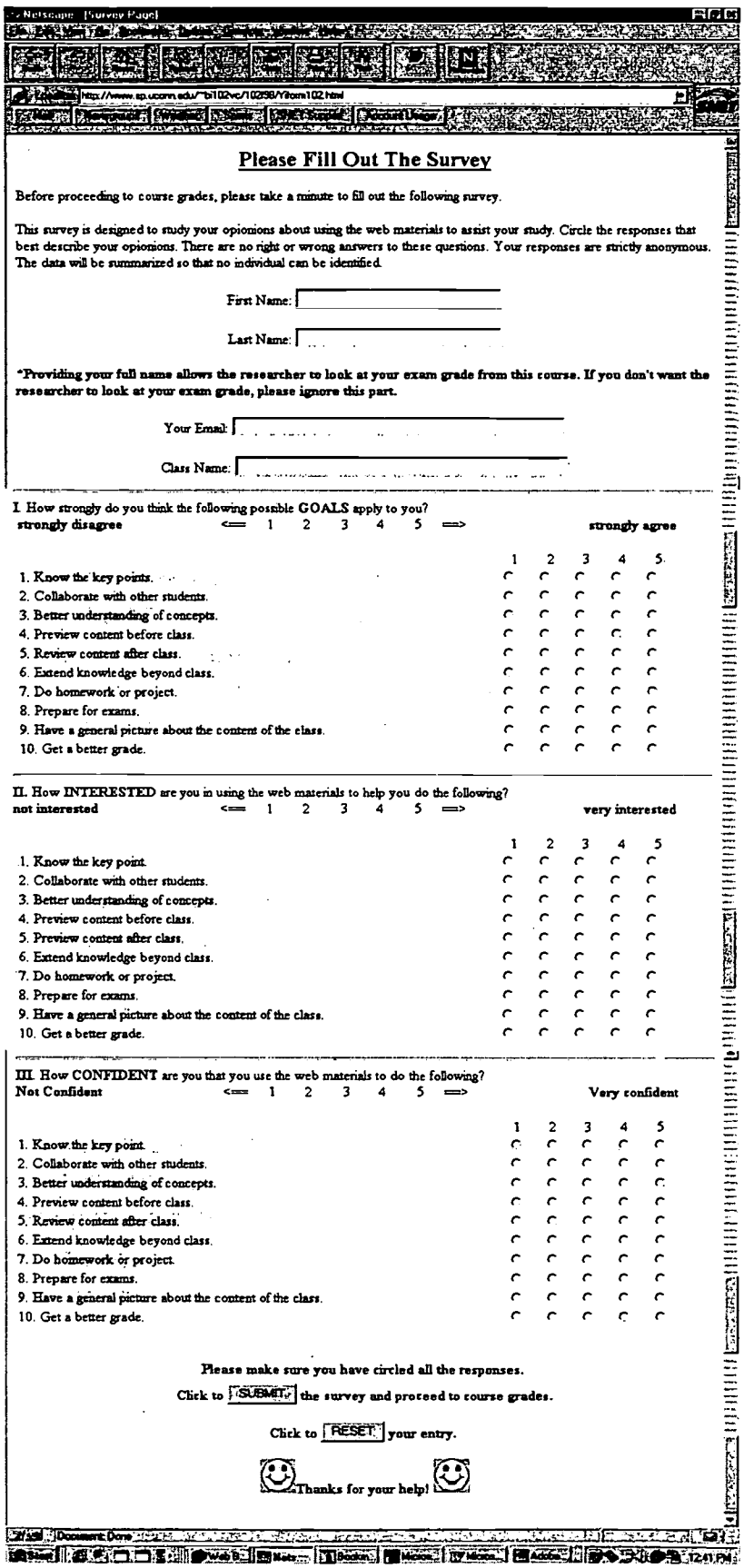
	Goals	Interest	Confidence
1. Know the key points.	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
2. Collaborate with other students.	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
3. Better understand concepts.	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
4. Preview content before class.	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
5. Review content after class.	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
6. Extend knowledge beyond class.	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
7. Do homework or project.	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
8. Prepare for exams.	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
9. Have a general picture about content of the class.	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
10. Get a better grade.	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5

I grant permission for the researcher to look at my exam grade for the explicit purpose of this study.

Print your name _____

Sign your name _____

Appendix B: The On-Line Motivational Survey



Netscape: [Survey Page]

Please Fill Out The Survey

Before proceeding to course grades, please take a minute to fill out the following survey.

This survey is designed to study your opinions about using the web materials to assist your study. Circle the responses that best describe your opinions. There are no right or wrong answers to these questions. Your responses are strictly anonymous. The data will be summarized so that no individual can be identified.

First Name:

Last Name:

***Providing your full name allows the researcher to look at your exam grade from this course. If you don't want the researcher to look at your exam grade, please ignore this part.**

Your Email:

Class Name:

I. How strongly do you think the following possible GOALS apply to you?

strongly disagree <== 1 2 3 4 5 ==> **strongly agree**

	1	2	3	4	5
1. Know the key points.	○	○	○	○	○
2. Collaborate with other students.	○	○	○	○	○
3. Better understanding of concepts.	○	○	○	○	○
4. Preview content before class.	○	○	○	○	○
5. Review content after class.	○	○	○	○	○
6. Extend knowledge beyond class.	○	○	○	○	○
7. Do homework or project.	○	○	○	○	○
8. Prepare for exams.	○	○	○	○	○
9. Have a general picture about the content of the class.	○	○	○	○	○
10. Get a better grade.	○	○	○	○	○

II. How INTERESTED are you in using the web materials to help you do the following?

not interested <== 1 2 3 4 5 ==> **very interested**

	1	2	3	4	5
1. Know the key point.	○	○	○	○	○
2. Collaborate with other students.	○	○	○	○	○
3. Better understanding of concepts.	○	○	○	○	○
4. Preview content before class.	○	○	○	○	○
5. Preview content after class.	○	○	○	○	○
6. Extend knowledge beyond class.	○	○	○	○	○
7. Do homework or project.	○	○	○	○	○
8. Prepare for exams.	○	○	○	○	○
9. Have a general picture about the content of the class.	○	○	○	○	○
10. Get a better grade.	○	○	○	○	○

III. How CONFIDENT are you that you use the web materials to do the following?

Not Confident <== 1 2 3 4 5 ==> **Very confident**

	1	2	3	4	5
1. Know the key point.	○	○	○	○	○
2. Collaborate with other students.	○	○	○	○	○
3. Better understanding of concepts.	○	○	○	○	○
4. Preview content before class.	○	○	○	○	○
5. Review content after class.	○	○	○	○	○
6. Extend knowledge beyond class.	○	○	○	○	○
7. Do homework or project.	○	○	○	○	○
8. Prepare for exams.	○	○	○	○	○
9. Have a general picture about the content of the class.	○	○	○	○	○
10. Get a better grade.	○	○	○	○	○

Please make sure you have circled all the responses.

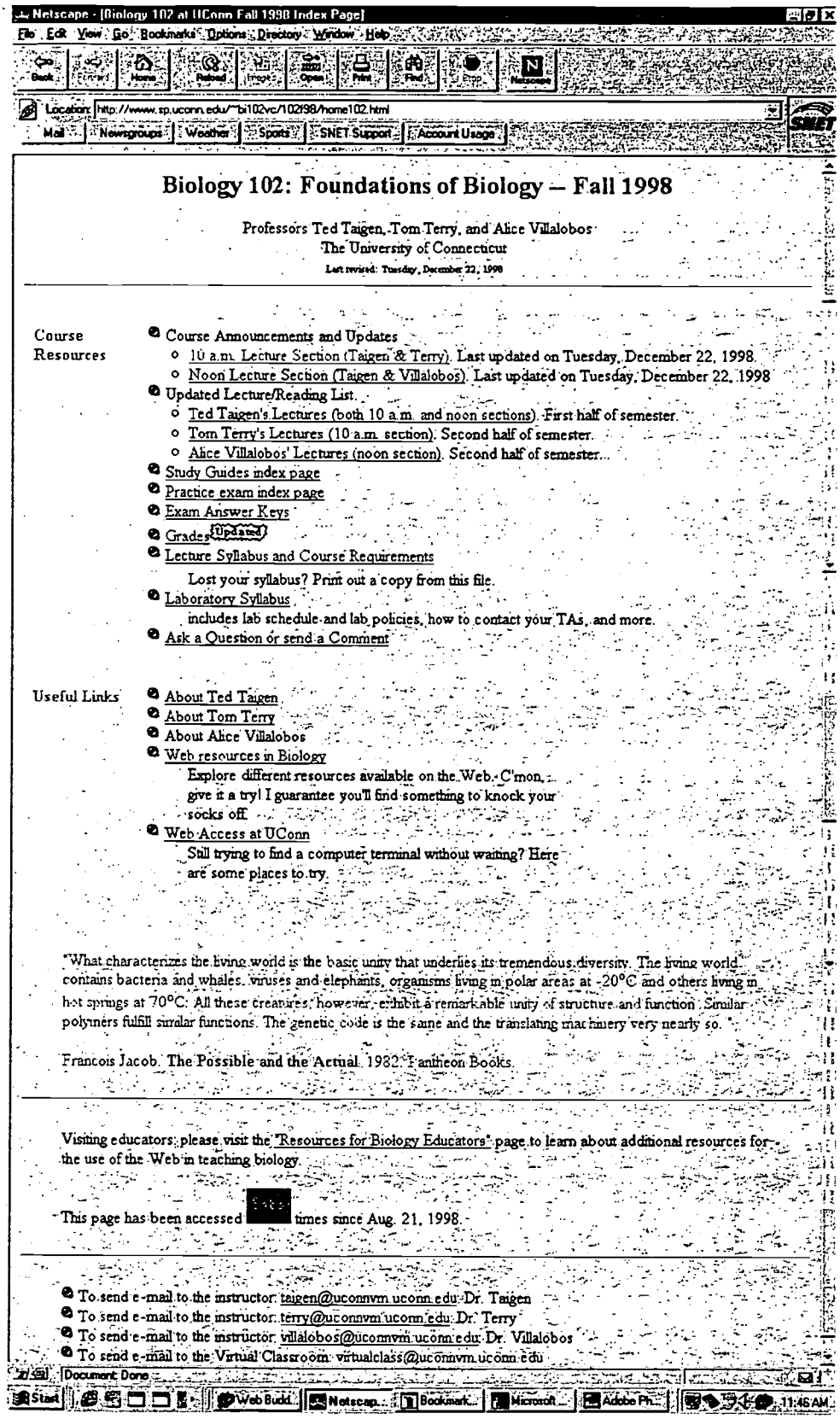
Click to [SUBMIT] the survey and proceed to course grades.

Click to [RESET] your entry.

Thanks for your help!

Document Done

Appendix C: A Sample Web Page



Netscape - [Biology 102 at UConn Fall 1998 Index Page]

File Edit View Go Bookmarks Options Directory Window Help

Location: http://www.sp.uconn.edu/~bi102vc/102f98/home102.html

Mail Newsgroups Weather Sports SNET Support Account Usage

Biology 102: Foundations of Biology – Fall 1998

Professors Ted Taigen, Tom Terry, and Alice Villalobos
The University of Connecticut
Last revised: Tuesday, December 22, 1998

Course Resources

- Course Announcements and Updates
  - 10 a.m. Lecture Section (Taigen & Terry). Last updated on Tuesday, December 22, 1998.
  - Noon Lecture Section (Taigen & Villalobos). Last updated on Tuesday, December 22, 1998
- Updated Lecture/Reading List.
  - Ted Taigen's Lectures (both 10 a.m. and noon sections). First half of semester.
  - Tom Terry's Lectures (10 a.m. section). Second half of semester.
  - Alice Villalobos' Lectures (noon section). Second half of semester.
- Study Guides index page
- Practice exam index page
- Exam Answer Keys
- Grades (Updated)
- Lecture Syllabus and Course Requirements

  Lost your syllabus? Print out a copy from this file.
- Laboratory Syllabus

  includes lab schedule and lab policies, how to contact your TAs, and more.
- Ask a Question or send a Comment

Useful Links

- About Ted Taigen
- About Tom Terry
- About Alice Villalobos
- Web resources in Biology

  Explore different resources available on the Web. C'mon, give it a try! I guarantee you'll find something to knock your socks off.
- Web Access at UConn

  Still trying to find a computer terminal without waiting? Here are some places to try.

"What characterizes the living world is the basic unity that underlies its tremendous diversity. The living world contains bacteria and whales, viruses and elephants, organisms living in polar areas at -20°C and others living in hot springs at 70°C. All these creatures, however, exhibit a remarkable unity of structure and function. Similar polymers fulfill similar functions. The genetic code is the same and the translating machinery very nearly so."

Francois Jacob. The Possible and the Actual. 1982. Pantheon Books.

Visiting educators: please visit the "Resources for Biology Educators" page to learn about additional resources for the use of the Web in teaching biology.

This page has been accessed [redacted] times since Aug. 21, 1998.

- To send e-mail to the instructor: taigen@uconnvm.uconn.edu Dr. Taigen
- To send e-mail to the instructor: terry@uconnvm.uconn.edu Dr. Terry
- To send e-mail to the instructor: villalobos@uconnvm.uconn.edu Dr. Villalobos
- To send e-mail to the Virtual Classroom: virtualclass@uconnvm.uconn.edu

Document Done

Start Web Budd... Netscap... Bookmark... Microsoft... Adobe Ph... 11:46 AM

Appendix D

Student Survey

This survey is designed to study your opinions about using the web materials to assist your study. For each of behaviors, three questions are asked. Circle the responses that best describe your opinions. There are no right or wrong answers to these questions. Your responses are strictly anonymous. The data will be summarized so that no individual can be identified.

Please do not circle here.

1. How strongly do you think the following possible goals apply to you?

1 2 3 4 5

not strong<----------> very strong

2. How interested are you in using the web materials to help you do the followings?

1 2 3 4 5

no interest<----------> high interest

3. How confident are you that you use the web materials to do the following?

1 2 3 4 5

not confident<----------> very confident

Please circle the following responses.

*1. Know the key points.	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
2. Collaborate with other students.	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
*3. Better understand concepts.	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
4. Preview content before class.	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
5. Review content after class.	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
6. Extend knowledge beyond class.	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
7. Do homework or project.	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
*8. Prepare for exams.	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
9. Have a general picture about content of the class.	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
*10. Get a better grade.	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5

I grant permission for the researcher to look at my exam grade for the explicit purpose of this study.

Print your name _____

Sign your name _____

*** Item 1, 3, 8, and 10 were selected for confirmatory factory analysis and structural equation modeling analysis.**

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