

Evaluation of Students Enrolled in Online Human and Child Nutrition Courses

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Abstract

The objective of this study was to evaluate influences of age, online experience, classification, course type and semester on characteristics of students enrolled in online Nutrition courses. Of the 655 students enrolled in online introductory Human and Child Nutrition courses during a 4 year period, 354 responded to an initial survey and 281 responded to a final survey. Educators can use presented information for development and/or improvement of online nutrition courses, such as determining methods of teaching, use of media, presentation of materials, and methods of communication.

Introduction

Because of the personal nature of the material, introductory Nutrition courses can be easily adapted to online teaching methods. Introductory Nutrition courses are suitable for inclusion of personal application exercises, in addition to Internet, scientific journal and textbook research. Online courses continue to expand and make up the largest growth in higher education enrollments.¹ A comprehensive U.S. study revealed that 77% of prospective college student in the US would consider enrolling in an online program.² With this large expanding emphasis on teaching online, research is critical to optimize the learning experience; however, research is only at the beginning stages of evaluating and understanding the online student and course environment.³

Online students are typically older,^{3,4} more likely to be seniors,⁵ more comfortable with their current level of the knowledge of the subject⁵ and are more prone to have prior computer skills and Internet course experience.⁶ Students enrolled in online introductory Biology courses judged themselves as having a more favorable attitude towards computers, more apt to work independently, more self disciplined, better time managers, but not favorable to working in groups.⁷

Outcomes appear at least similar between typical and online courses. Similar assessment scores, completion of projects, participation performance and final grades were reported in introductory Nutrition classes either taught in the classroom or email-delivered.⁵ Students in online versus traditional introductory Biology courses had similar grades, similar development of skill (graphing and scientific experimentation)⁷, similar mastery of course content and similar perception of learning.⁸ And students in an online Psychology course even outperformed traditionally-enrolled students on exams.⁹

Online students report that they are satisfied with the variety of subjects, that they felt the online courses are more academically demanding than traditional courses and that they received a quality academic experience.^{5, 9-13} Students who are not satisfied with online courses or those receiving failing grades tend not to interact with other classmates or the professor to a great extent^{14,15} and students consider the discussion board, communication with instructors and classmates as advantages of web-enhanced courses.¹⁶ Students with prior online course or technology experience also appear to be more satisfied with online courses.^{3,5}

While a substantial base of knowledge exists concerning online courses in general, limited information is available specifically regarding nutrition courses. Thus the objective of this research was to determine influences of two introductory Nutrition courses and semester taken on student characteristics, initial experiences, initial perceptions, enrollment, student outcomes, final perceptions, satisfactions, time involvement, course involvement, behavior improvements and skills improvements. The impact of age, online experience and classification was also assessed for most criteria.

Methods

Six hundred twenty two students across a wide variety of majors who were registered in online introductory Human and Child Nutrition courses during a four year period were invited to respond to an initial survey during the first week of class and to a final survey after completion of the course. The procedures of the invitation and surveys and course performance data were approved by the university human research committee and were voluntary and ensured confidentiality. Final course grades and course and individual assignment completion were recorded. Over the course of the study, 360 students enrolled in 14 sections (26.5 students/section) of Human Nutrition and 262 students enrolled in 10 sections (25.8 students/section) of Child Nutrition.

Course/Student Description

Two introductory level Nutrition courses were offered online via Blackboard; Human Nutrition, three credit hours and Child Nutrition, two credit hours. Human Nutrition was offered every semester, while Child Nutrition was offered one or two of the three yearly semesters. Since the Human and Child Nutrition courses are part of the core requirement of the university and have no prerequisites, students majoring in a variety of degrees enrolled. While both courses consisted of basic nutritional concepts, the Child Nutrition course included only birth to age 18, pregnancy and lactation, but the Human Nutrition course included all stages of life. Both courses, taught by the author, used the same text, involved the same level of content, were directed toward first year students and consisted of eight equally weighted assignments (due every two weeks in the spring and fall--sixteen week session-- and every week in the summer--eight week session) involving book research, application exercises, online research and scientific journal research. Applications of knowledge for health improvement, in addition to fundamental nutritional principles, were presented in the courses.

The Surveys

The initial survey consisted of 22 questions, administered during the first week of class, included questions regarding demographic data, motivations for enrolling, perceived initial technical experiences, perceived current nutrition knowledge and perceived adherence to food pyramid. For most questions answers included yes, no and where appropriate, somewhat.

The final survey consisted of 35 questions administered after the final assignment was submitted, including questions dealing with attitudes toward the course, types of involvement in the course and changes in knowledge and skills as a result of the course. Answers were based on a modified Likert scale (1=strongly agree; 2= agree; 3=disagree; 4=strongly disagree).

Statistical Analysis

All students were divided into two age groups and two online experience groups. Age Group 1 was less than or equal to 25 years of age and Age Group 2 was over 25 years of age. Online Experience Group 1 had no previous online courses and Online Experience Group 2 had taken one or more previous online courses. Since few males participated, comparisons based on gender were not included in the study.

Some student characteristics (age, miles from campus, prior number of online courses, current online courses, previous college nutrition courses) and mean enrollment and performance data (enrolled, dropped, grades awarded, assignment completion) for each course, semester and year were determined by the General Linear Model (GLM) procedures of the Statistical Analysis System.¹⁷

Frequency data of the initial surveys were determined using the Frequency procedures, Chi Square option of the Statistical Analysis System.¹⁷ Student Characteristics [(age group, online experience group, gender, classification (freshman-first year, sophomore-second year, junior -third year, senior-fourth year, or post-baccalaureate) and prior nutrition experience group (no, some, adequate, or exceptional)] were acquired for each course (Human Nutrition or Child Nutrition), semester (spring, summer, or fall) and year (1, 2, 3, or 4). The post baccalaureate classification included both masters and doctoral level students

analyzed separately, but presented together because of the small numbers of students. In addition, frequency data for the questions regarding motivations for enrolling, perceived initial technical experiences, perceived current nutrition knowledge and perceived adherence to food pyramid were determined based on course, semester, year, age group, online experience group and classification.

Final and initial survey data were merged by student. Final survey question means for each course, semester, year and in a separate analysis for age group, online experience group and classification were determined by the general linear model procedures of Statistical Analysis System.¹⁷ In all analyses where appropriate, means were separated using Tukey's studentized range test and standard errors of the means were presented as a measure of variance.

Results and Discussion

Characteristics

Student response. Three hundred fifty four of the 622 (57%) originally enrolled participated in the initial survey and 281 of the 622 (45%) originally enrolled participated in the final survey; however, because some students omitted some information only 257 surveys were available for some data. Often students left answers or whole sections blank, thus resulting in small differences in total numbers of students participating in each question. Of the total that participated in the initial survey, 215 (61%) were enrolled in Human Nutrition and 139 (39%) were enrolled in Child Nutrition (Table 1), this corresponding to the number of course sections offered. Of the total number of students that completed the entire final survey, 182 (71%) were Human Nutrition students and 75 (29%) were Child Nutrition students.

Gender. In both courses, female students greatly outnumbered male students (87 to 13%), but this trend was even more evident in the Child Nutrition course (96% female), conceivably related to the requirement of Education majors to complete Child Nutrition. Likewise female students dominated (73%) online Consumer Science and Merchandizing courses.¹⁸ Attitudes of females toward web-based general biology learning are more positive and females use the web more often than males.¹⁹

Age. Even though about half of all students fell above and below 25 years of age, students ranged in age from 17 to 56, were predominantly (57%) between 20-29 years of age and averaged 27.5 years of age. Older students populated the summer courses in much greater numbers than younger students [summer (61% in group 2); fall (33% in group 2); spring (46% in group 2)]. Dutton et al⁴ found online students to be typically older and less likely to be traditional students; conversely, Wilson-Jones and Caston²⁰ reported that older and non-traditional students preferred a traditional human growth and development course over its web-enhanced counterpart. Temple²¹ also reported that younger students are generally more receptive to computer based learning than older students.

Online experience. Half of the students who participated had not previously taken an online course and similar numbers of first time online students were attracted to both courses, in all semesters and years of the study. Students reported having previously completed a mean of 1.65 online courses prior to enrolling in the course and were currently enrolled in a mean of 2.03 online courses. Prior Internet course experience is considered important by students engaged in Internet-delivered instruction.⁶

Classification. It appeared that seniors, juniors and sophomores were more attracted to the online Nutrition courses than freshman or post-baccalaureate students (26-28% versus 4-14%). Likewise, Knous⁵ reported that when given a choice between a traditional and email option of a course, more seniors choose the email option. Stewart et al¹⁸ reported that the majority of students enrolled in Consumer Science and Merchandizing courses were seniors. Seniors were more likely to be part of the spring Human Nutrition courses, while freshman were more likely to be part of the summer Child Nutrition courses. Over the course of the study, freshman and sophomores became more enticed by the online Nutrition courses possibly because of the increased offerings and advertisement, thus increased awareness of offerings during this time period.

Table 1. Characteristics of Students [Number(Percent)] Enrolled in Online Human and Child Nutrition Courses during the Spring, Summer and Fall Semesters Over a 4 Year Period

	Course		Semester			Year			
	Human	Child	Spring	Summer	Fall	1	2	3	4
<i>Characteristic</i>									
N	215(61)	139(39)	112(32)	152(43)	90(25)	76(21)	102(29)	154(44)	21(6)
Gender ^{*‡}									
Females	175(81)	133(96)	94(84)	138(91)	76(84)	67(88)	95(92)	132(86)	14(67)
Males	40(19)	6(4)	18(16)	14(9)	14(16)	9(12)	8(8)	22(14)	7(33)
Age Group ^{†‡}									
Group 1	106(49)	74(52)	60(54)	60(39)	60(67)	34(44)	43(41)	91(59)	12(57)
Group 2	110(51)	67(48)	52(46)	95(61)	30(33)	43(56)	61(59)	64(41)	9(43)
Online Experience [¶]									
Group 1	104(49)	69(49)	50(45)	83(54)	40(45)	46(61)	51(50)	69(45)	7(33)
Group 2	110(51)	71(51)	62(55)	70(46)	49(55)	30(39)	52(51)	85(55)	14(67)
Classification ^{*†‡}									
Freshman	25(12)	26(18)	4(4)	41(27)	6(7)	6(8)	18(17)	27(17)	0(0)
Sophomores	48(22)	43(31)	32(29)	28(18)	31(34)	15(20)	25(24)	48(31)	3(14)
Juniors	58(27)	43(31)	32(29)	38(25)	31(34)	28(36)	31(30)	42(27)	0(0)
Seniors	79(36)	21(15)	42(38)	39(25)	19(21)	23(30)	26(25)	34(21)	17(81)
Post Baccalaureate [§]	6(3)	8(5)	2(2)	9(6)	3(3)	5(6)	4(4)	4(3)	1(5)

* Course Effect (P < .05).

† Semester Effect (P < .05).

‡ Year Effect (P < .05).

§ Post baccalaureate includes both masters and doctoral students, analyzed separately.

|| Group 1) less than or equal to 25 years of age; Age Group 2) over 25 years of ages.

¶ Group 1) no previous online courses taken; Group 2) 1 or more previous online courses taken.

Initial Experiences

Attendance. During the 4 years of the study, online course offerings at the university attracted 9% of all students enrolled in the online Nutrition courses (Table 2). Online Nutrition courses attracted more part-time freshman (12% part-time) and seniors (15% part-time) than sophomores (3% part-time) or juniors (4% part-time). More students in the older age group (20% in Group 1 versus 6% in Group 2) and with prior online course experience (17% in Group 2 versus 8% in Group 1) appear to have been attending the university only because of the variety of online courses offered. However, classification was not a factor in a student's attendance for online Nutrition or other online course offerings. When asked reasons for taking the course online, students reported a variety of reasons including decreasing commuting time, allowing time to work, helping with child care situation and disliking lecture courses. Other researchers reported that the most important reasons motivating students to enroll in online courses are to decrease conflict with work, decrease commuting time and for convenience, interactivity and flexibility.^{3,4,11,12} Since the average commute time was over one hour, students enrolling in the online Nutrition courses reported similar reasons. Having family commitments, heavy workload and added flexibility were also stated to be reasons for enrolling in an online Biology course.⁷

Technology experience. About half of all students declared to be experienced with computers (53%) and the Internet (55%). Most of the remainder of the students (41%) maintained that they were somewhat experienced with computers and the Internet. Seventy five percent of all students asserted that they were experienced with email, while only 21% stated that they were somewhat experienced with email. Only between 3-5% of all students reported no experience with computers, the Internet or email. Similarly, 96% of full time registered nurses enrolled in an online baccalaureate nursing program used email, while only 55% reported themselves to be familiar with computers.¹³ Online freshman Biology students had a more favorable attitude towards computers than their traditional peers.⁷ Although age did not influence experience with computers and the Internet in this study, Temple et al²¹ reported that older students enrolled in a home study introductory Nutrition course had less computer and Internet skills and were less receptive to computer based learning. Prior computer experience is an important factor in performance in online courses⁴ and computer skills are considered important by students engaged in Internet-delivered instruction.⁶ However, prior computer experience was independent of web use in a web-enhanced introductory Biology course.¹⁹

Students enrolled during the summer session considered themselves less experienced with computers, the Internet and email as compared to students enrolled in the spring or fall. Forty two percent of summer students, 68% of spring students and 54% and fall students reported they were experienced with computers. Forty four percent of summer students, 66% of spring students and 62% and fall students reported they were experienced with the Internet. Sixty six percent of summer students, 83% of spring students and 81% and fall students reported they were experienced with email. This could have been influenced by the larger number of older students and freshmen who enrolled during the summer semesters. The number of students who stated they were experienced with computers, the Internet and email, steadily increased during the course of the study, which was likely because of the increasing availability of Internet courses during this time.

Not only were summer students less experienced with computers, the Internet and email and were less likely to use the university online library resources than spring or fall students (38 versus 52 and 42%). Fifty eight of the students never used the university library's online resources.

Computer and Internet experience or use of online university library resources was not related to prior online course experience. Younger students were more experienced with computers and the Internet but had similar experience with email and the online university library. Classification did not influence experience with computers, the Internet and email. However, it appeared that as students took more online courses they were more likely to use the online library resources.

Independent learning. Nearly all (79%) students professed to be an independent learner, while 20% reported to be somewhat of an independent learner and 1% reported to not be an independent learner. Eighty three percent of older students claimed that they were an independent learner; while only 74% of

younger students classified themselves similarly. Classification, course and prior online experience did not influence whether a student professed to be an independent learner.

In comparison, students enrolled in an email versus a traditional delivery of a Nutrition course considered themselves to be more motivated and responsible for their own learning.⁵ Because of the nature of Internet courses, it was expected that most students enrolled in online courses would be independent learners;²² however, only one fifth of all students considered themselves somewhat independent learners. Contrary to expectations, apparently no particular learning style predominates in students who enroll in online courses,²³⁻²⁵ and learning strategies among online students are similar to students enrolled in traditional courses.²⁶ Classification did not influence whether a student professed to be an independent learner in the online Nutrition courses, but contrary to this Knous⁵ found that with increased class standing came an increased acceptance of personal responsibility for learning. As students gain more Internet experience they become more responsible for their own learning;²⁷ however, online students in a Speech and Language Therapy course were reluctant to develop an independent learning style.²⁸

Current nutrition knowledge/application. Although students only reported previously completing a mean of 0.25 college level nutrition courses, most students considered themselves to have some (68%) to adequate (24%) nutritional knowledge, while only 8% reported having no nutritional knowledge on initiation of the course (data not shown). Knous⁵ observed that more students who choose a traditional version of a Nutrition course as compared to an email version stated that they were not exceedingly comfortable with their level of nutrition knowledge. Similarly, students with higher biology pre-test scores were more apt to enroll in an introductory online versus a traditional Biology course.⁷ It appears that students who feel that they have at least some nutrition knowledge base are more likely to enroll in the online version of the course.

While the majority of the online Nutrition students considered themselves to have some nutrition knowledge, even more (84%) did not follow the food pyramid. In comparison, only 44% of non-nutrition majors enrolled in a traditional introductory Nutrition course had heard of the food pyramid and 30% of the students who had heard of the pyramid had never seen it.²⁹ These same students only consumed between 16 (grain group) to 56% (fruit group) of the recommended servings for each food group.²⁹ Likewise, Schuette et al³⁰ reported only 45% of college students consumed at least the minimum amount of meat servings and 33% did not consume any fruits, while 70% ate the minimum amount of vegetable servings.

Table 2. Initial Experiences (Attendance, Technology Experience, Learning Style and Food Pyramid Usage) in all Students (N=354) [Number(Percent)]Enrolled in Human and Child Nutrition Courses Over a 4 Year Period

<i>Item</i>	No	Yes	Somewhat
<i>Attendance</i>			
Regular student [†]	30(9)	316(91)	-----
Only for nutrition course	347(98)	7(2)	-----
Only for variety of online courses [‡] [§]	306(87)	45(13)	-----
<i>Technology Experience</i>			
Computers [*] [†] [‡]	20(6)	189(53)	146(41)
Internet [*] [†] [‡]	14(4)	198(56)	144(40)
Email [*] [†] [§]	11(3)	267(75)	77(22)
Online library resources [*]	203(58)	150(42)	-----
Independent Learner	5(1)	279(79)	70(20)
Use of Food Pyramid	296(84)	56(16)	-----

*Semester Effect (P < .05).

†Year Effect (P < .05).

‡Age Group Effect (P < .05).

§Online Experience Effect (P < .05).

|| Classification Effect(P < .05).

Enrollment and Performance

Enrollment and completion rates. Equal numbers of students per section enrolled in both Human (26.5 students/section) and Child Nutrition (25.8 students/section) over the four years of the study (Table 3). However, because the maximum number of students allowed in the spring and fall are 30 but only 20 in the summer, that resulted in a lower number of students enrolled in the summer (19.4 students/section) as compared to the spring or fall (31.2 and 32.7 students/section). These are suggested numbers of total students for online introductory Nutrition courses that rely heavily on assignments, as opposed to online exams. McDonnell and Achterberg¹⁰ stated that a small class size was referred to as essential when delivering a distance Nutrition Education course with an email component and Orellana³¹ suggested an online course size of 15.9 to achieve the highest possible level of interaction. Both online Nutrition courses are always in high demand: the maximum number of students every semester is reached within the first week of enrollment. Any variations in enrollment from these maximum numbers were based on the total number of students that remained in the course after the last day to add.

Only about two-thirds of all students enrolled in the online Nutrition courses were graded. Typically online students are less likely to complete the course as compared to traditional courses.^{4,7} Completion rates for the online Nutrition courses were highest in the summer (74%, versus 54 and 60% for fall and spring courses), while a higher percentage of older students enrolled during the summer session. Although, Morris et al³² reported that age was not as important of a predictor of retention in online general Education courses as high school GPA, SAT-math, current credit hours and college GPA.

Assignment completion and grades. The percent of students who completed each individual assignment only ranged from 55 to 75% and was similar between both courses. The assignments, even given two weeks to complete in the spring and fall, are lengthy and involve a large amount of research outside of the main text book reference. An approximately 10 percentage point decrease in individual assignment completion was observed between the first and second assignments. Thus it appears that if students completed the first 2 assignments, they were less likely to drop the course. Most students who dropped the course did so before even turning in the first assignment or immediately after turning in the first assignment.

The summer students are only given one week to complete the assignments; thus, in opposition to results, it was expected that the assignment completion rates would be lower in the summer. Correspondingly, as Dutton⁴ reported those who do complete online courses score higher on exams, a larger percentage of the online Nutrition course students receive the grade of A in the summer. Others report similar grades between online and traditional students in both introductory Nutrition⁵ and Biology courses.^{7,8} Given that the same percentage of students in the summer turned in all assignments, this suggests that the students enrolling in the summer were more motivated to achieve higher grades.

Table 3. Mean Enrollment and Performance of Students (N=354) [Number(Percent)] Enrolled in Online Human and Child Nutrition Courses during the Spring, Summer and Fall Semesters Over a 4 Year Period

Statistic	Course		Semester			Year			
	Human	Child	Spring	Summer	Fall	1	2	3	4
Students/ section	26.5	25.8	32.7 ^a	19.4 ^b	31.2 ^a	28.4	23.4	26.6	30.0
Grades									
Graded	17.0 ^a (67)	15.3 ^b (61)	19.3 ^b (60 ^{ab})	14.3 ^a (74 ^b)	16.5 ^a (54 ^b)	19.1 ^{ac} (72)	13.8 ^{bd} (60)	16.4 ^{cd} (65)	16.0 ^{cd} (53)
Dropped	9.5(33)	10.5(39)	13.4 ^a (40 ^{ab})	5.1 ^b (26 ^b)	14.7 ^a (46 ^a)	9.3(28)	9.6(40)	10.3(35)	14.0(47)
A	8.2 ^a (32 ^a)	4.8 ^b (21 ^b)	6.7(21 ^a)	6.6(34 ^b)	7.2(23 ^{ab})	5.9 ^{ac} (23 ^{ac})	5.3 ^{ac} (23 ^{ac})	9.1 ^{bd} (37 ^{bd})	7.0 ^{cd} (23 ^{bd})
B	3.7(14)	3.4(14)	5.1 ^a (16)	2.7 ^b (14)	3.3 ^{ab} (11)	4.7(18)	3.4(14)	3.0(11)	2.0(7)
C	1.7 ^a (7 ^a)	3.7 ^b (14 ^b)	3.3(10)	1.7(9)	3.2(11)	3.9(14)	2.1(10)	1.8(6)	3.0(10)
D	0.5(2)	0.9(4)	1.3(4)	0.5(3)	0.3(1)	0.7(2)	0.6(3)	0.5(2)	2.0(7)
F	2.8(12)	2.6(10)	2.9(9)	2.8(14)	2.5(9)	4.0(15)	2.61(1)	1.9(8)	2.0(7)
Assignment Completion									
1	19.7(74)	19.1(75)	26.0 ^a (80)	14.4 ^b (74)	21.2 ^a (67)	20.4(73)	16.3(70)	21.1(79)	25.0(83)
2	17.6(66)	15.8(62)	22.7 ^a (70)	12.6 ^b (65)	17.8 ^c (57)	18.3 ^a (66)	13.6 ^b (59)	17.9 ^a (67)	24.0 ^a (80)
3	17.1(64)	15.1(60)	21.1 ^a (66)	12.1 ^b (62)	18.3 ^a (58)	17.1(64)	13.1(56)	17.9(67)	23.0(77)
4	16.7(63)	14.4(58)	20.0 ^a (63)	12.4 ^b (64)	17.0 ^a (54)	16.3(61)	13.0(56)	17.3(65)	22.0(73)
5	16.3(62)	14.4(58)	19.3 ^a (60)	12.5 ^b (65)	16.7 ^a (53)	16.4 ^{cd} (61)	12.8 ^{ac} (55)	17.1 ^{bd} (65)	18.0 ^{cd} (60)
6	16.1 ^a (61)	13.8 ^b (55)	19.4 ^a (61)	11.5 ^b (60)	16.7 ^a (53)	15.7(58)	12.5(53)	16.6(63)	20.2(67)
7	16.1(61)	14.0(56)	19.7 ^a (62)	11.8 ^b (61)	16.3 ^a (52)	15.7 ^{cd} (58)	12.5 ^{ac} (54)	16.8 ^{bd} (64)	22.0 ^{bd} (73)
8	16.1(61)	14.0(56)	19.7 ^a (62)	11.8 ^b (61)	16.3 ^a (52)	15.7(58)	12.5(54)	16.8(64)	22.0(73)

^{abcd} Means with different superscripts differ (P < .05).

Satisfaction, Perceptions, Involvement and Improvements

Upon completion of the course, mean scores over 2.5 on the final survey suggested that many students did not use the online university library resources, did not follow the food pyramid, did not often communicate with other students in the course, did not often use the discussion board and did not often physically go to the library (Tables 4-7). Mean scores under 2 suggested that students were satisfied with the course, learned a lot, improved computer skills, improved Internet skills and improved email skills. Additionally, they also spent more time in the online course versus a traditional course but were more likely to enroll in future online courses. Furthermore, many students agreed that their independent learning skills improved, that their research skills improved and that their nutrition knowledge improved. Students were also more likely to view nutrition topics, dietary supplements, foods and diets differently after completion of the course. Other actions likely to change by completion of the course were to spend more time at the grocery store and to only trust scientific researched health and nutrition information. They also professed that their knowledge of nutrition before the course was very different than that presented in the course.

Knous⁵ reported that communication among students in an email section of a Nutrition course was equal to students in a traditional section. The online Nutrition students in this study did not heavily participate in student-student communication and they did not frequently utilize the discussion board. No student to student communication was required of the students and during the years of this study a minimal amount of discussion board postings were required. Similarly, ChanLin et al³³ found that students in Nutrition courses including web-based instruction did not have much interest in online discussions and suggested that discussion should be encouraged. On the other hand, in surveying students in both web-enhanced and traditional courses, more students preferred discussion on the discussion board as compared to face to face discussion²⁰ and considered the discussion board, communication with instructors and classmates as advantages of web-enhanced courses.¹⁶ In subsequent years of teaching the online Nutrition courses, students have been required to answer several questions on the discussion board, which has increased discussion board involvement. It appears that optional postings on the discussion board do not motivate many students. Likewise, it is suggested from the current study that without motivation, students in introductory online Nutrition courses will not extensively communicate with each other. Tallent-Runnles et al³ reviewed numerous studies which concluded that guided discussions increase participation. Whether communication improves performance or satisfaction in online courses remains unclear. Performance of students receiving passing grades in online courses is not related to the amount of online interaction¹⁵ or the perceived sense of community or personal relationship with the instructor,³⁴ but students receiving failing grades¹⁵ and students less satisfied¹⁴ interact less frequently while enrolled in online courses.

Even though students reported spending more time in the online Nutrition courses, they were satisfied, learned more and were more likely to enroll in other online courses. Similarly, students who enrolled in an email-delivered Nutrition course were more satisfied, but in contrast they equally felt that they learned a lot as compared to traditional course participants.⁵ In addition, students in a distance education/email-delivered Nutrition Education course had favorable attitudes toward the course and mastered the concepts and skills of the course.¹⁰ And, most students in a variety of online courses stated that they were satisfied,¹¹⁻¹³ that the course was more academically demanding than traditional courses and that they received a good to excellent quality academic experience.¹² Students in an introductory Psychology course reported greater satisfaction,⁹ whereas students in an introductory statistics course reported the same level of satisfaction³⁵ as students enrolled in the traditional counterparts.

In the present study, summer students were most satisfied, while communicating more with other students, although fall students were least satisfied with the course, while communicating less with other students. Perhaps students tended to be more satisfied with the course if they engaged in more communication with other students. Keefe¹⁴ reported that a lack of interaction appeared to contribute to inferior performance and satisfaction in online versus traditional courses. In an online baccalaureate Nursing program, students who were full time registered nurses reported that the greatest hindrances to being satisfied with the online learning experience were primarily related to inadequate interactions with students and teachers, while the primary reasons for being satisfied were the ability to take responsibility

for their own learning and the convenience to work at their own pace.¹³ Similarly, an autonomous learning mode^{3,36} and flexible learning literature^{18,36} were the most important factors influencing student satisfaction in online courses. Students enrolled in online Nutrition/Dietetic courses also stated advantages were flexibility and autonomy.^{37,38}

In the online Nutrition courses, more experienced students were also more likely to be satisfied, agree that they learned a lot, agree that the course met their learning style and agree that they would enroll in more online courses. Tallent-Runnles et al³ reviewed numerous studies each of which showed that students with more prior experiences felt more satisfied and comfortable with their experiences with online courses.

Students in this study developed more knowledge and skills relatively to nutrition and technology and perceived many topics differently after completion of the course. Knous⁵ also reported that email-delivered students felt more comfortable with email and computers and gained the same level of nutrition knowledge as students in a traditional section. Most importantly, students enrolled in the online Nutrition courses reported that they will only trust health and nutrition information that originated from scientific research. Students completing the online Nutrition courses reported improved research and independent learning skills. In the same way, Knous⁵ reported that email delivery of a Nutrition course improved independent learning skills more than a traditional course.

Older students in this study did not appear to be as involved in the use of resources or communication tools as younger students; however, older students were more apt to alter their eating habits and eat according to the food pyramid upon completion of the course. Temple et al²¹ reported that older students enrolled in a home study introductory Nutrition course had less computer and Internet skills and were less receptive to computer based learning. Online Nutrition students with more online course experience were more likely to increase their nutrition knowledge and to alter views toward nutrition topics and take longer at the grocery store. It is apparent that students who have already taken online courses can spend less time learning the skills necessary to complete the course and spend more time on the content of the course. Previous application of the technical skills, perhaps leads, in part, to the increased satisfaction, learning and application of nutrition information. In agreement, students with prior online experience take more responsibility for their own learning²⁷ and regard online instruction more positively.⁶ However, in opposition, grades were not linked to confidence with computer skills in online general Education courses.³⁹

Freshmen were more apt to state that they were satisfied with the online Nutrition course than master's level students. Freshmen were also more apt to view foods differently after completion of the course than all post baccalaureate students. However, only a small number of post baccalaureate students enrolled in the courses which must be considered in any comparisons. In addition, freshmen were also more likely to communicate with the professor during the course than sophomores and seniors.

Table 4. Mean Student (N=257) Satisfaction, Final Perceptions, and Time Involvement For Each Semester, and Year of Online Human and Child Nutrition Courses during the Spring, Summer and Fall Semesters Over a 4 Year Period

	Course		Semester			Year				SEM
	Human	Child	Spring	Summer	Fall	1	2	3	4	
<i>Question*</i>										
N	182	75	74	120	63	78	68	94	14	
1	1.73	1.84	1.85 ^{ab}	1.63 ^b	1.90 ^a	2.00 ^a	1.84 ^a	1.49 ^b	1.86 ^{ab}	0.046
2	1.54	1.60	1.64 ^a	1.40 ^b	1.76 ^a	1.74 ^a	1.56 ^{ab}	1.38 ^b	1.71 ^{ab}	0.041
3	1.98	2.05	2.05	1.90	2.13	2.21 ^a	2.09 ^{ab}	1.81 ^b	1.71 ^{ab}	0.060
4	1.90	2.12	1.86	1.97	2.08	2.01	1.99	1.84	1.79	0.053
5	1.49	1.52	1.59	1.43	1.51	1.37 ^a	1.44 ^a	1.53 ^a	2.29 ^b	0.044
6	1.95	2.08	2.00	1.93	2.10	2.09	2.00	1.93	1.79	0.055
7	1.44	1.53	1.55 ^a	1.33 ^b	1.62 ^a	1.55	1.44	1.37	1.71	0.039
8	1.57	1.55	1.73 ^a	1.40 ^b	1.68 ^a	1.59	1.63	1.43	2.00	0.044
27	1.93	1.87	2.04	1.75	2.06	2.04	1.91	1.82	1.79	0.063
28	1.85	2.00	1.92	1.83	1.98	2.03	1.88	1.76	2.07	0.050
29	1.55	1.50	1.66	1.45	1.55	1.55 ^a	1.51 ^a	1.44 ^a	2.21 ^b	0.041
30	1.51	1.50	1.62	1.45	1.47	1.51 ^a	1.49 ^a	1.43 ^a	2.07 ^b	0.039
32	1.68	1.69	1.80 ^a	1.53 ^b	1.84 ^a	1.72	1.63	1.63	2.07	0.044
33	1.72	1.78	1.88 ^a	1.58 ^b	1.89 ^a	1.79	1.75	1.64	2.07	0.045
34	1.66	1.70	1.82 ^a	1.50 ^b	1.78 ^{ab}	1.65	1.63	1.60	2.14	0.042

*Final Survey Question in Table 8; 1=strongly agree; 2= agree; 3=disagree; 4=strongly disagree.

^{a,b}Means with different superscripts differ (P < .05).

Table 5. Mean Student (N=257) Course Involvement and Behavior/Skills Improvements For Each Semester, and Year of Online Human and Child Nutrition Courses during the Spring, Summer and Fall Semesters Over a 4 Year Period

	Course		Semester			Year				SEM
	Human	Child	Spring	Summer	Fall	1	2	3	4	
<i>Question*</i>										
N	182	75	74	120	63	78	68	94	14	
9	1.29	1.31	1.32	1.25	1.35	1.22 ^a	1.31 ^{ab}	1.30 ^{ab}	1.64 ^b	0.034
10	2.53	2.52	2.61	2.48	2.54	2.18 ^a	2.56 ^{ab}	2.69 ^b	3.21 ^b	0.062
11	1.42	1.51	1.53	1.38	1.48	1.46	1.50	1.35	1.79	0.039
12	2.64	2.53	2.68	2.52	2.70	2.50	2.54	2.70	2.86	0.044
13	2.27	2.28	2.35	2.15	2.40	2.29	2.21	2.24	2.71	0.048
14	2.03	1.95	2.30 ^a	1.80 ^b	2.05 ^{ab}	1.94	2.04	1.96	2.50	0.055
15	2.03	1.97	2.30 ^a	1.81 ^b	2.06 ^{ab}	1.96	2.12	1.91	2.50	0.055
16	2.20	2.05	2.37 ^a	1.97 ^b	2.29 ^{ab}	2.09	2.31	2.06	2.50	0.056
17	1.86	1.83	2.05 ^a	1.73 ^b	1.83 ^{ab}	1.79	1.88	1.79	2.36	0.049
18	1.85	1.85	2.03 ^a	1.71 ^b	1.92 ^{ab}	1.86	1.87	1.76	2.36	0.049
19	2.97	2.83	2.88 ^{ab}	2.84 ^b	3.16 ^a	2.91	2.93	2.96	2.86	0.053
20	2.89	2.76	2.82	2.83	2.92	2.92	2.78	2.83	2.93	0.058
21	2.37	2.17	2.50 ^a	2.11 ^b	2.48 ^a	2.14	2.29	2.40	2.71	0.046
22	2.18	2.07	2.24 ^{ab}	2.01 ^b	2.30 ^a	2.13	2.21	2.08	2.43	0.048
23	2.73	2.77	2.92 ^a	2.53 ^b	2.94 ^a	2.96 ^a	2.84 ^a	2.42 ^b	3.21 ^a	0.053
24	2.70	2.78	2.85	2.59	2.85	2.90 ^b	2.79 ^{ab}	2.47 ^a	3.21 ^b	0.055
25	30.9	2.62	2.97	3.00	2.85	2.72	2.93	3.14	3.14	0.062
26	1.25 ^a	1.85 ^b	1.41	1.42	1.48	1.27 ^a	1.34 ^a	1.51 ^a	2.21 ^b	0.045
31	2.24	2.30	2.32	2.13	2.45	2.24	2.25	2.25	2.43	0.056

*Final Survey Question in Table 8; 1=strongly agree; 2= agree; 3=disagree; 4=strongly disagree.

^{a,b}Means with different superscripts differ (P < .05).

Table 6. Mean Student (N=281) Satisfaction, Final Perceptions, and Time Involvement For Each Age Group, Online Experience Group and Classification of Online Human and Child Nutrition Courses during the Spring, Summer and Fall Semesters Over a 4 Year Period

Question*	Age Group		Online Experience Group		Classification [†]					SEM
	1	2	1	2	Fresh	Soph	Jr	Sr	Post BS	
N	127	154	135	146	41	60	76	92	12	
1	1.65	1.66	1.75 ^a	1.56 ^b	1.45 ^a	1.64 ^{ab}	1.70 ^{ab}	1.67 ^{ab}	2.16 ^b	0.042
2	1.51	1.42	1.58 ^a	1.35 ^b	1.38	1.56	1.44	1.46	1.41	0.038
3	2.05	1.87	2.05	1.86	1.93	1.97	2.08	1.83	2.08	0.053
4	1.98	1.94	2.07 ^a	1.86 ^b	1.98	2.10	1.88	1.95	1.92	0.046
5	1.54	1.47	1.48	1.52	1.45	1.64	1.40	1.49	1.67	0.043
6	1.87	1.82	1.96 ^a	1.74 ^b	1.86	1.92	1.81	1.82	2.08	0.050
7	1.42	1.36	1.51 ^a	1.27 ^b	1.34	1.43	1.42	1.36	1.42	0.035
8	1.53	1.53	1.63 ^a	1.43 ^b	1.43	1.64	1.48	1.50	1.67	0.039
27	1.87	1.75	1.93 ^a	1.70 ^b	1.88	1.73	1.92	1.73	1.83	0.059
28	1.88	1.89	1.99 ^a	1.79 ^b	1.88	1.80	1.91	1.86	2.17	0.051
29	1.54	1.50	1.54	1.50	1.42	1.46	1.46	1.60	1.92	0.038
30	1.48	1.40	1.50	1.38	1.41	1.39	1.41	1.50	1.58	0.036
32	1.75	1.58	1.63	1.68	1.50	1.72	1.65	1.66	1.75	0.040
33	1.71	1.60	1.66	1.64	1.38 ^a	1.80 ^b	1.57 ^{ab}	1.71 ^{ab}	1.83 ^{ab}	0.040
34	1.66	1.61	1.59	1.66	1.34	1.67	1.71	1.63	1.67	0.039

*Final Survey Questions in Table 8; 1=strongly agree; 2= agree; 3=disagree; 4=strongly disagree.

[†] Fresh=Freshman, Soph=Sophomore, Jr=Junior, Sr=Senior, Post-BS=Post-baccalaureate. Post-BS students were combined for presentation, but masters and doctorate students were analyzed separately. Question 1 answers were only different for freshman versus master's level students.

^{a,b}Means with different superscripts differ (P < .05).

Table 7. Mean Student (N=281) Course Involvement and Behavior/Skills Improvements For Each Age Group, Online Experience Group and Classification of Online Human and Child Nutrition Courses during the Spring, Summer and Fall Semesters Over a 4 Year Period

Question*	Age Group		Online Experience Group		Classification [†]					SEM
	1	2	1	2	Fresh	Soph	Jr	Sr	Post BS	
N	127	154	135	146	41	60	76	92	12	
9	1.31	1.21	1.22	1.29	1.67	1.46	1.18	1.23	1.33	0.032
10	2.61	2.62	2.50	2.71	2.81	2.49	2.49	2.70	2.50	0.059
11	1.61 ^a	1.44 ^b	1.54	1.48	1.43	1.57	1.57	1.43	1.58	0.037
12	2.66 ^a	2.51 ^b	2.56	2.59	2.50	2.56	2.62	2.58	2.50	0.041
13	2.31 ^a	2.08 ^b	2.23	2.14	2.07	2.38	2.10	2.16	2.17	0.039
14	1.97	1.99	1.90	2.06	1.79	1.95	1.97	2.14	1.92	0.049
15	2.06	2.01	1.97	2.08	1.93	2.05	1.96	2.15	1.67	0.053
16	2.13	2.19	2.19	2.15	2.12	2.05	2.13	2.32	2.00	0.052
17	1.83	1.78	1.79	1.81	1.76	1.75	1.78	1.89	1.83	0.043
18	1.86	1.81	1.86	1.81	1.76	1.79	1.84	1.88	2.08	0.042
19	2.98	3.00	3.01	2.98	3.05	3.07	2.87	3.02	3.08	0.049
20	2.90	2.99	2.97	2.92	2.83	2.93	2.95	3.03	2.64	0.052
21	2.45 ^a	2.25 ^b	2.28	2.39	2.19	2.48	2.29	2.36	2.42	0.045
22	2.23	2.13	2.20	2.15	1.86 ^a	2.32 ^b	2.12 ^{ab}	2.26 ^b	2.46 ^{ab}	0.046
23	2.73	2.73	2.71	2.75	2.50	2.79	2.78	2.76	2.75	0.051
24	2.74	2.74	2.76	2.72	2.55	2.75	2.76	2.82	2.82	0.050
25	2.91	3.01	2.96	2.97	2.87	3.02	2.86	3.09	2.82	0.057
26	1.52 ^a	1.27 ^b	1.41	1.36	1.33	1.52	1.35	1.30	1.67	0.046
31	2.24	2.15	2.31	2.08	2.14	2.18	2.16	2.21	2.50	0.049

*Final Survey Questions in Table 8; 1=strongly agree; 2= agree; 3=disagree; 4=strongly disagree.

[†] Fresh=Freshman, Soph=Sophomore, Jr=Junior, Sr=Senior, Post-BS=Post-baccalaureate. Post-BS students were combined for presentation, but masters and doctorate students were analyzed separately.

^{a,b}Means with different superscripts differ (P < .05).

Table 8. Final Survey Questions

1. I am overall satisfied with the course.
 2. I feel that I learned a lot from this course.
 3. I am happy that I chose to take this course via the Internet as compared with a typical classroom lecture course.
 4. I have learned more from this course compared with a typical classroom lecture courses of similar difficulty.
 5. I put more time into this course as compared with typical classroom courses of similar difficulty. (Don't forget to consider the in-class time for typical classroom courses)
 6. The learning style of this online course met my learning style.
 7. My nutrition knowledge improved since taking this course.
 8. I view nutrition related topics differently after taking this course as compared with before taking this course.
 9. I used Internet resources a lot during this course.
 10. I used the online NSU library resources a lot during this course.
 11. I used the External Links provided a lot during this course
 12. I currently eat as recommended by the food pyramid.
 13. I have altered my eating habits since taking this course.
 14. My computer skills improved since taking this course.
 15. My Internet skills improved since taking this course.
 16. My email skills improved since taking this course.
 17. My skills in locating information improved since taking this course.
 18. I feel that my independent learning skills improved since taking this course.
 19. I communicated with other students a lot during the course.
 20. Communicating with other students helped me in the course.
 21. I communicated with the professor a lot during the course.
 22. Communicating with the professor helped me in the course.
 23. I used the Discussion Board a lot during the course.
 24. Use of the Discussion Board helped me in the course.
 25. I physically went to a University or public library a lot during this course.
 26. I used the required text book a lot during this course.
 27. I will be more likely to take more Internet courses after taking this course.
 28. A lot of the nutrition information presented in this course was different from what I heard or read.
 29. I will only trust scientifically researched nutrition information since taking this course.
 30. I will only trust scientifically researched health information since taking this course.
 31. It takes me longer in the grocery store since taking this course.
 32. I have a different view about dietary supplements since taking this course.
 33. I have a different view of many foods since taking this course.
 34. I have a different view of diets since taking this course.
-

Implications

Since older students were more prevalent in the summer courses and were less experienced with computers and the Internet, educators should consider the possibility of more technology related questions and issues during summer sessions. Since less than half of students potentially have never used online library resources, emphasis should be placed on the availability of these resources, such as posting links to databases and preparing a module requiring the use of library resources. Educators should not expect that all students have experience with the university; about 13% of online Nutrition students were only attending the University for Internet offerings and many did not live within driving distance. Thus students will likely benefit from links to general university web sites, such as the student handbook or university catalogue. And in addition, all course activities should be completely online to provide opportunities to all students, including those in distant locations.

Educators should be prepared for a majority of students who perceive themselves to have adequate or at least some nutrition knowledge, while not choosing to follow nutritional guidelines. Since many perceive to possess nutrition knowledge, it should be emphasized in introductory materials of the likelihood of current nutrition knowledge to possibly be different from legitimate nutrition information presented in the course. And preparing modules that require students to review current nutrition behaviors and report ways and health reasons to improve nutrition behaviors can perhaps help gap the divide between simply obtaining nutrition knowledge and application.

A suggested number of total students for online introductory Nutrition courses that rely heavily on assignments, as opposed to online exams, are 30 in a 16 week session and 20 in an 8 week session. Potentially high withdrawal rates should be anticipated and conceivably larger withdrawal rates in the spring or fall as compared to the summer. Students are likely to drop the course in the first few weeks, thus any initiatives to improve retention should begin on the first day.

Since previous research suggests a link between many positive outcomes and communication in online courses and as learned in this study, since students are not as likely to extensively communicate without motivation, educators should require communication in online Nutrition courses.

Online Nutrition courses provide satisfaction and allow students to improve nutrition knowledge and technology and research skills. It should, however, be highlighted that students will likely spend more time in an online Nutrition course as compared to a traditional Nutrition course. Students are open to change views on many commonly misconceived nutrition topics, spend more time at the grocery store, but are less likely to alter food intake patterns. With this information, common myths should be accentuated and student food intake should be evaluated as often as possible. Educators should anticipate that older students might be less likely to be involved in student-professor communication and less likely to use available recourses; whereas younger students would be less likely to alter eating habits. In addition, increased satisfaction, nutrition knowledge gained and changes in behavior are more likely for students with prior online course experience. And, the summer semester appears to excel for positive outcomes and student involvement.

Educators can use presented information for development and/or improvement of online nutrition courses, such as determining methods of teaching, use of media, presentation of materials, and methods of communication.

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