Assessing How Students Value Learning Communication Skills in an Undergraduate Anatomy & Physiology Course

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Assessing How Students Value Learning Communication Skills in an Undergraduate Anatomy & Physiology Course

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ABSTRACT

Students, particularly those in STEM and healthcare-related programs, should develop proficient interpersonal skills, including communication. To help students develop effective communication skills, instructors need to consider the value students give to learning these skills. The Student Attitudes Toward Communication Skills Survey (SATCSS) was developed to measure how undergraduate students value learning communication skills based on Expectancy-Value Theory across three modes of communication (verbal, written, non-verbal). The survey was given to students interested in healthcare professions and enrolled in an undergraduate anatomy and physiology course (n = 233) at a Midwest research active university. The survey showed evidence of validity, measuring two components: Value to Profession (attainment and utility value) and Value to Self (intrinsic value and cost). There was a significant difference in sub-scores among the four task values such that students thought that learning communication skills was important and relevant (high attainment and utility value) but not interesting (low intrinsic value) and costly. Students with high total scores valued communication skills across all four task values. As total value scores decreased, it was first due to students finding learning communication skills to be time prohibitive and then a lack of interest in learning communication skills. Based on these results, it is recommended that instructors incorporate communication skills training into content that is already part of their anatomy and physiology course to reduce time concerns. Additional recommendations include using reflective activities and humor to increase student interest.

Keywords: undergraduate education, communication skills, expectancy-value theory, task value, non-technical skills
INTRODUCTION

Communication skills are important for all students to develop. Communication is a key component of the scientific and engineering practices prescribed for K-12 students in the *Next Generation Science Standards* and is considered a critical part of postsecondary success in the modern world (NGSS Lead States, 2013). All college students are expected to become proficient in interpersonal skills, including communication (Rhodes, 2010; Herman and Hilton, 2017). Communication is explicitly defined as important for undergraduates in STEM fields where presenting technical information to diverse audiences requires more skill and practice than traditional speech and composition courses provide (AAAS, 2011; ACS, 2015; Saxe and Braddy, 2015; Heron and McNeil, 2016). Recently, the core competencies for biology students from the *Vision and Change report* (AAAS, 2011) were unpacked with the BioSkills Guide, which includes the recommendation that instructors should help students to communicate with targeted audiences using appropriate language, style, and multiple modes of communication (Clemmons et al., 2020).

Modes of communication are widely defined and organized based on the context (Kumar and Lata, 2015). This study focuses on verbal and non-verbal modes of communication. Verbal communication includes both oral (spoken) and written communication because they both use words as their primary medium. Non-verbal communication includes physical postures and gestures, tone and pace of voice, and conveyed attitude (Mehrabian, 2017). Successful communication in different modes requires unique skills, as noted in the Oral Communication and Written Communication VALUE Rubrics (Rhodes, 2010). It is recommended that students
thoroughly understand the context, purpose, and specific audience in order for effective communication to occur (Wack et al., 2021).

Communication skills are particularly important for students planning to enter healthcare-related fields (AAMC, 1999; Makoul, 2001; AAMC-HHMI, 2009; Metcalf and Colgate, 2019; Peddle et al., 2019). One reason such students need to learn communication skills is to become professionals who offer patient-centered care. Professionals who have poor communication skills may fail to help patients feel heard and leave them unable to understand the complex issues involved in their healthcare. Patient-centered care can be critical for successful outcomes (Stewart et al., 2000; Street et al., 2009; Adams, 2010). Effective communication also includes increasing students’ cultural competency and ability to communicate with diverse patients (Evans, 2013, Evans et al., 2018, Evans and Pawlina, 2020; Greene and Scott, 2021). When asked to describe their best physician experiences, patients across 14 medical areas and using inpatient and outpatient services at Mayo Clinic, focused on interpersonal skills (e.g., empathy, personal, respectful) over technical abilities (Bendapudi et al., 2006). Strong communication allows professionals to demonstrate these important interpersonal skills, also defined as nontraditional discipline-independent skills or non-technical skills.

Medical schools have been increasingly asked to incorporate non-technical skills, like communication, into their courses (Heidenreich et al., 2016; Evans and Pawlina, 2020; Lachman and Pawlina, 2020). This necessitates the incorporation of such training into courses that traditionally are more content-focused. Combining technical and non-technical skills training in the same course allows more practice for students as they develop into successful professionals (Gregory et al., 2009; Heidenreich et al., 2016; Evans and Pawlina 2020; Lachman and Pawlina,
The interest in and importance of students learning effective communication skills in healthcare-related programs has been well documented in the literature, but most research has focused on oral modes of communication and in the context of graduate and medical schools (AAMC, 1999; AAMC-HHMI, 2009; Makoul, 2001; Duffy et al., 2004; Haq et al., 2004; Schirmer et al., 2005). As effective communication includes more than just oral skills, the skill set required for proficiency in all modes of communication is valuable and deserves attention in both training and practice. Further, the development of effective communication cannot just begin in graduate school but can and should be developed earlier in students’ academic careers. Skills, like communication, require both practice and time to gain proficiency (Gettinger, 1985).

Anatomy and physiology (A&P) courses provide a common experience for many students interested in healthcare-related fields. Students interested in nursing, occupational and physical therapy, kinesiology, other professional schools, and even nutrition are encouraged or required to take some type of anatomy and/or physiology course. These courses are thus well placed for allowing students to begin to have exposure to learning relevant communication skills. Incorporating communication skills training into an anatomy and physiology course would allow students to connect these critical skills to their content learning. Similar non-technical skills training has been successfully introduced and assessed in medical training (Gregory et al., 2009; Heidenreich et al., 2016; Lachman and Pawlina, 2020) and could be beneficial for other students interested in healthcare. To help students develop effective communication skills, however, instructors need to consider the value students give to the task of learning communication skills.
Theoretical Framework

According to expectancy-value theory (EVT), an individual’s motivation to choose, persist in, and perform well on an activity will be based upon their beliefs about how well they will do (expectancies) and how they value the activity (Wigfield and Eccles, 1992). Here, the focus is on value because research suggests that task values directly influence student motivation related to completing a task and continuing with such tasks in the future (Wigfield and Eccles, 2000). Eccles et al. (1983) initially elaborated upon the value construct within EVT and posited that the value held for a specific task affects the motivation a person has for completing it. For example, a student taking anatomy and pursuing a nursing career may value their role in communicating about a patient’s health challenge and therefore be motivated to learn best practices for doing so. Such value is divided into four task values: attainment value, intrinsic value, utility value, and cost (Figure 1) (Eccles et al., 1983).

Attainment value is defined as the importance of doing well on a task as it relates to confirming one’s identity. Utility value is defined as how a task relates to future goals. Intrinsic value is defined as the enjoyment a person gets from performing an activity or the interest a person has in the subject (Wigfield and Eccles, 1992; Rowland et al., 2019). Cost is defined as all of the negative aspects of engaging in a task, including emotional and effort costs (Wigfield and Eccles, 1992). The four task values within EVT interact for each person to determine if a task is worthy of completion and if a person will complete the task. Previous work looked at attainment, intrinsic, and utility value and found them to be distinct and measurable constructs (Wigfield et al., 1997). Therefore, instructors need to consider each of these distinct task values when looking to motivate students.

[FIGURE 1 HERE]
Early research into the effects of individual task values focused more on attainment, intrinsic, and utility values (Wigfield et al., 1997). The task value of cost has been only recently investigated and expanded upon. Cost can be further separated into effort costs, emotional/psychological costs, and opportunity cost or loss of valued alternatives (Perez et al., 2014; Flake et al., 2015; Gaspard et al., 2017). For students in challenging undergraduate STEM courses, in which many healthcare focused students are enrolled, the cost perception of how much effort is required or how much time the course takes (i.e., opportunity cost) can play a critical role in determining student motivation and even persistence in the field (Seymour and Hewitt, 1996; Correll, 1997; Wigfield and Eccles, 2000; Wigfield and Cambria, 2010). The benefit of looking at cost and value from both an institutional as well as a personal lens, particularly in anatomical sciences education, has been of interest to researchers (Chumbley et al., 2021; Maloney et al., 2021). It is critical for students to feel that the value to be gained from their learning will not be associated with too high of a cost. Investigating the costs perceived by students is important to fully understand the total value that students have for learning competencies, including communication skills.

Students in a wide variety of disciplines often struggle with how to manage and use their time effectively. Undergraduates, in general, have difficulties with time management which can lead to increased stress (Misra and McKean, 2000; Balduf, 2009; Van Der Meer et al., 2010). Healthcare students in nursing (Sharma and Kaur, 2011) as well as other fields, like physical therapy and nutrition science, also perceive high stress levels due to academic concerns with managing their time in their respective programs (Jacob et al., 2013). Healthcare students who move into medical school continue to find time management to be a problem (Bickerdike et al., 2016; Hill et al., 2018; Bergmann et al., 2019). Students who lack time management skills and
thus use a more surface approach to their learning through cramming have lower academic performance compared to their peers (Bickerdike et al., 2016). For all such students, the time demands of any activity must be carefully considered and the value that they place on these activities will play a role in their motivation. Time constraints may play an outsized role in determining the cost that students feel for engaging in certain activities. The students in this study are undergraduates interested in healthcare. Since students like the ones in this study have been shown to struggle with time concerns, this investigation is limited to one specific aspect of opportunity cost, the time spent learning communication skills rather than learning or doing something else.

Baseline Value Measurements

It is important to understand students’ values and to measure a baseline value when considering curricular design. Recent research has investigated student value toward using math in biology (Andrews et al., 2017) and using modeling in biology classrooms (Gettings and Long, 2020). When instructors understand what their students value, they can tailor activities to address where students have lower perceived value. This will allow instructors to not spend limited class time covering things that students already find valuable. This will increase the efficiency of students learning skills, like communication (Hanley et al., 2019). These activities can then be assessed for their effectiveness with the right tool.

Previously, others have attempted to assess student value for learning communication skills through a survey using the Communication Skills Attitude Scale (CSAS) (Rees et al., 2002; Rees and Sheard, 2003; Rees et al., 2004; Cleland et al., 2005; Anvik et al., 2007). The CSAS offered a baseline for studying the value of communication, but it was not explicitly grounded in EVT. Some of the task values included in EVT are implicitly present in the CSAS,
but only one item was related to the task value of cost. The CSAS measured positive and
negative attitudes towards communication learning for medical students; however, negative
attitudes were grouped together, making it difficult to understand how the value students held for
various task values differed. Additionally, the survey was focused on communication skills in
general without addressing the different modes of communication. The CSAS was also designed,
implemented, and validated with graduate students in medical schools (Rees et al., 2002).

Although evidence for validity and reliability exists for the CSAS, it is important to have an
instrument that assesses all four task values in the context of different modes of communication
(i.e., oral, written, and non-verbal communication). There is a need for an instrument to measure
students’ value towards learning the different modes of communication, particularly in the
context of undergraduate students interested in health care.

The current study

Here, an instrument grounded in EVT was developed to answer the following research
question: How do undergraduate anatomy and physiology students value learning
communication skills? In order to investigate this question, the validity and reliability of the
instrument were investigated; however, an extensive validation study of this instrument was not
the focus of this work. This measurement of students’ baseline values will help inform
instructors when designing curricula that includes the teaching of important communication
skills. The instrument will also help instructors assess the effectiveness of such curricula after its
use with students.

MATERIALS AND METHODS

Survey Design
An instrument was developed, primarily by one author (CC), to measure value grounded in the four task values of EVT across three modes of communication, called the Student Attitudes Toward Communication Skills Survey (SATCSS). The survey consisted of 36 items and is provided in Supplementary Material 3. Each item presents with a six-point Likert-type response ranging from strongly agree to strongly disagree. The six-point response scale was used to force a positive or negative response from participants, unlike previous work with the CSAS, which used a five-point Likert-type response scale. The survey included 12 items for each mode of communication (verbal, written, and non-verbal). The term verbal communication was used in place of “oral” because the colloquially accepted definition of verbal communication implies speaking. Verbal and written communication were not explicitly defined in the survey, but examples of eye contact and body language were given for non-verbal communication. The items were presented in question blocks based on the mode of communication in order to help students consider each mode distinctly. The 12 items for each mode are further separated into items related to each of the four task values (Table 1). There were 21 positively framed items (e.g., item 18- “In order to be good at my future job, I must have good written communication skills.”) and 15 negatively framed items (e.g., item 9- “I am not interested in learning verbal communication skills.”).

[TABLE 1 HERE]

Sample, Course Context, Data Screening, and Demographics

The survey was given to undergraduate students (N = 233) in an anatomy and physiology course (BIOS 357) in fall 2019 and spring 2020 at a four-year university for students pursuing a
B.S. or B.A. The same instructor taught both semesters. The survey data in spring 2020 was collected before Spring Break when the university made significant changes to the schedule and mode of the course, due to the pandemic. By collecting the data before large-scale changes occurred, the pandemic did not impact survey results. BIOS 357 is Anatomy and Physiology for health sciences majors (e.g., pre-nursing, kinesiology) and covers the human body in a body systems approach. Students spent three hours per week in a physiology-focused lecture and four hours a week in a models-based anatomy laboratory. Cadavers were not used in teaching, but some cadaveric materials (organs) were available for interested students to compare with the models. The course was graded out of a total of 1000 points where 800 points were divided between five lecture examinations and six laboratory practical examinations. The remaining 200 points were given for completing digital review assignments for each chapter, three short online quizzes, and participating in three online discussion board posts. Communication skills were not an explicit goal of the course and therefore it did not have communication-specific interventions or evaluation; this allowed for the assessment of students’ baseline value for this research.

The survey was distributed through Qualtrics (Qualtrics, Provo, Utah, USA) and all students were invited to participate through a posted link on the course management system site. Data is presented from students who completed the survey and consented to this research. Extra credit points were given to students who completed SATCSS regardless of whether or not they agreed for their data to be included in this research. Survey data were screened by first removing data from students who did not indicate a career interest in healthcare. The average time taken to complete the survey was 6.7 minutes and it was determined that students needed a minimum of three minutes to read and respond to all 36 items. Data were then removed for those who took the survey in less than three minutes. In the Fall of 2019, 151 of 171 (88%) took SATCSS and
consented to be included in this research study, 149 of whom met the screening criteria and were
included for further analysis. In the Spring of 2020, 84 of 115 students (73%) took the SATCSS
and consented to participate in this research study, all of whom met the screening criteria and
were included for further analysis. The majority of the participating students were female (78%),
between the ages of 18-21 (74%), and in their second or third year of school (77%). This work
was conducted with prior IRB approval through Northern Illinois University (NIU HS20-0042).

[TABLE 2 HERE]

**Analysis for Reliability and Validity**

Reliability is used to determine an instrument’s internal consistency (Couch et al., 2019).
Cronbach’s Alpha is a standard metric for examining evidence for reliability (Lovelace and
Brickman, 2013) with an alpha level of 0.7 considered good preliminary evidence of reliability
for an instrument (Matheson, 2019). Cronbach’s Alpha was measured for SATCSS as a whole
and for each subset of items related to a task value construct (Figure 1).

Validity is used to determine if the instrument being used is actually measuring what it is
costually designed to measure (Couch et al., 2019; Knekta et al., 2019). First, content validity
was pursued was by having experts review items during development. Items were reviewed for
phrasing, readability, and interpretability, as well as how they aligned with the task values in
Expectancy Value Theory. Experts included two of the authors who have experience in
education research with surveys (HBR and NL) and an expert in survey development who leads
a survey development course. Second, the construct validity of SATCSS and its internal structure
were investigated with the guidance of one author who is an expert in psychometrics (AS). Both
were assessed through Principal Component Analysis (PCA) with an Equamax rotation using
SPSS statistical package, version 26 (IBM Corp, Armonk, NY). The Kaiser-Meyer-Olkin (KMO) Test for Sampling Adequacy and Bartlett’s Test of Sphericity were used to determine if PCA was appropriate. The PCA was used as an exploratory technique that is similar to factor analysis but uses all item variance to investigate item loadings and inform construct validity (Rattray and Jones, 2007; Devallis, 2016; Alavi et al., 2020). The current work was not intended to be a complete validation study of the SATCSS and therefore additional analyses such as multiple iterations, student interviews, and multiple institutional contexts (Adams and Wieman, 2011) were not pursued.

Survey Scoring

For each student, a total value score and sub-scores were calculated for the two main components (from the PCA), for each mode of communication, and for each of the four task values. Positively framed questions (e.g., item 18- “In order to be good at my future job, I must have good written communication skills.”) received a 6 for strongly agree down to 1 for strongly disagree. There are 15 negatively framed items (e.g., item 9- “I am not interested in learning verbal communication skills.”) that were reverse scored such that strongly disagree received a 6 and strongly agree received a 1. Total value scores and all sub-scores were calculated without the item scores from the non-verbal section (items 25-36) due to the results of the validity testing indicating that the non-verbal items did not have a similar factor structure as the verbal and written items (described in results section).

Sub-scores of the two components (1- Value to Profession, 2- Value to Self) that resulted from the PCA (described in results section) were calculated by adding scores for the items related to attainment value and utility value together (for component 1- Value to Profession) and
then adding the items relating to intrinsic value and cost together (for component 2- Value to Self). Individual mode of communication sub-scores were calculated by adding the scores for the 12 items related to each mode (Table 1, Supplementary Material 1). Individual task value sub-scores were calculated by adding scores for the six items related to each task value construct (Table 1, Supplementary Material 1).

Analysis

Total scores were compared between semesters, first-generation status, age groups, and sex using a one-way ANOVA. Component, task value, and mode of communication sub-scores were compared with a repeated measures general linear model using post hoc Tukey tests for multiple comparisons using SPSS statistical package, version 26 (IBM Corp, Armonk, NY). Parametric tests were used for the Likert-type data because there is support for using the more powerful analyses when scale scores are computed instead of looking at individual item scores (Lovelace and Brickman, 2013). The scores showed evidence of a non-normal distribution with a slight negative skew, but they did show homogeneity of variance and had a visibly normal Q-Q plot. Additionally, F-tests have been shown to be robust to various types of non-normality suggesting that the general linear model was acceptable (Blanca et al., 2017). Effect size was calculated using eta squared, as it is the most common effect size used when comparing means of multiple groups (Levine and Hullett, 2002; Maher et al., 2013).

Individual students were characterized based on their total value scores and then on their combination of task value scores. Total value scores were divided into tertiles and assigned a ranking of high, medium, and low value (Table 3). Then for individual task value sub-scores, scores were divided into categories of high and low; where a score of 27 or above was defined as high because this represents a case where the individual items averaged a score of 4.5 or higher.
(between somewhat agree and agree on positive items and somewhat disagree and disagree on negative items). Conversely, task value scores below 27 were defined as low because this represents item choices which average below a 4.5 (moving from somewhat agree to somewhat disagree for positive items and moving to somewhat agree for negative items). Classifications emerged from the various combinations of high and low task value sub-scores (Table 4).

Pseudonyms were used when individual student results are presented.

RESULTS

The Student Attitudes Towards Communication Skills Survey was developed as an instrument, grounded in EVT, to measure how undergraduate students value learning communication skills. It was examined for evidence of reliability and validity. Based on these results, the specific types of task value undergraduate anatomy and physiology students have for learning communication skills were investigated as well as the value held for the different modes of communication.

Instrument Reliability and Validity

Cronbach’s Alpha is a standard metric for examining evidence for reliability (Lovelace and Brickman, 2013) with an alpha level of 0.7 considered good preliminary evidence of reliability for an instrument (Matheson, 2019). The Student Attitudes Toward Communication Skills Survey showed evidence of reliability for measuring the total value that students have for learning communication skills ($\alpha = 0.946$). The survey also showed evidence of reliability for measuring each of the modes of communication, verbal ($\alpha = 0.832$), written ($\alpha = 0.903$) and non-
verbal ($\alpha = 0.911$) and each of the task values, attainment ($\alpha = 0.819$), utility ($\alpha = 0.839$),
intrinsic ($\alpha = 0.876$) and cost ($\alpha = 0.875$).

For validity, the Kaiser-Meyer-Olkin (KMO) Test for Sampling Adequacy indicated that there were sufficient items for each factor with a value of 0.92. Bartlett’s Test of Sphericity was significant ($p < .001$), meaning the correlation matrix was significantly different from an identity matrix. This indicated that the survey items were related and PCA was appropriate. A nonsignificant difference would have indicated that the items were unrelated and thus had no underlying factor structure. The results from the PCA with Equamax rotation suggested that SATCSS has a complex structure, potentially due to interactions between the two dimensions of mode and task value for each item.

A PCA was completed for each individual mode of communication (verbal, written, non-verbal) to determine the structure present within each mode. Verbal and written items produced a similar two-component solution with attainment and utility items loading together (labeled as Value to Profession), and intrinsic and cost items loading together (labeled as Value to Self, Figure 2, Supplementary Material 2). This two-component solution explained 49% of the total variance for verbal items and 62% of the total variance for written items. Items 12 and 24 (“I don’t see the point in learning verbal/written communication skills.”) loaded onto both components although they were phrased to represent the task value of relevance. For future implementations of SATCSS, it is recommended items 12 and 24 be dropped or rephrased. Non-verbal items (25-36) had multiple cross-loadings on both components and did not share the same structure as the verbal and written items; therefore, the non-verbal items were not included in the further analyses that characterize students’ values of learning communication skills.

[FIGURE 2 HERE]
Value Comparisons

Total and Sub-Score Values

Total value scores between semesters, first-generation status, age groups, and sex were compared with separate one way ANOVAs using SPSS statistical package, version 26 (IBM Corp., Armonk, NY). With the removal of the non-verbal items, the maximum total score was 144. There was not a significant effect on total value based upon semester \( (F(1,232) = 0.84, p = 0.36) \) between the fall \( (M = 118.3, SD = 15.1) \) and spring \( (M = 116.5, SD = 13.8) \). Nor was there a significant effect on total value based upon first-generation status \( (F(1,231) = 2.55, p = 0.11) \) between first-generation students \( (M = 119.1, SD = 14.0) \) and students who were not first-generation \( (M = 116.0, SD = 15.3) \). There was a significant effect on total value based on age groups \( (F(1,231) = 6.64, p = 0.01, \eta^2 = 0.03) \) where the students who were 18-21 years old \( (M = 116.2, SD = 15.0) \) had lower total value than the students who were 22 years old and older \( (M = 121.9, SD = 12.9) \), however it was a small effect. There was also a significant effect on total value based upon sex \( (F(2,232) = 3.92, p = 0.02, \eta^2 = 0.03) \) where females \( (M = 119.0, SD = 14.1) \) had higher total value than males \( (M = 112.4, SD = 15.7) \), but it was a small effect.

When looking at sub-scores, there was a significant difference between the two components that resulted from the PCA validity analysis, where scores ranged from 20 to a maximum of 72 (Figure 3) \( (F(1,232) = 552.90, p < 0.001, \eta^2 = .31) \). The students thought that the Value to Profession component of learning communication skills \( (M = 64.3, SD = 6.8) \) was significantly more valuable than the Value to Self component of learning communication skills \( (M = 53.3, SD = 9.3) \) and it was a large effect.

[FIGURE 3 HERE]
There was also a significant difference between modes of communication, where scores ranged from 21 to a maximum of 72 (Figure 4) ($F(1,232) = 32.39, p < 0.001, \eta^2 = 0.02$). The students thought that learning verbal communication skills ($M = 59.9, SD = 6.9$) was more valuable than learning written communication skills ($M = 57.7, SD = 8.9$), however it was a small effect.

There were also significant differences among task values, where scores ranged from 8 to a maximum of 36 (Figure 5) ($F(2.4,232) = 343.38, p < 0.001, \eta^2 = .31$). Intrinsic value ($M = 28.0, SD = 4.9$) and cost ($M = 25.3, SD = 5.1$) were both significantly different from each other and the other task values ($p < 0.001$) and it was a large effect. Attainment value ($M = 32.5, SD = 3.6$) and utility value ($M = 31.8, SD = 3.7$) were not significantly different from each other ($p = 0.45$). High sub-scores were interpreted as having higher value for attainment, intrinsic, and utility value. For cost, a low cost sub-score indicated lower value and that cost (specifically loss of time) was a significant obstacle for students.

Characterizations of Value

Each student was classified as having high, medium, or low total value by dividing the students’ total scores into tertiles (Table 3). The high value students ($n = 82$) had total scores from 124 to 144 which is an item average of 5.17-6, representing agree and strongly agree choices for positive items and disagree and strongly disagree choices for negative items. The medium value students ($n = 77$) had total scores from 113-123 which is an item average of 4.7-5.13, representing somewhat agree to agree choices for positive items and somewhat disagree to
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agree choices for negative items. The low value students \( (n = 74) \) had total scores of 112 and below which are item averages of 4.67 and lower, representing somewhat agree choices changing to somewhat disagree for positive items and somewhat disagree choices changing to somewhat agree for negative items.

A student who had a high total value suggests that they found learning communication skills to have high attainment value, intrinsic value, utility value and was a good use of their time (i.e., cost is not an issue). Total scores were reduced for students having lower attainment value, intrinsic value, utility value, and thinking that learning communication skills was not a good use of their time (i.e., cost is an issue).

To delineate how these task values were differentially affected, individual students were characterized based on their combination of task value scores (Table 4). The classification with the highest frequency (36%) was “Bought In” where students had high scores for all four task values. “Bought In” students represented most (83%) of the students who had high total value.

The next classification that was identified was “Taxed” (25%), which had high sub-scores for attainment, utility, and intrinsic value, but low cost scores. The majority (52 out of 59) of “Taxed” students found cost to be a minor concern with cost sub-scores between 22 and 27. However, there was a small group (7 students) that found cost to be a major concern with cost sub-scores below 22. “Taxed” students were the most common classification in the medium total value group. There were two students in the taxed category who had such low cost sub-scores that they were classified in the low total value group. For example, Abigail had high sub-scores for attainment, intrinsic, and utility value (30, 27, and 31 respectively), but her cost sub-score
was an 18. This would suggest that although she found learning communication skills to have low total value, this was almost exclusively due to cost concerns.

The “External Only” classification included 26% of the sample. These students found learning communication skills to have high attainment and utility value, but low intrinsic value and low cost (i.e. time concerns were an issue). “External Only” students were the most common classification (57%) in the low total value group. The last classification, “All Low,” included 4% of the sample. These students found learning communication skills to have low attainment, utility, and intrinsic value as well as being too costly. All of the “All Low” students were in the low total value group. The remaining students were classified as “Other” because of various task value combinations that each had low numbers of students. These included students who only scored low for intrinsic value, only scored high for attainment value, scored low for attainment value and cost, or scored low for utility value and cost. The low intrinsic value students (3%) were found mostly in the medium total value group while the remaining students were mostly found in the low total value group.

DISCUSSION

The Student Attitudes Toward Communication Skills Survey (SATCSS) was developed and tested to measure multiple types of value for learning communication skills in the context of undergraduate anatomy and physiology students who are interested in healthcare careers. Preliminary results indicated the survey was reliable with this sample population and had strong construct validity when excluding the non-verbal items. How these students valued learning communication skills and how instructors and researchers can use SATCSS to help understand student value and guide instructional practice in their own courses and work is discussed below.
Types of Value

Students, in this population, had high value for learning communication skills. Many students in the low total value tertile were still on the agree side of the scale (item averages of 4.67 and lower). Thus, even the low overall value students still found learning communication skills to be somewhat valuable. The majority (87%) of students were classified as having high attainment and utility value (Table 4). A decrease in value was mostly due to lower intrinsic value and cost. Students’ perceptions that learning communication skills would not be worth their time was the most significant factor that lowered their overall value for learning communication skills. The significantly lower cost sub-scores (Figure 5) suggest that students thought learning communication skills would take time away that would be better dedicated to other endeavors. Similarly, the student classifications based on individual task value scores (Table 4) showed that the first task value to drop from high to low was cost. The concern about time, a major factor of cost, has also been seen in nursing students (Sharma and Kaur, 2011), and across multiple healthcare disciplines, like physical therapy, despite differences in the programs (Jacob et al., 2013). This time concern is also found in medical school where students found that they had little time for leisure activities or for maintaining a healthy lifestyle because of excessive workloads and difficulties managing their study time (Hill et al., 2018; Bergmann et al., 2019). When assessing student motivation in regards to other activities, like online learning, student concerns are centered on high workloads where they must use large amounts of valuable time (Vanslambrouck et al., 2018). Cost has also been shown to negatively affect continued interest in and performance at a task (Barron and Hulleman, 2015; Perez et al., 2019).
communication skills to a course, especially those in healthcare programs, instructors need to be
aware of the cost concerns of their students and adjust the curriculum accordingly.

Lack of interest was also a significant factor lowering the overall value for learning communication skills. The students held less intrinsic value for learning communication skills (Figure 5) compared to attainment and utility value. Similarly, the student classifications based on individual task value scores (Table 4) showed that, after cost, intrinsic value was the next task value to drop. Maintaining student interest in a task is shown to increase motivation and, although it does not predict performance, it is predictive of persistence with a topic (Barron and Hulleman, 2015). Therefore, instructors should think about how to boost intrinsic value in their students when creating activities that are aimed at learning communication skills, including in the anatomy and physiology context.

When studying complex competencies, like learning communication skills, it is important to consider not only the separate task values but also the effects of different aspects of the competency. The BioSkills Guide delineates different modes of communication for students to master (Clemmons et al., 2020). This work considered verbal, written, and non-verbal modes of communication in the development of survey items and analyses. The Principal Components Analysis was convoluted when considering task value and mode of communication (i.e., all 36 items together) such that a clear pattern did not emerge. Separating the mode constructs during analysis, however, showed a pattern where the verbal and written items followed a two-component solution where attainment and utility value combined into one “Value to Profession” component and intrinsic value and cost combined into a second “Value to Self” component (Figure 2). Therefore, when assessing value for multifaceted competencies, including those
unpacked in the BioSkills Guide (Clemmons et al., 2020), it may be necessary to attend to each aspect separately to gain a clear understanding of student value.

Here, it was essential that non-verbal communication was separated, as items related to non-verbal communication did not load in a similar structure compared to the verbal and written items, due to several items cross-loading onto both components. Although there were examples given in the prompt for non-verbal communication (“e.g., eye contact and body language”), the complexity of non-verbal communication, as an idea, may be influencing student answers and could explain the lack of similar structure. Cultural differences and bias may also play a role in how students value non-verbal communication (Phutela, 2015). It also may be that this population (undergraduates going into healthcare-related fields) simply found more value in communication that is more word based (verbal and written) and had not yet considered the role non-verbal cues play in communication. Future work is needed to investigate how and why students, specifically those in and aiming for healthcare fields, value non-verbal communication skills.

Implications

When looking to increase student motivation for learning certain competencies, like communication skills, these findings are useful in guiding instructors on where to focus their efforts. It suggests that instructors might not have to use valuable instructional time to emphasize the attainment and utility value of learning these skills, but rather focus their time on making activities that are both interesting and respectful of students’ cost concerns. Simply reducing the amount of time spent on communication skills training, however, could be counter-productive as effective learning requires a time investment for skill development (Gettinger, 1985). Instead,
instructors should acknowledge the cost concerns of students while explaining why such practice is worth the use of students’ time.

As an alternative to taking these results and assuming they apply to new contexts, instructors can implement SATCSS in their classes before presenting content and activities related to communication skills and use the results to guide instruction. They can classify their students as high, medium, and low total value by separating them into tertiles and if the majority of the students in a course fall into the high and medium total value classifications, then the results of this study (most students in the high category were “Bought In” and most students in the medium category were “Taxed”) suggest that the instructor can focus their efforts on reducing the cost effects of including new skills into the curriculum. If more of their students fall into the medium and low total value classification, then these results (most students in the low category were “External Only”) suggest that it is necessary to consider cost and student interest or lack thereof in learning the particular skill. When educators can more effectively assess and understand the value their students hold, future curriculum and instruction can be designed for maximum effect at reaching and motivating students.

Modifying Curriculum to Increase Student Value.

Modifying existing activities and assessments to include communication skills could help minimize the perceived time constraint that may be limiting the motivation and engagement that students have with learning critical skills like communication. Specifically, content learning, that may already hold value for students, could be supplemented with opportunities to practice communication skills (Heidenreich, 2016; Evans and Pawlina, 2020; Greene and Scott, 2021). Designing courses to include non-technical skills, like communication, has been successfully
done in medical schools (Gregory et al., 2009) and thus could offer a model for such
modifications in undergraduate anatomy and physiology courses. An example from the literature
includes having medical students create written pamphlets explaining certain birth defects to
diverse audiences. Those students reported the activity to be useful, interesting, and gave them
an appreciation of how important it is to develop effective written communication skills (Evans,
2013). Undergraduate students in anatomy and physiology could begin practicing critical
communication skills by being assigned something similar where they are asked to create an
infographic explaining an anatomical region. Throughout the course, similar activities could be
adjusted to focus on different modes of communication and different audiences.

A second recommendation, based on these findings, is to help students develop their
intrinsic value for learning communication skills with elements of humor and reflection. Humor
has been shown to increase intrinsic value in a task (Matarazzo et al., 2010). To boost intrinsic
value in the undergraduate anatomy and physiology context with humor, instructors could use a
video clip from a modern medical drama (e.g., Grey’s Anatomy) where the doctor-patient
communication is humorously presented and have students “re-write” the dialogue to be more
professional.

Others have found that utility value interventions, where students reflect on the relevance
of coursework to their personal lives can also increase student intrinsic value (Hulleman et al.,
2010, 2017). The results of this study suggest that utility value is already high in this population
and other interventions may be needed to increase intrinsic value. The utility value items on
SATCSS, however, are all phrased in relationship to career relevance. It is possible that
connecting utility value to a more personal relevance may also increase intrinsic value in this
population. Instructors wanting to increase student intrinsic value in learning communication
skills could ask students if they or a loved one have had a negative experience with a medical provider due to a lack of communication and have them reflect on how the situation could have been handled differently. Conversely, students could also reflect on positive communication experiences and how the interaction was beneficial for all parties. As students develop personal connections to content, their motivation and engagement may increase.

Here, a survey was created to measure multiple dimensions of students’ value of learning communication skills. It is pertinent that instructors and researchers have tools available to measure student value of learning. This survey adds to a pool of others focused on important skills, including the Math-Biology Values Instrument that was developed to assess the value that undergraduate biology students have towards using math in biology (Andrews et al., 2017), and an instrument that is being developed to assess the value students have towards the use of modeling in biology classrooms (Gettings and Long, 2020). However, more work is needed to develop tools to measure the values students hold for learning a range of skills deemed vital across biology and healthcare programs. The SATCSS could serve as a template for developing these tools, particularly for developing instruments that assess students’ value of multifaceted skills like the different modes of communication.

Limitations of the Study

This study focused on undergraduate students taking an anatomy and physiology course that expressed interest in pursuing careers in healthcare fields. It is possible that these students may have had a higher baseline value for learning communication skills than students interested in other careers. Thus, the tertiles-based categorization of high, medium, and low total value may not be representative of different populations. To ensure that SATCSS is accurately measuring
student value, more work is needed to test its validity with larger and more diverse populations. This will also add to the evidence of reliability with the use of SATCSS in various contexts.

The SATCSS looks at the task value of cost from the lens of the opportunity cost of loss of time, particularly study time. This aspect of cost was chosen, believing it to be the most significant cost factor for students in challenging programs where time management is critical (Sharma and Kaur, 2011; Jacob et al., 2013; Bickerdike et al., 2016; Hill et al., 2018; Bergmann et al., 2019). Despite differences in academic programs, students across healthcare programs find time management to be a concern and source of stress (Jacob et al., 2013). It is possible that students’ cost concerns may be more nuanced, however, and include concerns related to effort costs and emotional/psychological costs (Perez et al., 2014; Flake et al., 2015; Gaspard et al., 2017). Past experiences and different cultural expectations may influence student value for learning communication skills. Further research, that includes detailed student interviews, may indicate that the cost items in SATCSS need to be expanded.

CONCLUSIONS

Non-technical skills, like communication, are important for students, particularly students in undergraduate STEM and healthcare-related programs. For instructors to help students develop effective communication skills, they need to consider ways to motivate students to engage in their learning. This requires instructors to consider the value students give to learning skills like communication. The Student Attitudes Toward Communication Skills Survey is an instrument that can help instructors understand the nuances of value held by their students. These baseline results offer a guide for instructors as they make curricular changes to incorporate needed communication skills training into anatomy and physiology courses.
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FIGURE LEGENDS

**Figure 1.** Four parts of value according to Expectancy-Value Theory as distinct task values.

**Figure 2.** Conceptual representation of how SATCSS items (represented by the white circles) for verbal and written modes (yellow and green rectangles, respectively) loaded onto two component PCA solution (black rectangles), which labelled as Value to Profession for component 1 and Value to Self for component 2.

**Figure 3.** Distribution of sub-scores of the two components identified by Principal Component Analysis (PCA). Scores ranged from 20 to 72, which was also the maximum possible score per component. Circles represent individual data points (i.e., student sub-scores). The ends of each box (i.e., hinges) represent the upper and lower quartile of scores so as to span the interquartile range (25-75 percentiles). The horizontal line within each box marks the median. Whiskers represent data that is within 1.5 times the interquartile range of the hinge. Colors that are different from each other represent a statistical difference ($p < .05$) between components.

**Figure 4.** Distribution of sub-scores of the modes of communication. Scores ranged from 21 to 72, which was also the maximum possible score per mode. Circles represent individual data points (i.e., student sub-scores). The ends of each box (i.e., hinges) represent the upper and lower quartile of scores so as to span the interquartile range (25-75 percentiles). The horizontal line within each box marks the median. Whiskers represent data that is within 1.5 times the interquartile range of the hinge. Colors that are different from each other represent a statistical difference ($p < .05$) between modes of communication.

**Figure 5.** Distribution of sub-scores of the four task values. Scores ranged from 8 to 36, which was also the maximum possible score per task value. Circles represent individual data points (i.e., student sub-scores). The ends of each box (i.e., hinges) represent the upper and lower quartile of scores so as to span the interquartile range (25-75 percentiles). The horizontal line within each box marks the median. Whiskers represent data that is within 1.5 times the interquartile range of the hinge. Colors that are different from each other represent a statistical difference ($p < .001$) among task values.
Figure 1. Four parts of value according to Expectancy-Value Theory as distinct task values.

83x81mm (330 x 330 DPI)
Figure 2. Conceptual representation of how SATCSS items (represented by the white circles) for verbal and written modes (yellow and green rectangles, respectively) loaded onto two component PCA solution (black rectangles), which labelled as Value to Profession for component 1 and Value to Self for component 2.

682x319mm (96 x 96 DPI)
Figure 3. Distribution of sub-scores of the two components identified by Principal Component Analysis (PCA). Scores ranged from 20 to a maximum of 72. Circles represent individual data points (i.e., student sub-scores). The ends of each box (i.e., hinges) represent the upper and lower quartile of scores so as to span the interquartile range (25-75 percentiles). The horizontal line within each box marks the median. Whiskers represent data that is within 1.5 times the interquartile range of the hinge. Colors that are different from each other represent a statistical difference (p < .05) between components.
Figure 4. Distribution of sub-scores of the modes of communication. Scores ranged from 21 to a maximum of 72. Circles represent individual data points (i.e., student sub-scores). The ends of each box (i.e., hinges) represent the upper and lower quartile of scores so as to span the interquartile range (25-75 percentiles). The horizontal line within each box marks the median. Whiskers represent data that is within 1.5 times the interquartile range of the hinge. Colors that are different from each other represent a statistical difference (p < .05) between modes of communication.
Figure 5. Distribution of sub-scores of the four task values. Scores ranged from 8 to a maximum of 36. Circles represent individual data points (i.e., student sub-scores). The ends of each box (i.e., hinges) represent the upper and lower quartile of scores so as to span the interquartile range (25-75 percentiles). The horizontal line within each box marks the median. Whiskers represent data that is within 1.5 times the interquartile range of the hinge. Colors that are different from each other represent a statistical difference ($p < .001$) among task values.
Table 1. Sample of SATCSS items.

<table>
<thead>
<tr>
<th>Task value</th>
<th>Mode of communication</th>
<th>Mode of communication</th>
<th>Mode of communication</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Verbal</td>
<td>Written</td>
<td>Non-verbal</td>
</tr>
<tr>
<td>Attainment</td>
<td>I don’t need to be good at verbal communication to be good at my job.</td>
<td>In order to be good at my future job, I must have good written communication skills.</td>
<td>Non-verbal communication skills are necessary to be successful in my future career.</td>
</tr>
<tr>
<td>Value</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intrinsic</td>
<td>Learning verbal communication skills is interesting.</td>
<td>I am interested in learning how to be a better written communicator.</td>
<td>I am not interested in learning non-verbal communication skills.</td>
</tr>
<tr>
<td>Value</td>
<td>Learning verbal communication skills is relevant in healthcare education.</td>
<td>Learning written communication skills is a useful part of my overall professional training.</td>
<td>I don’t see the point in learning non-verbal communication skills.</td>
</tr>
<tr>
<td>Utility</td>
<td>Practicing verbal communication skills takes time away from my content studying.</td>
<td>I don’t have time to learn written communication skills.</td>
<td>Practicing non-verbal communication skills is a good use of my study time.</td>
</tr>
</tbody>
</table>

Items are organized by task value (rows) and mode of communication (columns). Each item is presented three times in SATCSS but with the underlined mode of communication replaced with either verbal, written, or non-verbal.
Table 2. Demographic overview of participating students.

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>% (n) Fall 2019</th>
<th>% (n) Spring 2020</th>
</tr>
</thead>
<tbody>
<tr>
<td>Females</td>
<td>77.70% (115)</td>
<td>82.14% (69)</td>
</tr>
<tr>
<td>Males</td>
<td>22.30% (33)</td>
<td>17.86% (15)</td>
</tr>
<tr>
<td>18-21 years</td>
<td>72.30% (107)</td>
<td>78.57% (66)</td>
</tr>
<tr>
<td>22-25 years</td>
<td>22.97% (34)</td>
<td>20.24% (17)</td>
</tr>
<tr>
<td>26-50 years</td>
<td>4.73% (7)</td>
<td>1.19% (1)</td>
</tr>
<tr>
<td>White/Non-Hispanic</td>
<td>45.95% (68)</td>
<td>40.48% (34)</td>
</tr>
<tr>
<td>Hispanic or Latino/Latina</td>
<td>5.41% (8)</td>
<td>7.14% (6)</td>
</tr>
<tr>
<td>Black or African American/Non-Hispanic</td>
<td>16.89% (25)</td>
<td>19.05% (16)</td>
</tr>
<tr>
<td>Asian</td>
<td>8.11% (12)</td>
<td>11.90% (10)</td>
</tr>
<tr>
<td>Multiple Ethnicities</td>
<td>23.65% (35)</td>
<td>21.43% (18)</td>
</tr>
<tr>
<td>Freshman</td>
<td>0.00% (0)</td>
<td>9.52% (8)</td>
</tr>
<tr>
<td>Sophomore</td>
<td>45.27% (67)</td>
<td>48.81% (41)</td>
</tr>
<tr>
<td>Junior</td>
<td>33.11% (49)</td>
<td>25.00% (21)</td>
</tr>
<tr>
<td>Senior</td>
<td>18.92% (28)</td>
<td>16.67% (14)</td>
</tr>
<tr>
<td>Graduate or Postbacc</td>
<td>2.70% (4)</td>
<td>0.00% (0)</td>
</tr>
<tr>
<td>First Generation</td>
<td>49.32% (73)</td>
<td>55.95% (47)</td>
</tr>
<tr>
<td>Transfers</td>
<td>33.78% (50)</td>
<td>34.52% (29)</td>
</tr>
<tr>
<td>Cum. GPA ±SD</td>
<td>3.23 ±0.5</td>
<td>3.28 ±0.6</td>
</tr>
</tbody>
</table>
Table 3. Classifications for students’ overall value scores from SATCSS.

<table>
<thead>
<tr>
<th>Classification</th>
<th>Range</th>
<th>Average item response</th>
<th>Frequency n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>124-144</td>
<td>5.17-6.00</td>
<td>82 (35.19%)</td>
</tr>
<tr>
<td>Medium</td>
<td>113-123</td>
<td>4.70-5.13</td>
<td>77 (33.05%)</td>
</tr>
<tr>
<td>Low</td>
<td>0-112</td>
<td>4.67 and lower</td>
<td>74 (31.76%)</td>
</tr>
</tbody>
</table>

Classifications include range of scores, average response per item, and frequency for each classification.
Table 4. Task value sub-score combinations that define each student classification and frequency of occurrence.

<table>
<thead>
<tr>
<th>Classification</th>
<th>Attainment Value</th>
<th>Utility Value</th>
<th>Intrinsic Value</th>
<th>Cost</th>
<th>Frequency n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bought In</td>
<td>High</td>
<td>High</td>
<td>High</td>
<td>High</td>
<td>84 (36.05%)</td>
</tr>
<tr>
<td>Taxed</td>
<td>High</td>
<td>High</td>
<td>High</td>
<td>Low</td>
<td>59 (25.32%)</td>
</tr>
<tr>
<td>External Only</td>
<td>High</td>
<td>High</td>
<td>Low</td>
<td>Low</td>
<td>60 (25.75%)</td>
</tr>
<tr>
<td>All Low</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>9 (3.86%)</td>
</tr>
<tr>
<td>Other</td>
<td>Some other combination</td>
<td></td>
<td></td>
<td></td>
<td>21 (9.01%)</td>
</tr>
</tbody>
</table>