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Toward a Technique of Evaluating Student Ethical Sensitivity to Professional Issues of the Construction Industry

Kenneth S. Sands II[1*], Annie R. Pearce[2], Min Jae Suh[3], Denise R. Simmons[4], Christine M. Fiori[5], and Victoria A. Mouras[6]

[1]Assistant Professor, Department of Construction Management, Florida Gulf Coast University, USA, E-mail: kesands@fgcu.edu **(*corresponding author)**
[2]Associate Professor, Department of Building Construction, Virginia Tech, USA, E-mail: apearce@vt.edu
[3]Assistant Professor, Department of Engineering Technology, Sam Houston State University, USA, E-mail: mjs068@shsu.edu
[4]Associate Professor, Department of Civil and Coastal Engineering, University of Florida, USA, E-mail: denise.simmons@essie.ufl.edu
[5]Clinical Professor and Department Head, Construction, Engineering and Project Management and Systems Engineering, Drexel University, USA, E-mail: cmf356@drexel.edu
[6]Assistant Professor of Practice, The Charles E. Via, Jr. Department of Civil & Environmental Engineering, Virginia Tech, USA, E-mail: vmouras@vt.edu

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ABSTRACT

The construction industry is inundated with unethical activity and is viewed as one of the most corrupt industries in any business sector. This activity has caught the attention of public agencies, industry groups, and academic accrediting bodies such as the American Council for Construction Education (ACCE) and the Accreditation Board for Engineering and Technology (ABET) which lead to a requirement for ethics education. The problem is that the requirement to teach ethics is not complimented with an understanding of construction student ethical competency. Construction students should possess the ability to recognize ethical issues of the construction industry, namely have *ethical sensitivity*, as a milestone to making proper ethical decisions in practice. The purpose of this study is to suggest a qualitative response, quantitatively scored means of testing the ethical sensitivity of construction students known as the Test for Ethical Sensitivity in Construction (TESC). This paper presents the test development process of the TESC technique in addition to initial findings from piloting the TESC in two construction programs in the United States.

Keywords: Construction education, ethics, ethical sensitivity, instrument development

INTRODUCTION

The construction industry is plagued with a variety of unethical behaviors both societal and professional in nature [1]. The prevalence of unethical behavior in the construction industry has led to Transparency International's revelation that corruption is more ingrained in the construction sector than any other is [2]. Unethical conduct can result in negative effects that can be experienced by stakeholders external to the company performing unethically such as society, or internally within the company. Internal negative effects include wasted expenses on bidding,

legal repercussions, blacklisting, risk of reputation, blackmail, and other negative effects, and external negative effects include unsuitable, overpriced, overly complex, and delayed construction projects [1, 2, 3, 4]. According to Minchin Jr. et. al. [5], "As construction projects become increasingly sophisticated and have far-reaching impacts on the general public, construction professionals' ethical behavior is of critical importance."

Increasing awareness to ethical issues and ethical practice may provide positive effects such as an increase in financial returns due to increased business and improvement of working relationships between project stakeholders [1, 6]. McCord & Gunderson [7] studied that focuses on factors affecting relationships between general contractors and subcontractors highlights that unethical practices such as bid shopping, previous claims or disputes, and timeliness of payments (payment games) were factors in ending relationships between general contractors and subcontractors. They also highlight other ethical issues such as safety, honesty, and fairness as factors affecting relationships between general contractors and subcontractors.

Attempts to Curb Unethical Behavior

There have been attempts to curb unethical conduct of construction professionals by owners/clients, practitioners of the industry, and academe. One such effort on the public owner's side has been the implementation of the Federal Acquisition Regulation (FAR) [8]. Subpart 3.10-Contractor Code of Business Ethics and Conduct, of the FAR states, "government contractors must conduct themselves with the highest degree of integrity and honesty" (p. 3.10-1). Additionally, it adds that contractors should have a written code of business ethics and conduct. It also states that in order to promote compliance,

> contractors should have an employee business ethics and compliance training program and an internal control system that-
>
> (1) Are suitable to the size of the company and the extent of its involvement in Government contracting,
>
> (2) Facilitate timely discovery and disclosure of improper conduct in connection with Government contracts, and
>
> (3) Ensure corrective measures are promptly instituted and carried out.

The FAR ethical policy is one that requires serious consideration by construction companies and their employees who wish to participate in public sector projects. The FAR states that,

> a contractor may be suspended and/or debarred for knowing failure by a principal to timely disclose to the Government, in connection with the award, performance, or closeout of a Government contract performed by the contractor or a subcontract awarded thereunder, credible evidence of a violation of Federal criminal law involving fraud, conflict of interest, bribery, or gratuity violations found in Title 18 of the United States Code or a violation of the civil False Claims Act. Knowing failure to timely disclose credible evidence of any of the above violations remains a cause for suspension and/or debarment until 3 years after final payment on a contract (p. 3.10-1).

Notable organizations such as the Construction Management Association of America (CMAA), the American Society of Civil Engineers (ASCE), the American Subcontractors Association (ASA), the Project Management Institute (PMI), the Associated Builders and Contractors (ABC) and the American Society of Professional Estimators (ASPE) have established codes of ethics, which according to Collins [9] are "broad ethical aspirations."

Also, the Construction Industry Ethics and Compliance Initiative (CIECI), brings together U.S. construction companies who are committed to the highest level of ethics and conduct compliance with the law, to increase the ethical conduct of the industry. CIECI frequently shares best practices to address ethics and compliance risks, and they have published a program blueprint for organizations for the creation and maintenance of a business ethics program [10].

Additionally, Owusu et al. [11] evaluates several research articles to develop a framework of construction project management anti-corruption measures and has identified six ACM categories which are probing, compliance, regulatory, promotional, and reactive measures.

Even though there have been various efforts to curb unethical behavior by government agencies, industry groups, and researchers, unethical behavior is still prevalent in construction. The impact of their approaches to influence an organization's ethical behavior are hard to determine without empirical evidence from further research.

Publishing guidelines and regulations, having codes of conduct, and being part of trade organizations are important to improving ethical compliance, but they cannot be the only resource to assist an individual's understanding of why each professional should conduct themselves in an ethical manner. The guidelines and participation in organizations need to be complemented with the assignment of functional responsibility and employer training [12, 13] and this should be extended to future employees as well. This understanding of construction ethics is a necessary contribution of construction education. The FMI [3] survey reinforces this by highlighting industry opinion: 90% of the over 270 respondents agree that the construction industry should get more training in ethics.

In addition, Ahn, Pearce & Kwon [14] performed a study to assess the required competencies of construction students based on industry responses to a Likert survey assessing industry agreement with competencies required of construction students. Results of this study reveal that industry respondents strongly agree that ethical issues are an important competency for construction students.

Higher Education's Influence

In response to the assertion that the construction industry requires an increase in ethical competency or the ability to work in a manner as defined by professional ethical codes of conduct published by Friedman in 2007, education, and training for its construction students, construction higher education and its accrediting bodies responded by making construction ethics education required in construction curriculum. These bodies ensure that construction students, whether they are constructors or designers, receive similar competencies in each accredited program, and each has various requirements for student ethical competency.

There are two main accrediting bodies for construction higher-education in the U.S., the Accreditation Board for Engineering and Technology (ABET) and the American Council for Construction Education (ACCE). ABET requires that students be able to design a system, component, or process to meet desired needs within ethical constraints (among others) with an understanding of professional and ethical responsibility for their civil, construction engineering, and construction engineering technology programs [16]. In parallel, the ACCE requires ethics integration in the construction curriculum [17]. Both bodies leave the art of ethics pedagogy up to the program seeking accreditation, which can be difficult for educators who are technically trained and view ethical issues as secondary to primary coursework [1, 18, 19] which leads to the question of whether students are at a minimum, ethically sensitive, i.e. aware to various ethical issues of the construction industry.

ETHICAL SENSITIVITY

Ethical sensitivity is "a caring response, skill in identifying the ethical dimension of care, intuition regarding others' comfort and well-being, and a component of moral care" [20]. Ethical sensitivity is "the first step in real-life moral decision making. Without recognizing the ethical aspects of a situation, it is impossible to solve any moral/ethical problem, for without the initial recognition no problem exists" [21]. Ethical sensitivity combines two skills, moral imagination and recognition of ethical issues [21, 22].

The theoretical framework for this study is highlighted by Sands & Pearce [1] and is based on Rest's [23] four-component ethical decision-making (for the purpose of this paper, ethical decision-making is the course of action when face with an ethical dilemma) model. Rest's [23] components are:

1. *Moral Sensitivity – interpreting the situation as being moral*
2. *Moral Judgment – deciding which course of action is morally right*
3. *Moral Intent – prioritizing moral values over other values and;*
4. *Moral Behavior – executing and implementing the moral intention*

Briefly, moral sensitivity is the awareness of how our actions affect others. It involves an awareness of the effect of different lines of action and it includes "imaginatively constructing possible scenarios and knowing cause consequence chain of events in the real world; it involves empathy and role-taking skills" [23]. Note that, for the purpose of this study, the term moral refers to the personal belief or guiding principles of what is right and wrong whereas the term ethic refers to the community or organizational belief or guiding principles of what is right or wrong. Therefore, this research defines ethical sensitivity as the ability of an individual to recognize ethical issues of the construction industry [1, 18]. Ethical sensitivity for this study is a skill, and students should possess the required skill of being able to recognize ethical issues of the construction industry in order to behave ethically.

EVALUATION METHODS FOR ETHICS IN CONSTRUCTION EDUCATION

Several means have been suggested to evaluate ethical competencies of students that range from ethical sensitivity to ethical behavior. Robertson [24] proposes the use of detailed case study review analysis for course assessment. Sinha et al. [19] discuss the evaluation of student portfolios of essays analyzing ethical issues, demonstrating student ability to apply knowledge of ethical theories to decision making. These methods are useful for application purposes, but they do not specifically address the construct of ethical sensitivity.

Kang et al. [25] used the Defining Issues Test (DIT) to evaluate ethical sensitivity of construction workers in a multi-cultural ethics-training program but does not present the details of the test. The DIT requires participants to read a moral dilemma and then rate and rank 12 statements that define the issues of the dilemma in various ways. Participants must rate and rank the issues in terms of their perceived importance in deciding about the dilemma [26].

Killingsworth [27] suggests that ethical sensitivity testing should be done using the DIT as well. Killingsworth's derivative of the DIT uses a modified form that is construction-specific. Killingsworth also suggests that the test be used longitudinally, administering the test at the beginning of a student's curricular experience and at the end of the student's curricular experience. After the two tests, the participants took the test again, a few months after graduating from a course of study.

The evaluation methods suggested for ethical competency to issues of the construction industry either do not specifically measure the construct of ethical sensitivity, or they do not provide supporting details for the ethical sensitivity evaluation method suggested. To further knowledge of evaluation methods used for ethical sensitivity testing, we sought literature that goes beyond the discipline of construction.

THE PROBLEM

Entities related to the construction industry focus on the goal of decreasing unethical practices in several ways. The competency of ethics starts at the foundation of construction knowledge prior to and during practice, and teaching ethics helps construction students think critically about various situations that may possess ethical issues. This is essential for ethical behavior in practice. Requirements of accrediting bodies create an expectation that students will be ethically competent regarding issues of the construction industry prior to entry into full-time practice; however, the authors have not found a set standard of ethical competency evaluation in construction education and have only found limited resources on proper evaluation methods. Current construction literature pertaining to evaluating ethics competencies specifically addressing the construct of ethical sensitivity for construction students doesn't exist. Therefore, the question is, is there a technique available to measure student ability to recognize ethical issues specifically related to professional issues of the construction industry, thus helping future practitioners make informed and responsible decisions?

THE PURPOSE

Having the overarching question, the objectives of this study are two-fold. The first is to present the development of an evaluation method to understand construction student ethical sensitivity (the ability of an individual to recognize ethical issues of the construction industry) to professional issues of the construction industry via a Test for Ethical Sensitivity in Construction (TESC). The second is to use the TESC toward a preliminary understanding of the ethical sensitivity of construction students and present the results of this initial investigation.

ALTERNATIVE METHODS OF TESTING ETHICAL SENSITIVITY

Not many ethical sensitivity tests that particularly relate to issues of the construction industry exist; therefore, we draw inspiration from ethical sensitivity tests outside of construction to see what other alternatives exist.

Various means and techniques have been found reliable to test ethical sensitivity for their individual purposes, but many of the tests presented involve labor-intensive qualitative methodologies such as case studies, videotaped scenarios, responses to dramas, and others. that limit the participant sample size and are unsuitable in resource-constrained situations [21]. Clarkeburn's [21] Test for Ethical Sensitivity in Science (TESS) was developed as a test for ethical sensitivity that can be administered to a larger participant sample, thus increasing the generalizability of findings. Therefore, an aim of this research was to develop a test based on Clarkeburn's [21] model that has the characteristics of being able to be administered to a larger sample to increase generalizability of findings.

Clarkeburn [21] insists that an ethical sensitivity test "needs to measure the spontaneous recognition of moral issues, the interpretation of a situation in moral terms," if observations are to be made regarding ethical sensitivity of real-life situations. Therefore, testing ethical sensitivity should be qualitative, based on unstructured problems, and should consist of minimal guidelines. The TESS consists of three vignettes with embedded ethical issues. Students were asked to write down no more than five issues or questions that should be considered before deciding on the scenario. Administration of the TESS takes less than 15 minutes, and experienced raters can score approximately 30 protocols an hour, requiring less strain on students and raters than other ethical sensitivity tests such as the DEST and McNeel's [28] ethical sensitivity test. These tests are labor-intensive, requiring one-to-one interaction between participants and researcher and transcriptions which would be impractical when trying to administer a test to larger samples. They are also less suitable when time and resources are limited. Table I presents multiple ethical sensitivity tests exist in a variety of specific disciplines and each test defines ethical sensitivity in general as the recognition or awareness of ethical issues.

TABLE I. AVAILABLE ETHICAL SENSITIVITY TESTS

Authors	Test Name/Type	Participants	Administration
Bebeau et al. [29]	An ethical sensitivity test for dental students (DEST)	Dental students	Verbal responses to audio drama
Borenstein et al. [30]	Test of Ethical Sensitivity in Science and Engineering (TESSE)	Science/Engineering students	Open-ended case study responses with follow-up Likert rating agreement to statement
Brabeck et al. [31]	Racial Ethical Sensitivity Test (REST)	Graduate students	Videotaped scenarios and semi-structured interviews
Clarkeburn [21]	Test for Ethical Sensitivity in Science (TESS)	University science students	Open-ended questionnaire response to stories/ethical scenarios
Do Lim & Perry [32]	Ethical Sensitivity	Public administration students and servants	Open-ended responses & case studies
Ersoy & Goz [33]	Ethical Sensitivity	Turkish nurses	Open-ended questionnaire & case studies
Ersoy & Gundogmus [34]	Ethical Sensitivity	Turkish physicians	Open-ended questionnaire & case studies
McNeel [28]	Ethical Sensitivity	College students	Recorded dramas & qualitative interviews
Hébert et al. [35]	Ethical Sensitivity	Medical students	Open-ended survey via vignettes
Shawver & Sennetti [36]	Ethical Sensitivity	Accounting students	Open-ended survey via vignettes
Sirin et al. [37]	Racial and Ethical Sensitivity Test Compact Disk (REST-CD)	University Students	Videos and interactive interviews via compact disk
Sparks & Hunt [38]	Ethical Sensitivity	Marketing students and practitioners	Open-ended & case studies

This study seeks to defend a derivative of this method as a means of testing the ethical sensitivity of construction students; moreover, it proposes an approach that addresses the limitations of Clarkeburn's approach by being applicable to a larger number of respondents while reducing strain on both participants and raters of the test from Clarkeburn's cognitively intense qualitative format.

Instrumentation Quality in Ethical Sensitivity Testing

Even though ethical sensitivity is not detailed in construction education literature, there are inspirations toward understanding the maintenance of rigor of an ethical sensitivity instrument. To ensure validity, prior test development procedures on ethical sensitivity utilized expert review and participation by various researchers and practitioners of associated disciplines in the development of instruments to support arguments for content validity [30]. Literature also supports the argument that reliability can be attained in ethical sensitivity testing via

inter-scorer/inter-rater agreement [21, 29].

Additionally, Weaver [20] identified various reliability threats to instruments of ethical sensitivity, and reports that in quantitative studies of ethical sensitivity, generalizability is compromised due to convenience sampling, which also shows to be an issue of construct validity. Prompting participants to the presence of an ethical problem also was shown to reduce the rigor. What is shown to be effective was the qualitative inquiry of ethical sensitivity, as validity was found to be preserved through respondents' descriptions of their processes. This study establishes a test for ethical sensitivity in construction while keeping qualitative inquiry essential to the responses, but it also wants to ensure objectivity in scoring. Therefore, a numerical rating system is devised as discussed in the TESC development section of this study. Development of the TESC followed the test development model shown below in Figure I.

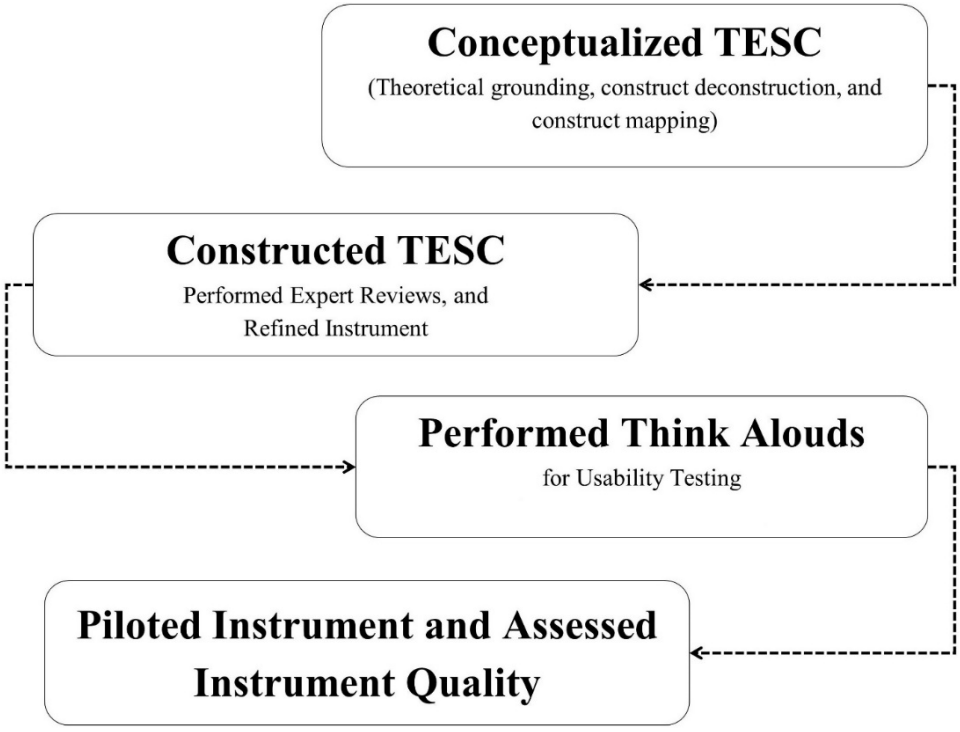

FIGURE I. TESC DEVELOPMENT PROCESS [18, 39]

TESC Conceptualization

TESC conceptualization began with the development of a construct map, and the construct map is a visual definition of the construct of measurement with the idea that this construct is composed of an underlying continuum of ability [40]. Utilizing Rest's moral development model [23] as a theoretical framework, the construct map for the TESC develops out of the idea that one can possess varying degrees of the skill of awareness to ethical issues of the construction industry as shown in Figure II. Essentially, the more a respondent recognizes ethical issues of the construction industry, the more ethical sensitivity awareness skill they can achieve. Likewise, the less a respondent recognizes ethical issues of the construction industry, the less ethical sensitivity awareness skill they can possess.

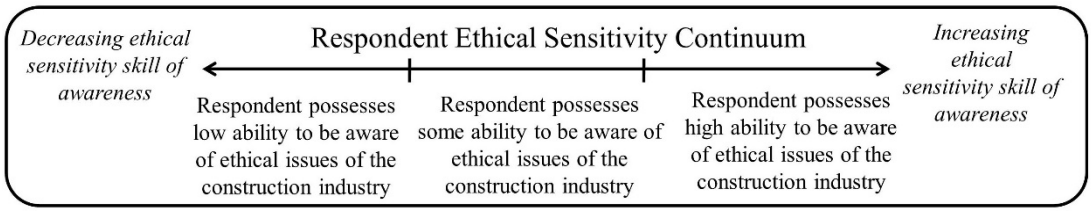

FIGURE II. RESPONDENT CONSTRUCT MAPPING FOR TESC

TESC Construction

Based on Clarkeburn's [21] model, an ethical sensitivity test was created and would situate students in eight exaggerated vignettes specific to actual ethical issues of construction practice (TESC). Sands and Simmons [18] also mentions that students are placed in the following scenario to begin the test.

> You recently graduated and have been hired as a project engineer for Solid Construction, an established medium-sized commercial construction company in the US. As an entry-level employee, you must participate in a rotation program so that you are involved in various company operations.

The eight-vignette pen-and-paper TESC is developed from various ethical issues for diversity of testing as an experiment with the different levels of difficulty each vignette poses while attempting to introduce this framework for testing ethical sensitivity of other issues. The pen-and-paper technique was utilized because it is found to be a preferred data collection technique by students [41].

The items for piloting this technique to test the ethical sensitivity of construction students varies in type. The original selection of ethical issues stems from the idea that construction students should be familiar with some of the ethical issues, and some issues should not be so apparent. In addition, the test items are also ethical issues that seemed to be ethical issues closely related to the construction industry [1]. This type of item selection was purposefully done as a means of diversity and discrimination in the test. This research tries to observe student responses to each vignette. The TESC embeds 12 sample professional issues of the construction industry. The issues of the TESC include claims games, collusion, bid shopping, bid peddling, theft, underage labor issues, safety front-loading, payment games, low competence of work performance, improper client relations, and bid rigging. These issues are embedded in eight vignettes as seen below in Table II.

To generate responses for the TESC, participants were told, "reflect on the situation, and write down at least 3 issues you are concerned with and/or questions you may have about the situation" and "please be as descriptive as possible." Requiring participants to write down multiple issues of concern or questions concerning the situation will assist the participant's thought process, leading to the identification of ethical issues [21, 30].

TABLE II. EMBEDDED ISSUES OF THE TESC

#	Vignette	(#) Item of Interest
1	Your first assignment is to shadow the estimator on an open bid, commercial renovation project with an estimated value of $15 million. Winning this project can significantly boost your company's financial position. Prior to estimating the job, you and the estimator perform a routine site visit to go over the existing conditions of the project. You notice a peculiar look on the estimator's face and hear him say with a smirk, 'looks like the architect missed that.' As you continue to shadow the estimator to pre-bid meetings, and assist with the bid process, there is no mention of, or questions asked about this error on the bid documents.	(1) Claims Games
2	It is bid day and you recall last night (the night before bid day), the familiar face of the renovation project's owner's representative (from the pre-bid meeting) entering your boss' office. Today, your boss and estimator frantically receive sub-bids, complete bid forms with specific subcontract bids, and run out of the office to deliver the bid. A few hours later, a call comes in to your office and you hear, "we were the lowest bidder."	(2) Collusion
3	Your company was awarded the renovation project and immediately begins preparations for project administration. You work with another colleague to buy out the project (i.e., material purchase and subcontracting). You receive multiple calls from various subcontractors providing you with quotes for this project. Additionally, your boss leaves business cards on your table and tells you to call up these companies, send them plans for the project, and "see what prices you can get."	(3) Bid Shopping & (4) Bid Peddling
4	The renovation project has begun, and you spend a few days a week on this project's site. A while into the project, light-gauge metal framing work is 90% complete and material will be left over. The drywall subcontractor's foreman on your site talks about the renovations he is making at home. As you leave the site at the end of this day, you notice a bundle of framing material missing from the site.	(5) Theft
5	It is the end of the day on Friday. Before leaving, you are asked by your boss to work after hours that same evening to accompany the electrician. The electrician needs to perform electrical work unable to be performed during normal operating hours. The electrician and an underage looking individual in plain clothes, not familiar to you, enter the project site. The unfamiliar person is introduced as the electrician's nephew.	(6) Labor & (7) Safety
6	Currently the project is 60% complete and has been active for 7 months. Based on recommendations by the superintendent, you have been required to update and submit payment applications on a monthly basis to the owner. Now that you are familiar with the project, you notice that a large portion of the work has already been paid out, seemingly more than the value of what has been completed to this point. A few hours into the workday, a subcontractor calls in anger requesting payment for an application his company submitted 2 payment periods ago.	(8) Front-end loading & (9) Payment Games
7	The renovation project is now substantially complete. A request for proposal (RFP) has been advertised for a project for which your company has no experience. The owner's representative of this RFP is highly involved in charitable work and has a specific charity he favors. The owner of your company recently showed his interest in charity work by giving a sizeable donation to that favored charity. You somehow overhear that your company may be a viable contender for this RFP project.	(10) Low/No Competence of Work & (11) Conflict of Interest
8	Your company has interest in another request for proposal (RFP). Prior to finalizing price and submission of the RFP, familiar faces of competing contracting firms enter your company's conference room with your boss and he locks the door. You have seen these familiar faces at previous bid openings and pre-bid meetings.	(12) Bid Rigging/ Price Fixing

Descriptors

As part of the original TESC, descriptor items are used as preliminary statistical data to assess statistical significance between groups. Descriptors includes student age, gender, academic level, type of construction program (e.g., building construction, construction management, construction engineering, civil engineering) of enrollment, amount of professional construction experience, and a question on the placement of ethics in their type of construction program.

Content Validity

Content validity of the TESC is supported via two processes. First, a literature analysis was performed using 65 non-instructional/educational studies and 14 instructional/educational studies which closely tied to the themes of ethics and construction. From this thematic analysis, 101 professional and societal ethical issues were found [1]. Selected issues were taken from the literature review and used for development of the vignettes of the TESC.

Second, since issues embedded in the TESC are specific to the construction industry, a panel of seven construction educators and industry professionals having significant experience in ethical teaching and practice were asked to conduct a preliminary review of the TESC and provide feedback on initially developed vignettes for their authenticity and relevance to the construction industry. All identifying information of participants were removed based on the request of one of the panelists.

Usability Testing for the TESC

Usability testing for the TESC was performed using think-aloud protocols, specifically a written transcript of think-aloud sessions. Think-aloud sessions require participants to continuously talk aloud as they responded to a testing instrument while being recorded [18, 39, 42]. By hearing each participant's thought processes, we can gather information on the validity of the test and understand whether students are responding to the test as intended while correcting issues that present threats to cognitive validity. Cognitive validity focuses on student ability to use cognitive skills to complete the test and threats to this ability such as confusing and ambiguous terms [43]. Statements should be limited, as long statements hinder student ability to complete the test as intended. In addition, structural issues such as typographical and grammatical errors can be identified and addressed from think-aloud protocols; however, cognitive issues are more considerable [18, 39].

Sands and Simmons [18] provide the details of the usability testing for the TESC. Three think-aloud sessions were performed with three different construction students, since the first three participants tend to detect the most severe problems of usability while additional participants are less likely to detect any additional issues [18, 39, 44]. The first participant's think-aloud protocol highlighted four cognitive issues and one structural issue of the TESC, and the issues were addressed prior to the second participant's think-aloud session. The second participant's think-aloud protocol highlighted two cognitive issues and no structural issues, and those issues were addressed prior to the third participant's think-aloud session. The third participant's think-aloud protocol identified one

cognitive issue of the TESC; this issue was addressed. The first participant was asked to review the TESC after the third revision of the TESC, after which the TESC was finalized.

The first participant found that the final version of the TESC is much clearer and easier to read and respond to than the first TESC administered, as major threats to cognitive validity and structural issues of the TESC were addressed. Additionally, it was determined that students required an average of three minutes to respond to each vignette, with a total average TESC completion time of 27 minutes. Time of completion was important for pilot testing recruitment of student participants when requesting class time from instructors to administer the TESC.

PILOTING THE TESC

After usability testing was complete, the TESC was pilot tested with a sample as similar as possible to the population of the main study as recommended by [45]. This study required pilot testing in a setting common to test taking, specifically a classroom setting that would be a familiar context for students.

Population of Interest

For this study, the target population were students, who are soon to be practitioners in the construction industry and who should have had construction ethics education at various times throughout their curricular experience. This study sought to understand how competent construction students were at identifying ethical issues of the construction industry. Educators may find that information on ethical sensitivity of seniors is useful for curriculum evaluation, and employers will find this information useful when recruiting construction graduates.

Rating, Inter-rater Reliability, and Rater Strain

Student response rating was originally based on a three-level scoring metric (0, 1, 2) indicating the level of student ability to recognize an issue. The three-level metric was meant to allow for differentiation between responses that seemed to fall just short of full recognition of construction ethical issues versus those that were obvious. Two rounds of TESC rating with three raters were performed with the original three level scoring metric. McHugh [46] defines Cohen's Kappa which was used to determine inter-rater reliability. The original rating scale yielded low inter-rater reliability results. To increase inter-rater agreement and objectivity in scoring, the scoring metric was changed, and a binary rating scale was developed to apply a scoring metric for keyword, statement, theme, and concept identification. Table III provides a sample of the types of terms/phrases/statements that were used to rate the TESC as they are synonymous with those significant ethical issues of the industry. The following was used for scoring participant TESC responses:

Score of 0 = Inability to recognize issue

Score of 1 = Ability to describe the issue by item name or synonym

TABLE III. SAMPLE KEYWORDS/PHRASES/STATEMENTS (AND SYNONYMOUS THEMES) USED FOR RATING THE TESC

Items	Item Name	Sample Key Terms/Phrases for Rating TESC
1	Claims Games	Change order; Construction change directive
2	Collusion	Should not be conversing with owner/owner's rep concerning project
3	Bid Shopping	GC should not be requesting additional sub prices after bid awarded; Fishing for lower bids
4	Bid Peddling	Other subs should not be calling awarded contractor post bid
5	Theft	Stealing; Should not be taking material from a site that owner pays for
6	Labor Issues	Minor, Child, Lawful to work, Legal age to work, possibly underage to work for electrician
7	Safety	Personal protective equipment (PPE), Liability, Incident, Injury, properly dressed, Hurt
8	Front-End Loading	Requesting for work not performed, Contractor should not ask for more money than work performed
9	Payment Games	Subcontractor should be paid, intentionally avoiding paying subs to gain financial benefit
10	Low/No Competence of Work	Should not perform work we have no experience in, Lack of knowledge
11	Conflict of Interest	Bribe, Gift, should not give donation, Under the table, Donation for favor, Unfair advantage, Unfair competition
12	Bid Rigging/Price Fixing	Unfair competition, Competitive advantage, Antitrust laws, Collusion to gain unfair advantage

The new scoring metric was used to re-score the TESC responses of individual test items (n=300). Cohen's kappa of the TESC using this scoring metric yielded a Kappa correlation coefficient of 0.85, which is in the range of 'almost perfect agreement' [47].

With the binary approach to rating, the efficiency of rating improved, and the tests were easier to rate. A rater with an average reading speed with the original rating metric yielded an average time to score each vignette of 2.25 minutes. With the new binary metric, the average speed to rate each vignette is less than a minute. To ensure quality in rating, regular 15-20-minute breaks were taken by raters to reduce rater fatigue.

PILOT INVESTIGATION USING THE TESC

Participants (n=124) for pilot testing the TESC were sophomores (n=12), juniors (n=8), seniors (n=97), and graduate students (n=3), with four respondents not indicating academic standing. These participants consisted of construction engineering students (n=28) and civil engineering students (n=87) with nine students not indicating program of study. The TESC was administered to three different classes for students in different types of construction programs: a senior level course in estimating, production, and cost engineering (n=17), a senior level professional and legal issues course (n=89), and a sophomore-level introductory course on construction engineering and management (n=18).

An initial understanding of the characteristics of the TESC was determined by performing item analysis using classical test theory (CTT) [48]. Table IV presents the initial difficulty assessment for each item of the TESC. The optimal difficulty level or 'p value' for an item, defined as the proportion of individual respondents in our sample to get an item correct, is 0.5 since the item at 0.5 difficulty level tends to be more useful at discriminating between

students [49].

Items having a difficulty level less than 0.30 are identified as having a high level of difficulty. Items having a difficulty level between 0.30 and 0.79 are identified as having a moderate level of difficulty. Items having a difficulty level above 0.80 are identified as having low difficulty.

TABLE IV. INITIAL ITEM ANALYSIS OF THE TESC

Items	Item Name	Difficulty Assessment	Difficulty	SD	Discrimination
1	Claims Games	High	0.09	0.29	0.15
2	Collusion	Moderate	0.32	0.47	0.63
3	Bid Shopping	High	0.04	0.20	0.02
4	Bid Peddling	High	0.00	0.00	0.00
5	Theft	Low	0.81	0.39	0.34
6	Labor Issues	Moderate	0.38	0.49	0.46
7	Safety	Moderate	0.45	0.50	0.61
8	Front-End Loading	High	0.05	0.22	0.07
9	Payment Games	High	0.05	0.22	0.15
10	Low/No Competence of Work	Moderate	0.38	0.49	0.54
11	Conflict of Interest	Moderate	0.63	0.49	0.59
12	Bid Rigging/Price Fixing	Moderate	0.41	0.49	0.76

Pilot investigations provided student performance of the TESC. An initial comparison was made between groups based on their academic level. Bebeau et al. [29] found that dental students at higher academic levels were more ethically sensitive to professional issues than students at lower levels. Therefore, this study sought to determine if students at higher academic levels [juniors-seniors] are more ethically sensitive to the professional issues of the TESC than students at lower levels [freshmen-sophomores] by testing the hypothesis:

H1: Students who participated in this pilot test at higher academic levels are more ethically sensitive to the ethical issues of the construction industry of the TESC than students of lower academic levels who participated in this pilot test.

H01: There is no difference in ethical sensitivity to professional issues of the TESC between students at higher academic levels and those at lower academic levels who participated in this pilot test.

Programs related to the construction industry have various ways of teaching ethics. Ethics education emphasizes the learning of professional norms applicable to the program of study [38]. For instance, civil engineering programs may focus on codes of ethics of the ASCE and ethical issues for the planning and design phase: whereas, construction engineering programs may focus on codes of ethics of the CMAA and ethical issues for the construction phase of projects. This study investigates whether a student's program of study affected their ethical

sensitivity to professional issues of the construction industry by testing the hypothesis:

H2: Construction engineering students of this pilot test are more ethically sensitive to the professional issues of construction in the TESC than civil engineering students who participated in this pilot test.

H02: There is no difference in ethical sensitivity to professional issues of the TESC between construction and civil engineering students who participated in this pilot test.

A one-tail Welch's t-test was performed to compare scores between student group one [freshman-sophomore] and student group two [juniors-seniors] of the pilot test. Student group two performed significantly better than student group one at the level of $\alpha = 0.01$ and a p-value = 0.0031. Therefore, the null hypothesis (H01) is rejected and there is no difference in ethical sensitivity between student group one and student group two.

The result of the one-tail Welch's t-test to compare scores between construction and civil engineering students of the pilot test indicates marginal significance at the level of $\alpha = 0.05$ and a p-value = 0.0503. Therefore, the null hypothesis (H02), that there is no difference in ethical sensitivity to professional issues of the TESC between construction and civil engineering students is rejected.

DISCUSSION

The results of the pilot study provide initial insight into test characteristics and student performance on the TESC. The intention of the pilot is not to perform a complete statistical analysis, but instead to provide a benchmark for future studies. First, the difficulty of items varies significantly. The pilot results indicate that five items of the TESC have high difficulty. Students of this sample tend to struggle with the items of claims games, bid shopping, bid peddling, front-end loading, and payment games. Of these items, bid peddling is found to be the highest difficulty.

High difficulty of the five items could indicate that the vignette may have had very high distractors or possibly could be the result of the structure of the vignettes. Low ability to recognize these issues could indicate low coverage of these topics in these civil and construction engineering programs, relating to the issue of person fit. The sample consisted largely of civil engineering students, answers for item one was consistent with design issues such as issues of public safety, which was not rated but could be considered in future administrations. The conclusion as to why these items show high difficulty cannot be made without further investigation into the programs of study.

Secondly, the first Welch's t-test highlighted that there is a significant difference (even at the significance level of 0.01) between results of a freshmen-sophomores group and a juniors-seniors group when comparing abilities of each group to recognize ethical issues of the construction industry. This initial result indicates that of the sampled programs, construction ethics education may have some positive impact on construction students' ethical sensitivity to issues of the construction industry. However, further investigation into curricular and co-curricular experiences of students during their course of study is necessary to explore the degree of impact.

Lastly, the p-value of the second Welch's t-test, 0.0503, is very close to the significance level of 0.05 which

observed results of students enrolled in a construction program and those enrolled in a civil engineering program. The results suggest that students of different construction related programs may have similar curricular experiences when it comes to construction ethics education; however, further research is necessary to make that conclusion.

The intent of the TESC is to provide a means for testing the ethical sensitivity of construction students. It is expected that students who are graduating construction related programs would be able to successfully identify ethical issues embedded within vignettes. The TESC may also be used within the industry to test the ethical sensitivity of construction practitioners to explore their understanding of various ethical scenarios.

Previous literature on the topic of evaluating student ethical competency regarding issues of the construction industry have not focused on the construct of ethical sensitivity or they do not substantially outline the development and means of testing for ethical sensitivity to issues of construction. This study provides the necessary detail to educators on the process of developing an immersive means of evaluating student ethical sensitivity through vignettes, which allows for a student to identify and/or explain the ethical issues that may be experienced in real-world scenarios. Additionally, this study provides the actual test and rating method for researchers/educators, which is missing from academic literature.

CONCLUSION

The construction industry is plagued by several unethical acts that impact society. There have been various means of being able to curb the ethical behavior of the construction industry and construction education requires it throughout a construction curriculum. The problem is that the requirements to teach ethics in construction education is not complemented by a means of evaluating student competency in ethical issues and it has been found that there is a gap in academic literature regarding the testing of student ethical sensitivity. Therefore, the objectives of this research were to develop a test for ethical sensitivity and to provide initial findings from a pilot test performed using this test.

Based on Clarkeburn's [21] model, an ethical sensitivity test specifically for construction known as the Test for Ethical Sensitivity in Construction (TESC) was created to evaluate student ethical sensitivity. The TESC was tested for usability and supported for content validity through an extensive literature review and via review by an industry panel. The TESC was pilot tested with 124 participants. Key findings of the pilot test indicate that there were multiple ethical issues that were difficult to identify by the students sampled. Additionally, initial observations from the pilot study indicate that junior-senior level students were able to recognize ethical issues better than freshmen-sophomore level students which may indicate that there is an educational influence. Lastly, initial observations of the pilot study indicate that there may not be a difference between the type of construction program a student is enrolled.

The TESC should be used by educators as a means of testing construction students' ethical sensitivity. One way the TESC could be used by educators is to test seniors in their final year to observe their ability to recognize ethical issues. Another use is via a pre-post testing which would allow construction programs to observe the effectiveness

of their ethics education by administering the test to students as freshmen and then again as seniors. By having a test that assesses student ability to recognize ethical issues of the construction industry, educators can understand how sensitive students are to ethical issues of the construction industry.

Limitations

Resources that are available to develop an auxiliary form TESC with new vignettes, administer the TESC, and rate the TESC may limit the use of the TESC technique. The ability to generalize results to the larger population is also a function of resource availability. A way to minimize this limitation would be to shorten the test to one or two vignettes with focused issues such as bid shopping and bid peddling, thus allowing for a broader distribution to a larger sample to determine student ability to recognize specific ethical issues of the construction industry. Additionally, the TESC does not provide the ability to control for other influences of ethical development such curricular and co-curricular experiences. In different types of construction programs, ethical concepts are taught throughout the curriculum and without resources to perform a longitudinal study, a pretest-posttest-control design is very difficult to perform.

Future Work

Ideally, expansion of the TESC to evaluate ethical sensitivity to include other ethical issues associated with the construction industry is desired. The conceptual framework of the TESC serves as a foundation, but there is a need for vignettes that will test construction students' ethical sensitivity to other issues not represented in this original TESC. Ideally, the research team envisions a vignette for each ethical issue of the construction industry that can be placed in a repository for ethics educators to teach in various courses throughout the construction curriculum. The inventory of ethical issues developed by Sands & Pearce [1] could be a useful starting point for vignette ideas.

Additionally, per the pilot results there is a need to investigate the ethics education further in the different types of construction programs to understand the high level of difficulty with five of the items of the TESC. Further investigations are necessary to compare results of the TESC to various construction ethics pedagogical techniques to investigate how ethics pedagogy influences the ethical sensitivity of construction students.

As with any new instrument, the research team intends to continue adding arguments of validity and reliability for the technique of evaluating ethical sensitivity via vignettes. Another design may assist this effort once resources are available. Additionally, this testing technique could be applied to a longitudinal study of construction students or via an experimental design where a workshop is used as an intervention technique.

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