# Constructing a Model for the Definition and Assessment of Teaching Effectiveness in Higher Education

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## Abstract

The definition of teaching effectiveness in higher education remains a mostly summative, top-down exercise with the definition being provided to instructors by institutional administration. Further, the assessment of teaching effectiveness often involves the use of summative instructor ratings that are completed by students. There exists a need to involve instructors in the definition and assessment of teaching effectiveness. In the context of the definition and assessment of teaching effectiveness in higher education, Systems Engineering is useful to view the educational environment of teaching effectiveness as a system, and to evaluate each component of the system with a view to maximizing the efficiency of the system. This paper is a continued work-in-progress that investigates the components of the system of teaching effectiveness in higher education, and addresses the methodologies used in gathering data from each component in order to define the overall system.

## Keywords

Assessment, Delphi Method, Higher Education, Systems Engineering, Teaching Effectiveness

## Introduction

This paper continues work investigating the definition and assessment of teaching effectiveness and delves into the specific methodology used to perform the study. The study utilizes a modified Systems Engineering approach that includes both traditional Systems Engineering method steps and artifacts, along with the steps and artifacts of the Delphi method. This combined approach allows a robust definition of teaching effectiveness formed from the consensus of subject matter experts. The combined approach further allows for the development of a conceptual model for assessing teaching effectiveness based on the formed consensus, and the subsequent evaluation of the alignment of the formed consensus and the developed conceptual model. The literature and practice has tended to approach the definition and assessment of teaching effectiveness as a composite endeavor, however, this is problematic in that it often fails to account for the different points of view from different stakeholder groups involved in the system. This study utilizes the different perspectives of each stakeholder group to form consensus of a definition for each group, and an associated conceptual model of an assessment methodology for each group.

## Methodology

The Delphi study method is a widely used and accepted method for gathering data from respondents within their domain of expertise [1]. The object of the Delphi method is to obtain the most reliable consensus of a group of experts, achieved by the use of questionnaires interspersed with controlled opinion feedback [2]. The literature is replete with the application of measures and methods for evaluating teaching effectiveness yet a concrete definition of what constitutes effective teaching in higher education is far less forthcoming [3]. Teachers often feel frustration while undergoing assessment of their effectiveness without a proper definition [4]. To this end, the use of the Delphi method to form consensus on the definition of teaching effectiveness provides a significant contribution to the assessment of teaching effectiveness. By creating consensus from identified stakeholders, definitions of teaching effectiveness can be created for each stakeholder perspective.

The Delphi method can be summarized as seen in Figure 1 below.

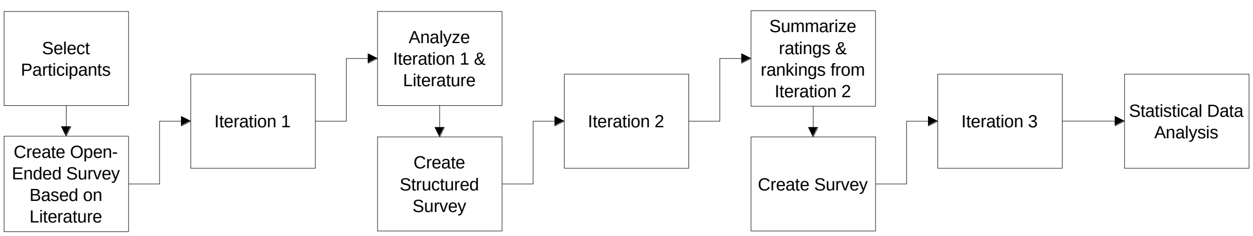


**Figure 1** The Delphi Method

As seen in Figure 1, the Delphi method uses surveys to poll selected participants through several iterations in order to arrive at informed consensus. Throughout the Delphi method, the participants provide rationale for their selections. In our combined approach a modified design rationale taxonomy is used to represent and store the captured rationale. Design rationale (DR) is the reasoning that goes into determining the design of an artifact and can include not only direct discussion of artifact properties but also any other reasoning influencing design of the artifact [5]. The participants of the Delphi method provide rationale as written and/or captured audio-visual recordings and these recordings are converted to a design rationale schema. The schema provides our combined approach with a record of decisions made, which helps to improve the analysis of our system. The literature indicates, with respect to capturing rationale, that improving analysis improves the design of a system [6].

Regarding the flow of the Delphi method, it is noted that the selection of participants in a Delphi study is a critical facet of the study since the selected participants are used to provide consensus for a population [7]. In the context of the current study, the participants are representative of the students, faculty, and administration in the School of Engineering at a Middle Atlantic Historically Black College and University (HBCU), and industry partners that traditionally hire graduates from the HBCU. The participants are solicited using emails to the stakeholder populations. Initial solicitation emails are sent to each population of stakeholders and respondents to this solicitation are provided with persona surveys that will be used to ascertain the level of experience and expertise that the respondents possess. Based on the respondents' responses to the persona survey participants are selected for the Delphi study, with a minimum of 5 and a maximum of 10 participants per stakeholder group. It is noted that the sample size in Delphi studies has been researcher and situation specific, and more often than not, convenience samples have been chosen dependent on availability of experts and resources [8]. In the instant study, participants are selected based on the availability of experts.

After the selection of the participants the literature is used to provide an open-ended survey for the participants, and this survey is provided in the first iteration. The results from this first iteration are used, along with the literature and rationale, to refine the initial survey and create a structured survey. The structured survey is provided to the participants for a second iteration and their responses and rationale are used to rank and sort the survey items. According to the literature, consensus usually starts forming after the second iteration [1]. The results from the second iteration are summarized and then used to create another structured survey that is presented to the participants in order to reach final consensus after the third iteration. Statistical analysis of the survey results are used to interpret the findings.

## Combined Approach

The Combined Approach employed in the current study can be seen in Figure 2 below. As shown in Figure 2 below, the CAM of the instant study correlates to the problem definition and analysis phases of the SDLC. The initial problem definition and first use of the Delphi method are analogous to the problem definition phase of the SDLC. The CAM, however, improves on the problem definition phase of the SDLC because it provides consensus on the problem definition from the participants of the Delphi method. In the specific application of the method in the instant study, a separate Delphi study is performed for each stakeholder group to form consensus on the specific definitions of teaching effectiveness in higher education for each stakeholder group separately. The Delphi studies for each stakeholder group are run concurrently so that relevant feedback from the groups can be used to inform each other.

After the results from the initial Delphi Method provide consensus on separate definitions for teaching effectiveness in higher education for each stakeholder group, the literature is further reviewed in light of the definitions. The different stakeholder group populations are further solicited for participants for JAD sessions for each stakeholder group. The JAD sessions are used to create conceptual models for the assessment of teaching effectiveness in higher education based on the consensus definition provided for each stakeholder group. The selection of JAD session participants is as critical to the CAM as the selection of participants for the Delphi method. The JAD session group must include enough people to make decisions, but should not have so many people that the progress of the group is stifled [9].As a rule, no overlap is allowed between participants in the Delphi studies and JAD sessions to reduce bias in the development of the conceptual model. As in the initial Delphi study, rationale is captured and in the JAD session. Based on the rationale, one-on-one follow-up interviews may be scheduled between JAD sessions in order to clarify rationale. A minimum of two JAD sessions are employed to arrive at a final conceptual model for each stakeholder group.

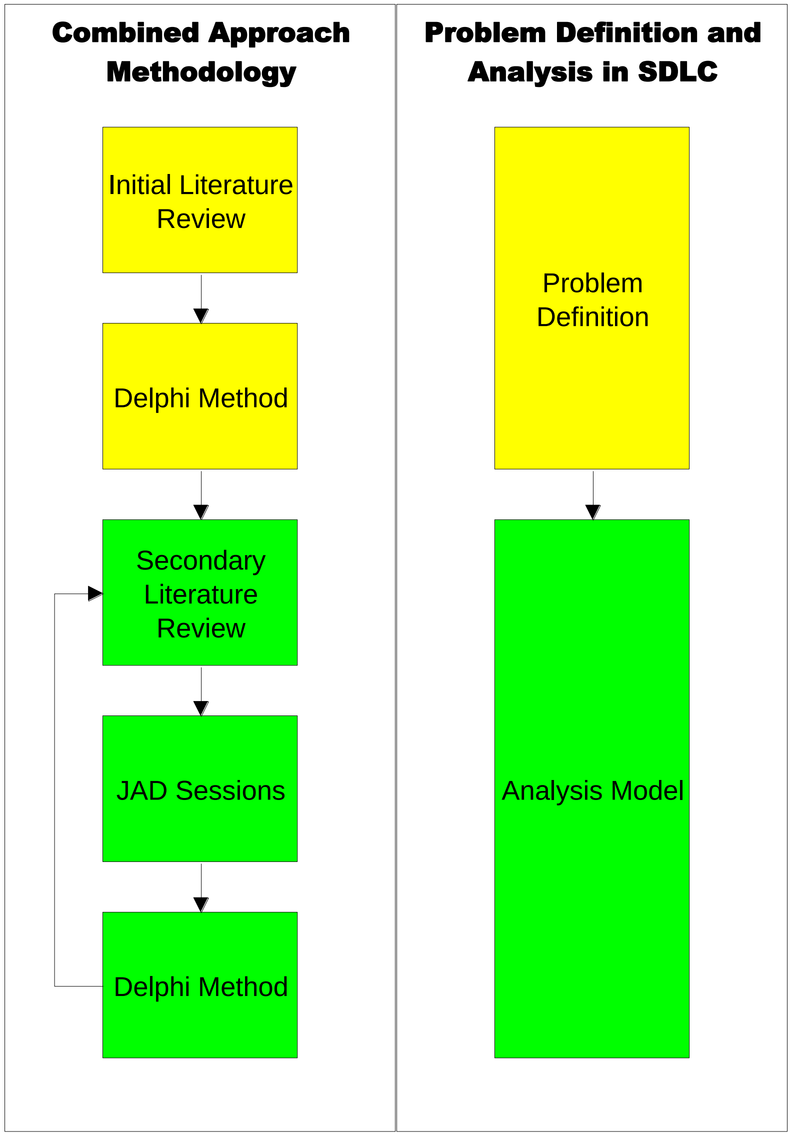


**Figure 2** Juxtaposition of the Combined Approach Methodology (CAM) and the Problem Definition and Analysis Phases of the Systems Development Lifecycle (SDLC)

The conceptual models from the stakeholder groups are used as input to second Delphi studies to measure the alignment of the models to the definitions derived from the initial Delphi studies. The participants for the second Delphi studies are the same as the participants for the initial Delphi studies in order to allow the initial experts to evaluate whether the conceptual models addressed their definitions. The use of the second round of Delphi studies provides the CAM with a method of evaluating the design of the conceptual models for improved analysis. If the second Delphi studies do not form consensus that the initial definitions are aligned with the conceptual models, then additional JAD sessions are conducted with the same or different groups of participants from the initial JAD sessions to refine the conceptual models based on the feedback and rationale from the second Delphi studies.

## Work In Progress

The solicitation of participants is currently underway, along with continued literature review. Additionally, design rationale taxonomies are being investigated for use with the CAM.

## References

1 Hsu, Chia-Chien & Sandford, Brian A. (2007). The Delphi Technique: Making Sense of Consensus. Practical Assessment Research & Evaluation, 12(10).

2 Dalkey, N., & Helmer, O. (n.d.). An experimental application of the delphi method to the use of experts. Retrieved October 8, 2016, from https://www.rand.org/content/dam/rand/pubs/research_memoranda/2009/RM727.1.pdf .

3 Fletcher, J., Bronner, L., Astatke, Y., & Dalrymple, O. (n.d.). *American Society of Engineering Education (ASEE) Spring 2016 Mid-Atlantic Region Conference*. Retrieved September 15, 2016, from http://www.asee.org/documents/sections/middle-atlantic/spring-2016/A_Systems_Engineering_Approach_to_Defining_and_Assessing_Teaching_Effectiveness_in_Higher_Education.pdf.

4 Graves, G. H., Sulewski, C. A., Dye, H. A., Deveans, T. M., Agras, N. M., & Pearson, J. M. (2009). How are you doing? assessing effectiveness in teaching mathematics. Primus : Problems, Resources, and Issues in Mathematics Undergraduate Studies, 19(2), 174- 193. Retrieved from http://search.proquest.com/docview/213423278?accountid=14753.

5 Dutoit A, McCall R, Mistrik I, Paech B (2006) Rationale Management in Software Engineering: Concepts and Techniques. In: Dutoit A, McCall R, Mistrik I, Paech (eds.) Rationale Management in Software Engineering, Springer-Verlag, Berlin Heidelberg, Germany, pp.1-48.

6 Buckingham Shum S, Hammond N (1994) Argumentation-Based Design Rationale: What Use at What Cost? International Journal of Human-Computer Studies, 40 (4): 603-652

7 Judd R. (1972). Forecasting to consensus gathering: Delphi grows up to college needs. College & University Business, **53**(1), 35-38, 43.

8 Akins, R. B., Tolson, H., & Cole, B. R. (2005). Stability of response characteristics of a Delphi panel: application of bootstrap data expansion. *BMC Medical Research Methodology*, *5*, 37.

9 Wood, J., & Silver, D. (1995). *Joint application development*. New York: Wiley.

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Jerry-Daryl Fletcher completed both his M.E and B.S.E.E. degrees from Morgan State University (MSU) and is a current doctoral student in the department of Industrial and Systems Engineering at MSU. He has been a full time patent examiner at the U.S. Patent & Trademark Office since July 2007. He has taught both as adjunct faculty and as a graduate teaching assistant in the department of Electrical and Computer Engineering at MSU between 2012 and 2015. He has coordinated summer programs at MSU directed at teaching middle and high schoolers engineering and has also coordinated pre-freshman summer bridge programs at MSU over the last 5 years. His research interests are focused on engineering education at HBCU institutions.

**Dr.**

Yacob AstatkeDr. Yacob Astatke completed both his Doctor of Engineering and B.S.E.E. degrees from Morgan State University (MSU) and his M.S.E.E. from Johns Hopkins University. He has been a full time faculty member in the Electrical and Computer Engineering (ECE) department at MSU since August 1994 and currently serves as the Associate Dean for Undergraduate Studies in the School of Engineering. He has more than 15 years of experience in the development and delivery of synchronous and asynchronous web-based course supplements for electrical engineering courses. Dr. Astatke played a leading role in the development and implementation of the first completely online undergraduate ECE program in the State of Maryland.

**Dr. LeeRoy Bronner**

Dr. LeeRoy Bronner completed his Master of Science in Electrical Engineering at Northeastern University (1966) and the Doctor of Philosophy in Systems Engineering at Case Western Reserve (1973). Also, Dr. Bronner spent 25 years in systems engineering at the IBM Corporation and 18 years at Morgan State University teaching System Engineering. His primary research addresses definition, analysis and solution of large complex systems (e.g., education, engineering, social, energy, medical, etc.) using the System Development Life Cycle (SDLC). One such complex system was the basis for a doctoral dissertation defined as “The Education of African Americans: Retention and Graduation.”

**Dr. Odesma Dalrymple**

Dr. Odesma Dalrymple is an Assistant Professor in the Shiley Marcos School of Engineering at University of San Diego. She conducts research on tools and techniques that can be readily applied in real engineering learning environments to improve student learning and teaching. In this respect her two prominent research contributions are with: 1) artefact-inspired discovery–based pedagogy, i.e., learning activities where students’ exploration of STEM knowledge is self-directed and motivated by interactions or manipulations of artefacts; and 2) the development of faculty expertise in outcomes-based course design through the use of the Instructional Module Development (IMOD) system, a self-guided web-based training tool.