# Structured Abstracts for the IEEE TRANSACTIONS ON EDUCATION

## I. INTRODUCTION

AS A JOURNAL for publication of significant and original scholarly contributions to education in fields within the scope of interest of IEEE, the goal of the IEEE TRANSACTIONS ON EDUCATION is to support advancement and improvement in the documentation and conduct of educational research. In 2013, the journal made significant progress in its continuing efforts to achieve its goal with the publication of review criteria in three areas of scholarship: application, discovery, and integration [1], [2]. Now, in 2018, the journal takes another step with the requirement of structured abstracts for all manuscripts considered for peer review. Starting with the issue published in May 2018, the journal requires that the abstract for every manuscript be written within a structured form—an abstract divided into specified sections. The purpose of this editorial is to present the rationale and expectations for structured abstracts.

Abstracts are becoming increasingly important in scholarly publications, for at least three reasons. First, readers must sift through an increasing number of journals, and the consequent increased number of articles, to identify relevant and significant contributions. Readers increasingly rely on the article abstract to help them understand what will be learned by reading the manuscript and to decide whether to investigate the entire manuscript more fully. Second, journal websites often make abstracts freely available for the articles that they publish. While individual readers may have to pay to access the entire article, they can read the abstract without charge and make decisions about whether to acquire the article. Therefore, the abstract has become the "Web gateway" for the article. Third, article databases (e.g., ERIC, Scopus, Google Scholar, etc.) often index an article by keywords in its title and abstract. Search results provided by these databases often depend on contents of the title and abstract.

Since abstracts have become increasingly important, many journals now require structured abstracts [3]–[6]. Now, the IEEE TRANSACTIONS ON EDUCATION also requires structured abstracts in order to provide a consistent introductory interface for each article published in the journal. A structured abstract has specified sections; the sections themselves vary according to the journal. For the IEEE TRANSACTIONS ON EDUCATION, the sections in the structured abstract depend on the area of scholarship for which the manuscript is submitted and reviewed. Since IEEE limits abstracts to 250 words, each section is limited to approximately two sentences. The purpose of this editorial is to review the requirements for a structured abstract for each of the three areas of scholarship to help authors increase the impact of the abstract, while adhering to the word limit.

Authors should note that the structured abstract *replaces* the traditional abstract. It is not intended as an additional element in the manuscript or a supplemental document.

## II. STRUCTURED ABSTRACT SECTIONS FOR THE THREE AREAS OF SCHOLARSHIP

First, the journal publishes significant and original scholarly contributions to education in fields within the scope of interest of IEEE, e.g., electrical and electronics engineering, computer engineering, computer science, etc. Contributions are accepted in three areas of scholarship, and the structured abstract sections depend on the area of scholarship.

Contributions for the Scholarship of Application will often describe how prior research on learning and teaching has been applied to create or design, implement, and evaluate educational activities in fields within the scope of interest of IEEE. These activities include, but are not limited to, courses, course segments, curricula, laboratory experiments, course projects, capstone courses, and outreach activities. Faculty members across the world design these activities for their students, but to be published in the IEEE TRANSACTIONS ON EDUCATION a paper describing this work must (a) demonstrate effectiveness of the educational activities with respect to clear, explicit outcomes and (b) provide a cogently articulated rationale for key design decisions. If paper states that the education activity leads to improved outcomes, then the paper will be expected to provide comparisons with prior approaches, methods, or activities. The sections for a structured abstract for the Scholarship of Application are listed here; these are expected to be the first word/s in each section of the structured abstract:

- Contribution;
- Background;
- Intended Outcomes;
- Application Design;
- Findings.

Contributions for the Scholarship of Discovery will be primarily in the form of new knowledge to education in a field within the scope of interest of IEEE. These contributions can take many forms. One example might be a tool or process for assessing student learning; another might be an explanation of difficulties that students encounter when learning one or more concepts. Other forms exist, but to be published in the IEEE TRANSACTIONS ON EDUCATION a paper asserting that new knowledge is being contributed requires an intimate

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understanding of prior contributions, and is expected to be supported by compelling evidence. The sections for a structured abstract for the Scholarship of Discovery are:

- Contribution;
- Background;
- Research Questions;
- Methodology;
- Findings.

Contributions for the Scholarship of Integration will often be multidisciplinary, integrative, and/or interpretive syntheses across extensive prior research to identify patterns, themes, trends, needs, and opportunities upon which other scholars can build. The sections for a structured abstract for the Scholarship of Integration are:

- Contribution;
- Background;
- Research Questions;
- Methodology;
- Findings.

## III. Common Structured Abstract Sections

Three sections are common to all three areas of scholarship: Contribution, Background, and Findings. Expectations for these sections are discussed here.

### A. Contribution Section

The Contribution section is expected to situate the contributions of the manuscript within the context of prior work, in a very concise format. Authors should briefly summarize relevant prior contributions in the area, and should describe how the contributions of the manuscript build on, and are distinct from, prior contributions.

Since the Contribution section comes first, authors may think they need to use this section to introduce the manuscript and what it will present. Authors may think they need to provide one or two transition sentences to help readers understand the nature of the study presented in the manuscript. These or similar ideas are **not** the intent of the Contribution section; it is **not** a summary of the content of the manuscript, a summary of the how the study was conducted, or an introduction to the manuscript. Instead, the purpose of the Contribution section is to ***summarize what prior work has contributed to the area being studied in the manuscript, and then state the additional contribution of the study presented in the manuscript***. If readers read nothing else, they will see from the Contribution section how the study has moved the field of study forward.

It may be helpful to consider a ***two-sentence template*** for the contribution section. The first sentence would summarize the state-of-the-art about the subject that is addressed in the manuscript. The first sentence focuses on prior research in the area and summarizes contributions from extant work, and might read: "*From prior studies on [fill in the area that is the focus of the study], it has been shown that [fill in what is already known].*" The second sentence describes how the study extends existing knowledge in the context of prior research; it might read: "*From this study, the contributions are [fill how the study presented in the manuscript contributes to the knowledge base as summarized in the first sentence].*" Manuscripts are not required to use this two-sentence template, but it is offered to help clarify expectations for this section.

*Example:* Here is an example of a hypothetical Contribution section for a paper on the signals and systems concept inventory published in the IEEE TRANSACTIONS ON EDUCATION in 2005 [7].

> *Contribution: While faculty members want students studying signals and systems to have a conceptual understanding of the subject, no assessment instruments exist to evaluate desired understanding. This paper presents an assessment instrument supported by evidence of its validity through use with over 900 students.*

*Example:* Here is an example of a hypothetical Contribution section for a paper, published in the IEEE TRANSACTIONS ON EDUCATION in 2009, that illustrated the effectiveness of an instructional approach that combined two instructional approaches: blended learning and problem based learning [8]. It should be noted that it is important to consider the publication date when reflecting on the state-of-the-art for the study.

> *Contribution: Both blended learning and problem based learning are widely used instructional approaches, and are shown to be more effective than traditional lecture in promoting student success. This paper presents an instructional approach that combines the two and shows that significant improvements in student success were observed.*

### B. Background Section

The Background section ***justifies the need for the study, based on the current situation with respect to education in the specific field that is the focus of the study***. While the Contribution section summarizes the state-of-the-art, the Background section provides a rationale for the study to extend or add to the state-of the art. This section addresses the question: Why is additional research in this subject needed? It should not mention the program, institution, or region in which the study is conducted, but should focus on the field to which a contribution is being made.

*Example:* Here is an example of a hypothetical Background section for a paper on teaching circuits using problem based learning, published in the IEEE TRANSACTIONS ON EDUCATION in 2007 [9].

> *Background: Extensive research has demonstrated the efficacy of problem based learning in improving student learning. In many electrical engineering curricula, circuits is a critical introductory course; the demonstrated effectiveness of problem based learning indicates it may be a worthwhile instructional approach for teaching circuits.*

*Example:* Here is an example of a hypothetical Background section for a paper on teaching design using real-world

projects published in the IEEE TRANSACTIONS ON EDUCATION in 2013 [10].

> *Background: Using projects sponsored by external clients in courses has been shown to lead to improved student learning and engagement. Motivated by these research findings and the increasing importance of systems engineering, an approach to teaching systems engineering design using university-funded research projects would be worthwhile to study.*

### C. Findings Section

The Findings section ***summarizes results from the study***. At least one difference between the Findings section and the Contribution section is that the Findings section *summarizes* specific results from the study, while the Contribution section *situates* those findings in the context of prior work. For an article under the Scholarship of Application, the Findings section may state how an instructional intervention influenced student learning, while the Contribution section describes the importance of these findings relative to results from prior studies. For articles under the Scholarship of Discovery and the Scholarship of Integration, the Findings section may summarize what the study uncovered, while the Contribution section illustrates how results from the study have added to knowledge in the field.

## IV. STRUCTURED ABSTRACT SECTIONS SPECIFIC TO THE SCHOLARSHIP OF APPLICATION

Two sections are specific to the Scholarship of Application: Intended Outcomes and Application Design.

### A. Intended Outcomes Section

Manuscripts submitted for the Scholarship of Application in the IEEE TRANSACTIONS ON EDUCATION present an intervention that is intended to achieve a desirable goal. These studies are expected to assess influences of the intervention and present compelling evidence supporting conclusions about those influences. Assessment evaluates influences of the intervention relative to a set of desired outcomes. Articles published in the journal are expected to make these outcomes explicit. The Intended Outcomes section ***presents a summary of these outcomes***. For example, if a study presents an intervention in a course intended to improve student learning, the Intended Outcome section summarizes the outcomes anticipated by the designers of the intervention, i.e., what are the observable expectations for student learning? Since the purpose of the Intended Outcomes section is to present the outcomes for the intervention, introductory phrases are unnecessary to indicate that outcomes will be presented. Instead, the section should focus on explaining the intended outcomes.

### B. Application Design Section

Manuscripts submitted for the Scholarship of Application present an intervention that was intended to achieve a desirable goal. Studies submitted for the Scholarship of Application in the IEEE TRANSACTIONS ON EDUCATION are expected to present an argument supporting the selection of that intervention, i.e., authors are expected to explain their rationale for choosing this intervention. The rationale is expected to be more than novelty or interest on the part of the authors; rather, it should be based on prior research on learning and teaching. The Application Design section of the structured abstract ***gives a summary of this rationale***. Since the purpose of the Application Design section is to present the rationale for the intervention, it is again unnecessary to include introductory phrases saying that the rationale will be presented or describe its nature. Instead, the section should focus on explaining why the authors chose the intervention to achieve their intended outcomes.

## V. STRUCTURED ABSTRACT SECTIONS SPECIFIC TO THE SCHOLARSHIPS OF INTEGRATION AND DISCOVERY

Two sections are specific to the Scholarships of Integration and Discovery: Research Questions and Methodology.

### A. Research Questions Section

Manuscripts submitted for either the Scholarship of Integration or the Scholarship of Discovery are expected to contribute new knowledge to education in the selected field within the scope of interest of IEEE, such as electronics, introductory programming, wireless communication, software design, and so on. In the case of the Scholarship of Discovery, empirical data is collected from individuals through interviews, observation and/or interaction with a study's participants in their real-life environment, and through surveys, testing, focus groups, and the like. In the case of the Scholarship of Integration, data is collected from prior studies; the research is a study of studies, or a meta-study. Development of the research method and the rationale for conducting the study depend on the research questions. This section of the structured abstract ***states the research questions and thus provides the reader with a useful encapsulation of the entire study and significant information about the relevance and importance of the study***.

### B. Methodology Section

This section of the structured abstract ***summarizes the research method for the study***. Manuscripts submitted for either the Scholarship of Integration or the Scholarship of Discovery are expected to describe how the study was conducted. Manuscripts submitted for the Scholarship of Integration are expected to present a method that indicates a systematic search and synthesis of the literature that, to the extent possible, is not influenced by biases, such as those of the researcher. In part, the decision of whether to accept manuscripts submitted for these areas of scholarship depends on the quality of the method, and therefore the likelihood that the findings presented will be accepted as contributions to the body of knowledge.

## VI. Conclusion

Starting in May 2018, the IEEE TRANSACTIONS ON EDUCATION began requiring structured abstracts for all published papers. This editorial presents the rationale for the decision to require structured abstracts, lists the required sections for the structured abstract, and explains expectations for each section in the structured abstract. The goal of this editorial is to help authors prepare structured abstracts that (i) show advancement of the fields of education in areas within the scope of interest of IEEE, (ii) give the reader a clear understanding of the manuscript's content, and (iii) meet the expectations for these abstracts.

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