From the Editor

Clarity of Scope and Focus: The Rearview Mirror is Always Clearer than the Windshield

Publication of this spring 2024 issue of the *Journal of Technology Education* (*JTE*) marks one year since taking on the role of Editor. During this first year several important short-term goals have been achieved, and a few long-term goals are targeted for completion during the upcoming year. Instrumental in achieving these goals were the efforts and contributions made by Associate Editor Phil Reed, the ITEEA Leadership Team, and the CTETE Executive Committee. My thanks to them all, and I look forward to their continued support of the *JTE*.

Most significant among the year-one goals was achieving a resurgence of manuscript submissions and the concurrent expansion of our group of expert reviewers. Moreover, the responsiveness of our reviewers has resulted in a shortened average timeframe of approximately three months between submission, review, and initial feedback to authors. At the same time, we have improved our global footprint leading to a significant increase in international manuscript submissions. As the *JTE* is an international journal, our improved global footprint brought about the need for expanding the Editorial Board to include additional scholars from around the globe to participate in the journal management.

Our expanded Editorial Board, as listed in this spring 2024 issue, enriches the mix of perspectives reflective of our profession as practiced in regions around the world. And it is these perspectives that will materially contribute to management of the *JTE* and ensuring journal viability and relevance in the coming years. An example of this is recent input from the Board regarding the relatability of the scope and focus sections of the journal to our international contributors. The concern being that the journal scope might be somewhat geocentric and is not being framed in terms of a scholarly platform intended to advance thought on issues relevant to the full spectrum of teaching and learning globally within the profession. As a scholarly platform, the scope should be framed to closely reflect the topics addressed within the body of published manuscripts. That said, the Board explored the research foci among articles published in the *JTE* over the past decade through analysis of keywords. Word-cloud summaries of these keywords revealed that technology, engineering, design, and STEM (in that order) were the prominent foci of research conducted. I extended this exploration to include articles from the past 20 years and analyzing keywords within 5-year spans. Using two different word-cloud generators set at 25% and rank ordering the top four disciplinary terms, the prominent research foci from 2004 to 2013 were consistently technology, engineering, and design. In the past 10 years (2014 to 2024), both design and

STEM rose in prominence as research foci of published articles. And of those articles focused on STEM (roughly 30%), the research was directed at investigating the integration of disciplines within the context of design (technological and/or engineering) education. This trend in technological/engineering design based learning research portrays the *Journal of Technology Education* as a scholarly platform for advancing our collective thinking on the epistemological, philosophical, theoretical, pedagogical, and cognitive foundations of technology, engineering, and design education. Though analysis of keywords is arguably cursory research, the trend in publications has clearly moved in the direction of increased investigations of design (technological/engineering) as a dominant method for teaching and learning within the profession globally. The trend of increased publications focused on investigating technological/engineering design based learning begs the question, *what unique position among the journals of our field does the JTE hold at this point in time?* Specifically, does the scope, focus, and even the title accurately reflect the unique position held by the *Journal of Technology Education*?

At its inception, the *JTE* was intended to be a scholarly outlet addressing the lack of published research from those in the field on P-16 technology education (Sanders, 1989; Sanders, 1994). However, over the past two decades the focus of research published in the *JTE* is less on technology education alone, and increasingly on engineering and design education. Design in particular has become a prominent focus of research investigated as a heuristic that students learn to call upon as a means of acquiring both content and practice knowledge – the designerly way of coming to know. A heuristic is a set of actions one knows to engage in when confronted with a certain category of problem (problem type) or when presented with a specific situational need to know. Historically, schooling (K-12 education) has promoted the learning of the scientific method and hermeneutic method as the two distinct heuristics students must learn to call upon for acquiring knowledge and/or solving problems. As a heuristic, the scientific method is that set of actions one follows in the sciences as a means to understand and/or explain phenomena, natural or otherwise. In the humanities, the heuristic one follows is the hermeneutic method for gathering and synthesizing information as a means of documenting and presenting acquired sociocultural knowledge. A third heuristic gaining traction in K-12 education is the designerly method – that set of actions one follows during the design process to acquire the knowledge necessary for achieving viable technological/engineering solutions addressing human (sociocultural) needs, i.e., Maslow. In the US, this traction has become increasingly evident in the preparation of national standards of learning, and overtly present in the standards for science education.

The educational priority that took root in the late 1980s was the integration of science, mathematics, and technology (SMT), but where this union was perceived to be that which "…forms the scientific endeavor…" (AAAS, 1989, p.

25). By the mid-1990s, this concept of the scientific endeavor carried through into the National Science Education Standards (NSES) (NRC, 1996) where technological design was included specifically as a strategy for teaching science concepts. This intent was articulated in Content Standard E of the 1996 NSES, which stated:

> …students' work with scientific investigations can be complimented by activities in which the purpose is to meet a human need, solve a problem, or develop a product rather than to explore ideas about the natural world. The tasks chosen should involve the use of science concepts already familiar to the students or should motivate them to learn new concepts… (p. 5).

Though not overt in 1996, the intent was clearly for students to learn the set of actions one follows during the design process (design heuristic) as a designerly method for learning science concepts. Educational reform over the next several decades brought about the inclusion of engineering in K-12 education, which gave way to the STEM education movement. The recently developed Next Generation Science Standards (NGSS) (Lead States, 2013) continued capitalizing on the designerly way of knowing by intentionally incorporating engineering practices (defining problems and designing solutions) as two of the eight practices all students are to learn in science. Why would science education now decide to explicitly require engineering practices as an integral component of their national standards? The reason can be seen in the Framework for K-12 Science (2011) from which the NGSS were developed:

> Engineering and technology are included as they relate to the applications of science, and in so doing they offer students a path to strengthen their understanding of the role of the sciences. We use the term engineering in a very broad sense to mean any engagement in a systematic practice of design to achieve solutions to particular human problems. Likewise, we use the term technology to include all types of human-made systems and processes (p. 11).
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> Finally, engineering and technology provide a context in which students can test their own developing scientific knowledge and apply it to practical problems; doing so enhances their understanding of science – and, for many, their interest in science – as they recognize the interplay among science, engineering, and technology. We are convinced that engagement in the practices of engineering design is as much a part of learning science as engagement in the practices of science (p. 12).

The above excerpts are clear in communicating that the NGSS includes engineering practices to teach the sciences, and not to teach engineering or design. Equally important is what they do not communicate - that

technological/engineering design based learning (T/E DBL) is a method of knowledge acquisition distinct from that of the scientific method. Nor that, in most cases, the design process inherently requires use not only of the design knowledge acquisition heuristic (KAH), but concurrent use of the scientific and hermeneutic heuristics as well. And yet, science education now overtly includes the design method as a set of actions, a unique KAH, in which all students are to engage when learning science.

The growing inclusion of T/E DBL in K-12 education standards unmistakably signals that the designerly way of knowing is gaining traction as one of three essential methods of knowledge acquisition. It would stand to reason then, that efforts should be made to ensure that all K-12 students exit schooling well versed in all three knowledge acquisition heuristics (scientific, hermeneutic, and designerly methods), and with the ability to select and implement any one of them when confronted by a specific problem type or situational need to know. Those in our profession have long recognized T/E DBL as a profoundly different way of learning, inclusive of distinct design language (heavily symbolic) used to communicate knowledge and understanding, and which inherently imposes cognitive demands on the learner. In fact, more than 30 years ago Archer proposed that "The justification for the nomination of a third area in education lies not in the existence of subjects which do not fit readily into the definitions of Science and the Humanities, but in the existence of an approach to knowledge, and of a manner of knowing, which is distinct from those of Science and the Humanities" (1979, p. 20. Cross (1982) continued advancing this justification by arguing for the inclusion of design learning as a "third culture" alongside the science and humanities cultures. Specifically, each of these learning cultures had unique ways of knowing – scientific, humanities, and designerly ways of knowing. Thus, very early on our field has recognized the significance of design as a unique way of coming to know and justified its inclusion as one of three knowledge acquisition heuristics all students should possess when they exit K-12 education. Given this long-standing recognition, it should come as no surprise that we see a steady flow of research focused on the educational benefits of design based learning (technological/engineering) by scholars in our field. Moreover, this research trend reflects the current emphasis in STEM educational reform of including T/E DBL as the third KAH all students should learn and know how/when to use.

Bringing this editorial full circle, I return to the issue regarding the scope and focus of the *JTE*, and the question of *what unique position among the journals of our field does the JTE hold at this point in time?* The answer would seem to fit the cliché that "the rearview mirror is always clearer than the windshield" (Buffett, 1991). Looking backward in time down the road of *JTE* publications, technology education alone as the research focus is not the largest object in the rearview mirror. Increasingly, the object becoming ever more prominent in that mirror is design based learning as that set of actions all

students will call upon when engaged in T/E DBL – the designerly way of coming to know.

Continuing the trend in research foci of submitted manuscripts, all of the articles included in this spring issue in one way or another addresses the designerly way of knowing. Beginning with the article by Hallström and Ankiewicz, design volition, as it relates to design methodology, is investigated as a philosophical component of most K-12 technology and engineering education subjects. Specifically, they review design as a value-laden sociocultural phenomenon with implications for K-12 schooling writ large. This is followed by the Blay and Espartinez article which presents research on the integration of Design Thinking (DT) in an undergraduate Philosophy course. Implemented in a discipline other than our own, their research demonstrated DT to be a transformative way of fostering problem-solving skills and a platform for improving the student learning experience. The research presented in the Thorne, et al. article follows with design based learning research investigating the optimization of classroom instruction. This was conducted within the context of T/E DBL where students were immersed in the Learning by Evaluating process as a means of promoting self-reflection specifically intended to enhance their critical thinking and decision-making skills. Buckley then connects the first three articles from a research design perspective by raising our awareness of the need to ensure a credible literature base supporting the social science research conducted in our field. Specifically, he offers a primer for conducting power analysis for common research designs chosen by scholars within the field. Collectively, the articles presented in this issue continues with the trend of research published in the *JTE* focused on validating the teaching and learning benefits of T/E DBL as a unique designerly way of coming to know. If one accepts that the scope, focus, and title of a journal should reflect the research published in that journal, then there is reason to revisit the current scope, focus, and title of the *Journal of Technology Education*.

JGW

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