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Clarifying the Use of Formative Measurement in the IS Discipline: The Case of Computer Self-Efficacy

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1. Introduction

The spirited nature of the Marakas et al. reply speaks volumes about the importance of continuing the debate on how best to measure computer self-efficacy (CSE), as well as on the proper application of formative measurement in the IS discipline. While we believe that formative measurement can be appropriately applied in very specific situations, we also continue to witness the misapplication of formative measurement in our discipline, including (in our opinion) the formative specification of CSE.

We believe the potential exists (given the natural constraints of time) for researchers in any discipline to necessarily rely on oft-cited papers when drawing conclusions on how to properly employ formative measures. In preparing our original comment on Marakas et al. (2007), we reviewed more than three decades' worth of work on formative measurement, and when conflicting opinions were discovered, looked to well-known psychological methods experts for clarification. Given the large quantity of methodological work that has spanned multiple disciplines across extended periods of time, we believe synthesizing this research—and applying it to the particular context of CSE in the information systems discipline—can help us better understand not only CSE, but also formative measurements in general. Such an understanding allows us to appropriately and systematically advance knowledge in our discipline.

2. Computer Self-Efficacy as a Formative vs. Reflective Construct

Rather than attempting to address all of the points raised in the Marakas et al. reply, we will focus our response on four specific issues related to CSE and formative measurement: 1) the use of formative measurement to measure psychological constructs, 2) the incorporation of previously reflective items as part of a new formative measure, 3) the effect of employing different endogenous measures on formative measurement results, and 4) the change in conceptual meaning resulting from formative measurement.

To the first point, CSE is a psychological construct, and psychological constructs have been consistently suggested as unsuitable for formative measurement (Diamantopoulos and Winklhofer 2001). For example, one central criterion for identifying formative constructs is that changes in the construct do not cause changes in the indicators (see Jarvis et al. 2003 for more on this issue). CSE as a psychological construct appears to fall short in this respect, as it seems clear that changes in a person's CSE would naturally cause changes in the indicators used to measure the concept.

To the second point, for two of the formative CSE measures developed by Marakas et al. (2007), (i.e., spreadsheet CSE and GCSE), the item pool consisted solely of indicators taken from two previously validated reflective CSE measures. We believe this may inadvertently send the (incorrect) message to IS researchers that it is acceptable to simply re-specify existing reflective indicators as formative without carefully considering the substantive theory underlying the construct.

To the third point, the formative CSE indicators proposed by Marakas et al. (2007) were in many cases dependent on the endogenous variable used to estimate them. Thus, many of the indicators that were retained represented the "best" predictors of the endogenous variable used for their estimation, and, as we illustrated empirically in our response, are not necessarily the best predictors when employed in a different context. While we understand that some indicators were retained in Marakas et al. based on the authors' collective belief that they were instrumental to the construct, we suggest that this criteria is too subjective, and that different researchers would quite possibly make different decisions in this regard.

Finally, because formative indicator weights are dependent on the nomological net in which they are estimated, and formative indicator weights are used to determine the conceptual meaning of constructs, the conceptual definitions of CSE formative constructs will likely differ as they are employed in different research models and contexts, impeding development of a cumulative CSE

research tradition.

3. Conclusion

The main focus of our comment is to caution researchers on the danger of misapplying formative measures in the IS domain, in this case as it pertains to CSE. As Marakas et al. point out in their reply to our comment, formative measurement is here to stay, so we believe it is critical that (as a discipline) we understand when, and when not, to use it. Without the appropriate application of the tools in our scientific toolkit, our ability to move knowledge forward in a systematic fashion is limited. We think there is no greater contribution to any discipline than to be sure that the processes used to conduct research are appropriate to the context.

We would like to express our sincere gratitude to Marakas et al. for their continued contribution to the CSE literature, and for raising the opportunity to discuss the relative merits of formative vs. reflective measurement. We would also like to thank the three anonymous reviewers and senior editor for their constructive feedback on preparing our comment, as well as a number of methodological experts who graciously took the time to discuss this issue with us. Given the frequent application of the CSE construct in IS research, and the inherent difficulty of interpreting the large body of literature surrounding both the concept of self-efficacy and formative measurement, further discussion regarding these issues is clearly justified.

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