International Journal of Teaching and Learning in Higher Education 2023, Volume 35, Number 1, 20-35
http://www.isetl.org/ijtlhe/ ISSN 1812-9129

A Mixed Methods Outcome Evaluation on Mixed Methods Research (MMR) Competencies

Su-I Hou
University of Central Florida

Mixed Methods Research (MMR) is growing rapidly, globally, and continues to develop across disciplines. A competency-based course design can better help develop mixed methods research scholars with competency-based learning outcomes. MMR-specific guidance, which informs meaningful design features for competency-based learning outcomes in graduate programs, has been scarce. The overarching aim of the study was to conduct a mixed methods evaluation of an innovative MMR course among doctoral students on MMR competency outcomes. This study examined five cohort groups of doctoral students enrolled in an MMR course during 2016–2020 (n=54) and provided a research-tested MMR tool that is sensitive to detect changes and easily administered. This MMR-Competency Outcomes Measurement Tool (MMR-COMT) included a 15-item quantitative Mixed Methods Research Competency Scale (MMRCS_15), a 2-item MMR overall competency assessment (MMROV_2), and 3-item qualitative probing questions. The findings showed strong convergent evidence from both the significantly increased MMR learning objectives and competency scale scores quantitatively, as well as overwhelmingly positive qualitative quotes, convergently demonstrating the significant impact on MMR competencies. The current study contributes to the overall scholarship of the teaching and learning community with MMR-specific empirical studies, providing MMR competency measurement tool, as well as highlighting key course design features with students' voices.

Mixed Methods Research (MMR) is growing rapidly, globally, and continues to develop across disciplines (Creswell & Clark, 2018; Guetterman, 2017). Given the increasingly complex and challenging social and health issues, there is an urgent need for mixed methods application. The evidence is clear with the increasing number of mixed methods proposals to federal agencies and foundations (Clark, 2010), as well as an NIH-funded R25 MMR Training Program specifically designed to equip faculty-level scholars in health science to conduct MMR (Guetterman et al., 2018).

The Need for Teaching and Training MMR Researchers

Demand for MMR training is high, as researchers are increasingly using MMR without substantive training in rigorous MMR methodology or techniques (Guetterman et al., 2017). Currently, only a paucity of empirical studies examines topics related to teaching and learning mixed methods. An advanced search was conducted with keywords of mixed methods, course or training, teaching strategies or methods, resulting in very limited relevant studies. One earlier case study, which examined two complementary MMR course designs, noted some specific steps critical to successful learning (Christ, 2009). These included creating an introduction with a problem statement, a purpose statement, review literature to justify the intervention, theoretical framework, and MMR design, compositing an overarching MMR question with qualitative and quantitative sub-questions, a methodological statement with research diagram, design replicable procedures, including specific design procedures for sampling, collection, analyses, and merging, and steps to support credibility and reliability. A competency-based course design can better equip MMR researchers with competency-based learning outcomes. Competency-based education has been an important criterion used by accreditation bodies and professional organization to assess the quality of academic programs and training (Council on Education for Public Health, 2018; Stevahn et al., 2005). Stevahn and colleagues noted competencies in the program evaluation field as "*the knowledge, skills, and dispositions [program evaluators] will need for successful professional practice*." (Stevahn et al., 2005, p. 45). As a young, rapidly growing yet emerging MMR field, there have been limited competency development efforts established thus far. As a result, MMR-specific guidance, which informs meaningful design features for competency-based learning outcomes in graduate programs, has been scarce.

Measurement of MMR Competencies

Understanding the skills needed to conduct MMR remains a relatively unexplored area despite the continued increase in the adoption of MMR. Currently, there is no agreed set of standard MMR competencies in the field. Guetterman and colleagues (2017) are among the first to use a proficiency framework to explore the skills needed to conduct MMR and developed a typology of three levels of mixed methods proficiency: novices, researchers, and methodologists (Guetterman, 2017; Guetterman et al., 2017). They generated a pool of items

to assess mixed methods research skills among faculty-level investigators in six domains related to the research process: research question (RQ), design approach (DA), sampling (S), data collection (DC), analysis (A), and dissemination (Dis). Respondents were asked to rate their ability to define or explain concepts of mixed methods under each domain, their ability to apply the concepts to problems, and the extent to which they need to improve (Guetterman et al., 2017). Although reliabilities and criteria validity were tested among a snowball sample of both faculty and graduate students, this measurement was mainly developed to assess MMR skills among faculty-level trainees.

Gap

There have been a few existing studies focused on how to teach MMR graduate-level courses (Bazeley, 2003; Christ, 2009; Earley, 2007; Frels et al., 2012; Guetterman, 2017; Hou, 2024; Poth, 2014) or faculty-level training programs (Guetternamn et al., 2019). However, more empirical studies are needed to inform and evaluate teaching and learning mixed methods. Competency-based education and corresponding outcome assessment and course development warrant our continued attention (Hou, 2009; Hou, 2022; Hou, accepted; Hou & Pereira, 2017; Poth et al., 2020). It is especially critical to provide design and assessment guidance, which ties innovative teaching pedagogies with corresponding competency-based MMR assessment.

There's an urgent need to develop graduate-level MMR competency-based measurement tools that can serve as a guide for MMR scholars and instructors to assess their training and teaching impact. It is critical to conduct empirical studies specific in the MMR field and provide teaching examples on course design with student learning outcome assessment among graduate courses in higher education settings (Poth, 2014). Guetterman's scale was originally developed with faculty in mind and measured specific independent skills, whereas the current study aimed to focus on graduate students and assess more integrated MMR competencies.

Purpose

The overarching aim of the study was to conduct a mixed methods outcome evaluation of an innovative MMR course among doctoral students on their MMR competencies. The key feature of the innovative teaching pedagogy involved hands-on data analyses practice using real-life MMR projects while immersing students in the integrated MMR learning experience, applying concepts learned in the classroom to real-life MMR project context and data. This study aimed to provide a research-tested MMR tool that is feasible and easily administered for MMR competency outcome assessment. The current embedded mixed methods evaluation design can not only show student learning outcomes via quantitative scores but also qualitative contextual data demonstrating the impact of the learning. The MMR-Competency Outcomes Measurement Tool (MMR-COMT) developed in the current study included a 15-item quantitative Mixed Methods Research Competency Scale (MMRCS_15), a 2-item overall MMR competency assessment (MMROV_2), and 3-item qualitative probing questions to assess learning impact and better understand the MMR competency skills gained. The key research questions were "Will students show increased MMR competencies at the end of the MMR course?" and "How will qualitative findings converge or diverge with the quantitative scores on MMR competencies?"

Audience

MMR instructors and educators can gain practical guidance on key competency-based design features will effectively train future generations of MMR scholars. More importantly, a corresponding research-tested mixed methods assessment tool is provided to assess the impact of MMR courses on essential MMR competency-based learning outcomes. The current study provides empirical data that highlights key competency-based course design features with students' course experiences, as well as corresponding MMR competency outcome measures. The lessons learned will contribute to the continued advancement of teaching and learning in the MMR field.

Methods

Course Design

PAF 7868 was a brand-new advanced methods course offered every Spring, focusing on the modern Mixed Methods Research methodology for the interdisciplinary doctoral students in the public affairs program. The course development began during Fall 2015 and was initially offered during Spring 2016 at a large public university in southern United States.

This doctoral-level MMR course was aligned with carefully designed assignments focused on developing relevant MMR competencies to reach the overall course learning objectives. The course topics were organized by a comprehensive research process outlined in Creswell and Clark's *Designing and Conducting Mixed Methods Research* textbook (Creswell & Clark, 2011; Creswell & Clark, 2018). Key course design elements included assigned readings, in-class lectures with Q&A, interactive class discussions and exercises, after-session homework assignments, article reviews, and a semester-

long MMR team project, including progress report and final presentations.

Class lectures were designed to reinforce assigned readings with step-by-step guidance on various MMR topics and provided opportunities to clarify and highlight critical concepts. In-class exercises provided real-life case studies and empirical examples for students to practice the concepts and skills learned, followed by class discussions with interactive just-in-time opportunities to encourage critical thinking and collaborative learning. Integrated interactive in-class activities and after-class mini-assignments helped to reinforce student learning. These intentionally designed pedagogy approaches and content sequence covering key MMR competencies aimed to develop and deepen the understanding of MMR as a distinct research methodology, its specific design procedures, and rationales to address different mixed methods research questions.

Semester-long hands-on MMR data analyses projects were also intentionally built-in to develop competencies beyond the MMR planning assessment (Hou, 2024 press; Poth, 2014) and aimed to build MMR implementation and dissemination capabilities. This course aimed to not only train students at novice scholars' level (focused on being a good consumer of mixed methods research) but also further equip beginning MMR researcher level skills to practice MMR scholarly activities, such as presenting and disseminating research in a safe learning environment (Guetterman et al., 2017).

Data Collection and Measures

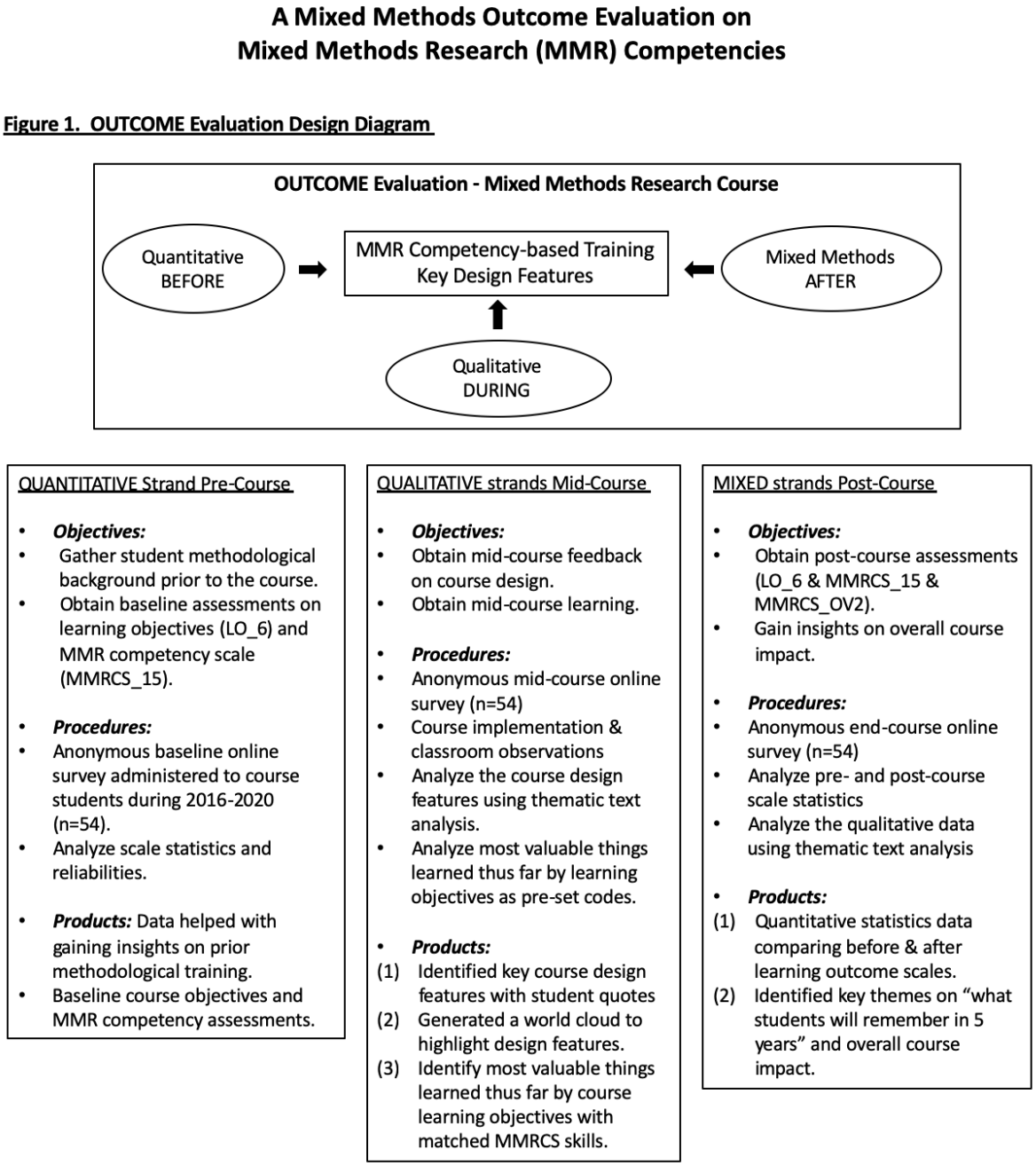
This study examined five cohorts of doctoral students enrolled in the MMR course during 2016–2020 (n=54). Three data sources were used in the current analyses: pre- and post-course quantitative self-assessment surveys, mid-course qualitative feedback, and end-course qualitative course feedback. These study instruments were pilot-tested among a small group of students to ensure item clarity and comprehension before it was formally used for the current 5-year data collection. Figure 1 details an MMR embedded outcome evaluation design diagram of the data collection and analysis procedures with attention to MMR competencies.

Quantitative Measures

The anonymous pre- and post-course quantitative self-assessment survey consisted of the two outcome measurement scales developed by the course instructor: (1) a 6-item course learning objectives scale (LO_6) and (2) a 15-item Mixed Methods Research Competency Scale (MMRCS_15). In addition, a "pre-course methodological background" section was included in the baseline survey, and two MMR overall competency items (MMRCS_OV2) were added in the end-course survey. These measurement scale items were researcher-developed and closely followed the research steps and process outlined in the *Designing and Conducting Mixed Methods Research* textbook by Creswell and Clark (2011, 2018) to ensure both face and content validities. These competencies were consistent with the key critical steps identified in Christ's case study (2009) and the six research process domains used by Guetterman and colleagues (2017). Both the LO_6 and MMRCS_15 were completed before and after the course by all five cohort groups (n=54), and MMRCS_OV2 was added in 2020; thus, only administered to the 2020 cohort group (n=9) at the end of the course.

The six MMR course learning objectives described the knowledge and skills students were expected to demonstrate upon completion of the course. The specific MMRCS_15 competencies were carefully developed to achieve the six key course learning objectives (LO_6) and were reflected in the weekly course topics and designs to ensure fidelity in course delivery. Two competencies, "define MMR and its core characteristics (MMRCS-1) and identify MMR designs (MMRCS-2)," were mapped to LO-1, "apply MMR concepts and terminology." Two competencies, "critically analyze MMR case studies (MMRCS-6) and evaluate MMR study quality (MMRCS-15)", were mapped to LO-2, "critically examine empirical MMR studies." "Explain MMR core designs (MMRCS-4) and advanced designs (MMRCS-5)" were mapped to LO-3, "interpret and explain various MMR designs." "Determine MMR mixing strategies (MMRCS-3), draw MMR design diagram (MMRCS-10) and discuss data collection by MMR designs (MMRCS-11)" were mapped to LO-4, "determine and engage in appropriate MMR analytic strategies." "MMRCS-12, design a joint display to represent data and answer MMR research questions," was mapped to LO-5, "display qualitative and quantitative data in a variety of figures and tables." And finally, five specific competencies, included "developing MMR introduction (MMRCS-7), purpose statement (MMRCS-8), research questions (MMRCS-9) by designs, identifying MMR journals for publication (MMRCS-13), and describing MMR writing structure by design (MMRCS-14)," were mapped to LO-6, "demonstrate oral and written communication skills in delivering MMR findings." This MMR course placed heavy emphasis on hands-on data analyses and MMR-specific structured writing techniques to equip essential MMR scholarship competencies beyond MMR planning and study design foundation training.

Figure 1
Mixed Methods Research Competency Outcome Evaluation Design Diagram



Qualitative Measures

Qualitative questions were used to gain a deeper understanding of competency learning outcomes, as well as highlight key course design features and obtain valuable learning experience and impact from participants' own voices.

Specifically, qualitative questions related to formative assessment in the mid-course feedback survey asked: "*What is the most important thing you have learned in this course so far?*" End-course qualitative outcome measures asked: (1) "*What I think I will remember for 5 years from now is … because ….*" and (2) "*Please briefly describe the course impact on your research skills, and how you intend to use MMR in the future.*"

Data Analysis

In addition to assess student learning outcomes, effective course design features were analyzed. The two qualitative probing responses from the "*What are things that you like, that you would suggest to keep?*" and "*What are things that you think could be improved?*" in the mid-course feedback and "*It most helped my learning of the content when … because …*" in the end-course feedback were combined for thematic analyses (Table 1). It should be noted that limited responses were provided for "*things that you think could be improved*" from the mid-course survey, as an overwhelming majority of the responses were "*Nothing*" or "*I love everything we have learned so far.*" Therefore, this qualitative item was not further analyzed.

Quantitative Learning Outcome Analyses

Descriptive statistics of pre-course methodological background were used to better understand the professional preparation of participants. Independent t-tests were used to assess the before and after course self-assessment of the LO_6 and 15-item MMR competency scale (MMRCS_15) (Tables 2 and 3). Cronbach's alphas were also calculated to assess the reliability of these two scales to ensure satisfactory internal consistencies among items (Cronbach, 1951). Changes on scale means over time were conducted using paired t-tests.

Qualitative Learning Outcome Analyses

A qualitative theme-based text analysis (Creswell, 2016) was used to analyze effective course design features and end-course learning impact with the individual student as the unit of analysis. Thematic analyses were conducted to identify common ideas and patterns to allow a flexible process to be adapted to the study purposes. The analyses followed the process of familiarizing the data via reading through text data with notes and memos on design features and course impact. Emerged codes from data were then grouped into meaningful themes (Creswell, 2016; Guetterman et al., 2019). The overall themes were identified and refined through analyzing and consolidating qualitative findings across data sources. Dedoose facilitated the qualitative analysis (Dedoose Version 8.3.21, 2020).

The analysis on findings were organized in the following ways: (1) Separate inductive analyses were conducted on each of the qualitative items and data sources, and (2) the three qualitative learning outcomes questions were analyzed individually with pre-set codes of course learning objectives and mapped with the MMRCS specific on competencies: "*What is the most important thing you have learned in this course so far?*" from the mid-course feedback (Table 4), and "*What I think I will remember for five years from now …*" and "*Describe the course impact …*" from the end-course feedback (Tables 5 and 6).

Results

Methodology Background Prior to Taking the MMR Course

A total of five cohort groups of doctoral students enrolled in the MMR course during 2016 to 2020 participated in the study (n=54). Participants were PhD students across fields of study, including four major tracks: criminal justice, healthcare services research, social work, and public administration. The program was an inter-disciplinary PhD program in Public Affairs with an inter-disciplinary focused curriculum and applied research methodologies. Students were mostly second year (full-time; about 60%) or third year (part-time; 40%) PhD students.

In terms of students' methodology background prior to taking the MMR course, data showed overall that students were more quantitatively trained, as over half took two statistics courses, one-third took three courses, and 10% had four or more courses. On the other hand, over 75% of the students took only one qualitative course prior to taking the current MMR course. This could be due to the heavy emphasis on the quantitative-oriented course curriculum with series statistics courses requirement, while only limited qualitative course options were available. Despite the quantitative-dominant training background, data showed interesting similar confidence levels on quantitative (38.5%) versus qualitative (36.5%) research methodology, with about only 20% indicating confidence in both quantitative and qualitative research approaches.

The top four ranked reasons for taking the MMR course were (most chosen rank of each option): (1) Better equip self for MMR competencies and skills

Table 1
Key Course Design Features with Student Quotes

Design Features	Student Sample Quotes
Integrated intentional coursework with hands-on assignments reinforced learning	• It was extremely helpful that we applied what we learned in class through homework and practice immediately after the lecture. It helps with integration. • The course was very well instructed, organized, and implemented. The professor did a great job of incorporating intentional coursework and activities. Everything built upon each other nicely. I learn best when I listen to lectures & then apply the material. It was hands-on & active throughout. • I loved the interactive in-class activities & the after-class assignments as they truly reinforced our learning. It allows for an opportunity to apply what we learned and further our understanding in each capacity.
Varied learning forms deeper learning	• I enjoyed the various forms of learning employed in this class. Specifically, we analyzed mixed-methods articles, had class lectures and discussions about the topics, and then took all that information and applied it to a final paper in which we analyzed data and wrote a final paper. • This course has significantly increased my confidence in MMR. We were able to read interdisciplinary articles, find model articles with our own MMR design, critique each other's work, see how my peer fellows grow, and how we applied what we learned and explained to others.
"I do, we do, you do" model facilitates concept-to-application	• I really like how the concepts are modeled first, then applied during class, and reinforced during after session activities. It is a class "I do, we do, you do" model, and it really works! • I really appreciated how we would go over a concept, and then apply it to our own research. That helped the class flow and really enabled us to see a connection between the text and the process.
Incremental course design enabled content appreciation	• I learned to really take an in depth look at mixed methods, from the title of the project to selecting statistical analysis. Everything is relevant, and I love the practice in evaluating MMR in articles. • Best practices regarding course structure should be shared with peer professors. The incremental design of [the professor's] course enables the student to appreciate the content being taught. • [The instructor] had us do these a little bit at a time. I learn so much better like that (little at a time). This was one of the best classes I had.
Relaxed, fun atmosphere encouraged engagement and development	• I really enjoyed the relaxed atmosphere, which made it a very comfortable learning space. I loved the engagement & discussions during class. I truly believe you care about the material & students! • Taking your classes are always a great experience. I've really enjoyed your class, including the assignments, discussions, & atmosphere! You keep the class fun & provide very clear instructions. I'm really honored to be your student. • [The instructor] is a pro in establishing a relaxed yet informative learning environment. She is a REALLY good professor, very engaging & encourages student participation. I appreciate her feedback & flexible style. It allows me to learn without intense pressure. • [The instructor] was incredibly supportive & encouraging and gave us autonomy to create "our own study." I like her teaching style: down to earth, thoughtful, funny. Thank you for an amazing experience!

Instructive guidance and continuous feedback eased challenges and obstacles	• [The instructor's] lectures were very instructive & helpful. The class was challenging at times, but you eased all [of] the obstacles. Your feedback was helpful to really get my own feel for explaining mixed methods. • What I really like was the continuous feedback throughout the assignments and progress reports. I would say this is one of the best courses in this program! • [The instructor] is extremely approachable & willing to assist when asked and offers to assist when not asked. I truly appreciate the opportunity to check in each week on our final projects to ensure we are on track. • Excellent professor who helps you along the way. [The instructor's] guidance was very helpful & shaped our project. I appreciate the time you put into our class, and I am grateful for your support! • The slides that [the instructor's] presents in class are extremely helpful!

Note. n=54.

Table 2

Baseline and End-Course Self-Assessments on Course Learning Objectives

I feel confident to …	Baseline (n=54) Mean (SD)	End-Course (n=50) Mean (SD)
LO-1. Apply mixed methods research (MMR) concepts and terminology.	2.67 (0.971)	4.77 (0.571)
LO-2. Critically examine empirical studies using mixed methods.	2.76 (0.989)	4.79 (0.559)
LO-3. Interpret and explain various MMR designs.	2.26 (0.935)	4.67 (0.715)
LO-4. Determine and engage in appropriate analytic strategies for mixed methods studies.	2.37 (0.917)	4.51 (0.798)
LO-5. Display qualitative and quantitative data in a variety of figures and tables.	3.09 (1.120)	4.53 (0.767)
LO-6. Demonstrate oral and written communication skills in the delivery of presentation(s) and paper(s) on MMR.	3.20 (1.155)	4.74 (0.581)
LO_6 [a] _Item mean (SD) ***	2.73 (1.038)	4.67 (0.595)

Note. [a] LO_6 = Learning Objective scale: Cronbach alpha was 0.858 (CITC ranged 0.522~0.771); *** p<.001.

Table 3
Baseline and End-Course Assessment on the 15-item Mixed Methods Research Competency Scale (MMRCS_15) [a]

I feel confident to …	Baseline (n=54) Mean (SD)	End-Course (n=50) Mean (SD)
MMRCS-1. Define mixed methods research (MMR) and its core characteristics.	3.87 (1.110)	4.88 (0.324)
MMRCS-2. Name and identify the different types of MMR designs.	3.11 (0.913)	4.81 (0.394)
MMRCS-3. Determine MMR mixing strategies (merging, connecting, embedding).	2.83 (0.975)	4.56 (0.666)
MMRCS-4. Explain MMR core designs (convergent, explanatory, & exploratory).	3.21 (0.948)	4.93 (0.258)
MMRCS -5. Explain MMR complex designs (intervention, case study, transformative, evaluation)	3.19 (1.057)	4.51 (0.768)
MMRCS-6. Critically analyze an MMR case study.	3.36 (0.942)	4.84 (0.374)
MMRCS-7. Write an MMR introduction.	3.40 (1.007)	4.81 (0.394)
MMRCS-8. Develop an MMR purpose statement based on an MMR design.	3.15 (0.949)	4.72 (0.504)
MMRCS-9. Develop MMR research question(s) based on an MMR design.	3.25 (0.918)	4.63 (0.618)
MMRCS-10. Draw an MMR design diagram of an MMR study.	2.81 (0.735)	4.72 (0.454)
MMRCS-11. Discuss data collection strategies by MMR designs.	3.42 (0.949)	4.72 (0.504)
MMRCS-12. Design a joint display to represent data and answer MMR research questions.	3.02 (0.909)	4.50 (0.768)
MMRCS-13. Identify suitable journals for MMR publication.	3.38 (1.078)	4.56 (0.666)
MMRCS-14. Describe a writing structure to reflect different MMR designs for an MMR journal article.	3.02 (0.820)	4.49 (0.703)
MMRCS-15. Critically evaluate the quality of an MMR study.	3.23 (0.933)	4.79 (0.412)
MMRCS_15[a] Scale item mean (SD) ***	3.22 (0.910)	4.70 (0.341)
Overall MMR Competency (end-course)		
MMRCS-OV1. Overall, this course increased my confidence in the MMR field.	NA	5.00 (0.000)
MMRCS-OV2. Overall, this course equipped me with important MMR skills and competencies I may use for my future career.	NA	4.89 (0.333)

Note. *** p<.001; [a] MMRCS_15 = Mixed Methods Research Competency Scale (15-item): Cronbach alpha was 0.938 (n=53; CITC ranged 0.611~0.858).

Table 4
Most Important or Valuable Things Learned Thus Far by Course Learning Objectives Analyses

Learning Objectives	Frequencies (%)	Sample quotes
LO1 MMRCS-1 MMRCS-2	9 (21%)	• What is MMR and what is not MMR (ID#23). • …MMR studies are not simply studies incorporating quantitative and qualitative methods. MMR integrates quantitative and qualitative methods in a systematic manner. … helps me better discern whether studies are truly MMR studies (ID#40). • Getting an in-depth understanding of MMR... learning the various designs and how to correctly integrate quantitative and qualitative pieces (ID#7).
LO2 MMRCS-6 MMRCS-15	5 (12%)	• I can now distinguish a strong MMR article from those that just use two methodologies and call it MMR (ID#37, 39). • Really taking an in-depth look at MMR, from the title, purpose, design to selecting statistical analysis. Everything is relevant, and I love the practice in evaluating MMR in articles (ID#14).
LO3 MMRCS-4 MMRCS-5	16 (37%)	• I have learned a great deal on different MMR designs and key logic - the purpose of integration between quantitative and qualitative research methods (ID#9, 34). • Being able to understand the strengths, relevance and structure of an MMR study is very valuable. I believe this skill will greatly assist in my academic and professional growth (ID#4, 10, 26).
LO4 MMRCS-3 MMRCS-10 MMRCS-11	3 (7%)	• Integrating and merging qualitative and quantitative strands of analyses & reinforcing both (quant + qual) practices (ID#12, 45). • The ability to use qualitative and quantitative analyses together in a single study is a very valuable skill (ID#41).
LO5 MMRCS-12	-	• Joint-Display (will be covered in the second half of the semester; not yet covered during mid-course feedback)
LO6 MMRCS-7 MMRCS-8 MMRCS-9 MMRCS-13 MMRCS-14	6 (14%)	• I've learned many new and useful concepts on how to properly write a MM research, even though it has been only a few weeks studying this course. I learned to be careful and specific when using MMR language. (ID#39). • That there is a specific way to write a mixed methods study and how to approach the study (ID#20, 29, 31, 36).
Other (team project/design)	4 (9%)	• The interaction with the cohort group in developing MMR strategies (#44). • The application of MMR is an extremely valuable tool to research (ID#13, 43).
Total	43 (100%)	

Note. Data source: Mid-course feedback.

Table 5
What Will be Remembered in 5 Years

Themes	Frequencies (%)	Sample Quotes
MMR values LO1	17 (35%)	• MMR studies are much more insightful than traditional qualitative or quantitative research because they provide both depth and breath, which the standalone methods can't do. (#39) • MMR is about integration because it provides a holistic view with more context than qualitative or quantitative data alone. (#6, 38). • How valuable and important MMR is and the different ways it can make my research stronger.(#6, 17, 23, 33, 35)
What MMR is LO2	7 (14%)	• … I now know what MMR actually is, and I don't think I will ever forget it. (#22, 34) • What constitutes a truly well-done MMR article as opposed to one that only "calls" themselves one. (#11)
MMR designs LO3	11 (23%)	• The different types of MMR designs and the added value of conducting MMR because we discussed this throughout the course, and it resonated with me. (#12, 24, 25, 27) • Key MMR features; why use MMR; core and complex designs; philosophy of science and MMR; how to do data analysis using MMR. (#8, 26) • To be honest, I will never forget the MMR designs... These designs are now ingrained in my brain.(#7)
How to conduct & write MMR research LO4-6	14 (28%)	• Everything! When to use MMR, how to use MMR, and definitely the various components of MMR that will help me determine if a study is really an MMR design or not. (#14) • How to do MMR research because that's what I am going to do in the next 5 years! (#23, 26, 32) • How to write a mixed methods paper, the components of a mixed methods article, and how to critique MMR articles because we reviewed these concepts multiple times and [the instructor] always expressed how important these concepts were. (#8, 15) • Group project on which we worked because it was a very exciting experience for me. (#23, 30, 35, 43)
Total	49 (100%)	

Note. Data source: End-course survey.

Table 6
End-Course Impact

Themes	Frequencies (%)	Sample Quotes
MMR competencies	3 (30%)	• I know how to integrate both together —it broadened my perspective, supplemented my understanding of quantitative and bolstered my qual knowledge. (#40, 42) • The course had real impact on my research skills. I now have the skills to more appropriately tackle social research because most (if not all) can be better explained by the use of synergy between qualitative and quantitative analyses. (#39)
MMR approach for future research	4 (40%)	• This course encouraged me to use mixed methods on future research projects, really helped me understand what an authentic MMR study looks like. (#37, 38) • I am no longer intimidated by MMR designs, and I plan to use MMR skills in my dissertation. (#35, 43)
Advocate MMR to transform own field	3 (30%)	• I would have liked to see our program place a greater emphasis in MMR research. In preparing for the qualify exams, I would have been confident in presenting an MMR design. However, the program focuses on Qn analysis, so I remain reluctant to choose any these other than a Qn design. I would like to see the transformation in future years. (#41) • Criminal justice is a field that doesn't utilize MMR nearly enough. I plan to do as much as I can to see that change. This revelation probably wouldn't have had much impact on me before this course. (#36) • I have advocated it [MMR] to my other professors and see the value in incorporating both types of data. (#43)
Total	10 (100%)	

Note. Data source: End-course survey.

for future research and career (43.8%); (2) Better equip competencies and skills needed for qualify exam (45.8%); (3) Enjoy taking another wonderful class with [the course instructor] (45.8%); and (4) Fulfill degree program requirement (41.7%).

MMR Course Design Features

Table 1 summarized the key successful course design feature themes with supporting students' quotes from mid- and end-course surveys to illustrate impact. Six effective course design feature themes emerged: (1) integrated intentional coursework with hands-on assignment reinforced learning; (2) varied learning forms deepened learning; (3) The "*I do, we do, you do*" model facilitated concept-to-application connections; (4) incremental course design enabled content appreciation; (5) a relaxed, fun atmosphere encouraged engagement and development; and (6) instructive guidance and continuous feedback eased challenges and obstacles (Table 1). Detailed mixed methods process evaluation on specific course elements and pedagogical design, as well as course experience, which included the challenges and approaches that students took to learn, and the overall student perceptions of instruction with feedback were discussed elsewhere.

Quantitative Findings—Before and After MMR Competency Outcome Assessment

The scale item mean of the 6-item course learning objectives (LO_6) was 2.73 (SD=1.038) on a 5-point Likert scale at baseline and significantly increased to 4.67 (SD=0.595) at the end of the course ($p<0.001$) (Table 2). The scale item mean of the 15-item MMR Competency Scale (MMRCS_15) was 3.22 (SD=0.910) on a 5-point Likert scale at baseline and significantly increased to 4.70 (SD=0.341) at the end of the course ($p<0.001$) (Table 3). In addition, the two overall MMR competency assessment items were also rated very high at the end of the course, with 5.00 (SD=0.000) on confidence in the MMR field and 4.89 (SD=0.333) on equipped with important MMR competencies for future career. The reliabilities of the LO_6 and MMRCS_15 scales were both satisfactory, with high internal consistencies showing Cronbach alphas of 0.858 (CITC ranged 0.522 ~ 0.771) and 0.938 (CITC ranged 0.611 ~ 0.858), respectively.

Qualitative Findings—The Most Important Things Learned Thus Far (Mid-Course) x Course Learning Objectives (LO)

Qualitative comments from five cohort groups of students on the most important things learned from mid-course feedback were merged and analyzed by the six course learning objectives as pre-set codes. An additional code beyond the pre-determined course learning objectives emerged and labeled as "Team Project," which included teamwork and project applications. A total of 43 text segments were coded. Table 4 noted how the 15-item MMRCS were matched with the six course learning objectives with sample student quotes on their learning. The most frequently voiced important things learned thus far were related to LO3, interpret and explain MMR designs (37%) and LO1, apply MMR concepts and terminology (21%).

End-Course—What will be Remembered in Five Years?

A total of 49 text segments were coded with four major themes identified as things students will remember 5 years from now. These themes were again linked back to the six course learning objectives to showcase the perceived sustained learning impact from student perspectives. The four key themes included were: (1) MMR values (35%); (2) What MMR is (14%); (3) MMR designs (23%); and (4) How to conduct and write MMR research (28%). Sample student comments corresponding to these four themes included: (1) "*MMR studies are much more insightful than traditional qualitative or quantitative research because they provide both depth and breath, which the standalone methods can't do.*" (2) *"… I now know what MMR actually is, and I don't think I will ever forget it*." (3) "*I will never forget the MMR designs... These designs are now ingrained in my brain*." and (4) "*Everything! When to use MMR, how to use MMR, and definitely the various components of MMR that will help me determine if a study is really a MMR design or not.*" "*How to write a mixed methods paper, the components of a mixed methods article, and how to critique MMR articles because we reviewed these concepts multiple times*." Table 5 detailed quotes by themes identified what students will remember in 5 years and linked to the six course learning objectives.

End-Course—Overall Course Impact

Overall course impact was also assessed among the 2020 cohort group (n=9). A total of 10 text segments were coded with three major themes identified as the overall course impact: (1) equipped MMR competencies; (2) intended use of MMR for future research; and (3) advocate MMR to transform own fields. Sample student comments corresponding to these themes included: (1) "*… I know how to integrate … it broadened my perspective, supplemented my understanding of quantitative and bolstered my qual knowledge."* (2) *"This course encouraged me … I am no longer intimidated by MMR designs, and I plan to use*

MMR skills in my dissertation." (3) *"I would have liked to see our program place a greater emphasis on MMR research… I would like to see the transformation in future years."*

Discussion

This study used real-time before and after course assessments and showed strong convergent evidence from both the significantly increased MMR learning objectives and competency scale scores quantitatively, as well as the overwhelmingly positive-rich qualitative quotes from multiple data sources demonstrating the profound impact and convergent evidence of the MMR course on competency-based learning outcomes among students.

Despite the quantitative-dominant training background, data showed interesting similar confidence levels on quantitative versus qualitative research methodology. This is an interesting area for future educational research and for academic leaders to reflect on the research methods training opportunities that higher education provides. Several doctoral students in the current study, after the MMR course, voiced their hope to see some transformation in higher education to have more MMR or qualitative friendly focus, instead of a traditionally quantitative-heavy oriented program of study.

There are several new contributions of the current study. First, current quantitative data showed that four areas from the MMRCS_15 assessment received lower confidence *before* the MMR course, which warrants attention: MMRCS-3 determine MMR mixing strategies (merging, connecting, embedding), MMRCS-10, draw an MMR study design diagram, MMRCS-12, design a joint display to represent data and answer MMR research questions, and MMRCS-14, describe writing structure to reflect a different MMR design (item means ranged 2.81 ~ 3.02). These findings were consistent with Guetterman's MMR training program, where two similar deficiency areas were also identified *before* the training: developing diagrams of mixed methods design (i.e., MMRCS-10) and mixed methods analysis through a joint matrix or table (i.e., MMRCS-12) (Guetterman et al., 2018; Guetterman et al., 2019). Future researchers should increase attention to strengthening scholars' integration and MMR writing skills (Cresswell & Clark, 2018; Fetters & Freshwater, 2015; Guetterman, 2017; Hou, in press; Poth, 2014).

Second, the "integrated" competency-based teaching approach was mapped with corresponding competency-based outcome competencies assessment serving as another important contribution to the training of future mixed methods scholars. The current course design provides a hands-on, interactive approach to develop MMR competencies, including attention to integration in the course design (Bazeley, 2003; Guetterman et al., 2019; Hou, in press). The course projects databases allowed students to practice integrated data analyses and develop a joint display to facilitate meta-interpretations of integrated quantitative and qualitative findings, as well as developing quality scholarly writing skills. The incremental design was key to enable students to better digest the complex concepts and learn to explain what they learned to others (Hou, 2009; Hou, 2024; Hou, 2022a; Hou, 2022b; Hou & Pereira, 2017). The opportunities to apply what they learned in each session have been a powerful way to help students ingrain core concepts in the brain (Hou, 2022a; Hou, 2022b; Poth, 2014). The use of a real-world MMR data analyses team project to provide the much-needed training with hands-on practice and visualization on potential ways qualitative and quantitative might be mixed or compared were truly eye-opening for students. This approach was innovative and critical to building the depth of MMR competency required. Such an approach provides practical learning opportunities to apply the skills learned to real MMR projects and is different from developing a hypothetical MMR proposal without real, hands-on analyses with MMR data. Students really appreciate the continuous feedback provided throughout the assignments and progress reports. Students also truly appreciated such "*learning-by-doing*" approach to practicing hands-on data analyses and quality scholarly writing skills through the MMR course to develop their confidence and competencies.

Third, the current study contributed to the much-needed new empirical studies related to the scholarships of teaching and learning in the MMR field and provided strong convergent mixed methods data evidence from multiple data sources assessing MMR competency outcomes. Designing and implementing an effective competency-based education for a graduate-level mixed methods research course requires dedicated and substantial instructor efforts and preparation. Conducting scholarship of teaching and learning on MMR education also demands considerable skillset and commitment. As noted by Poth and colleagues (2020), using a competency-based approach in course design requires "*requisite background, awareness of relevant competencies, and pedagogical acuity*" (Poth et al., 2020, p. 16). The current mixed methods outcome evaluation on MMR competency development provided the critical empirical evidence needed to demonstrate the significant positive impact among students. The study provides key course design features promoting competency-based learning and outcomes (Hou, 2021; Poth, 2014).

Fourth, this study provided a research-tested and validated brief MMR-COMT with three quantitative scales (LO_6, MMRCS_15, and MMRCS_OV2) and three qualitative items, which were effective and

sensitive to detect significant differences and showcase the profound learning impact of MMR competency outcomes. The MMRCS_15 items were carefully mapped to the six course learning objectives (LO_6). In addition, the themes identified from these qualitative responses were analyzed using LO_6 as pre-set codes to better link qualitative and quantitative data together for meta-inference. The MMRCS_15 assessed more integrated MMR competencies instead of specific independent skills assessed. For example, the current study used one item MMRCS-4, "explain MMR core designs (convergent, explanatory, and exploratory)" and one item MMRCS-5, "explain MMR complex designs (intervention, can study, evaluation)" to measure MMR design competencies instead of using six separate items (Guetterman et al., 2017). Similarly, the current study used one integrated item, MMRCS-11, "discuss data collection strategies by MMR designs" instead of multiple items. Although these overarching measures may lose precision on some specific independent skills, the current tool was proven to sensitively capture changes on the more integrated MMR competencies needed in real-life project applications while alleviating the response burden with fewer measurement items. On the other hand, instead of assessing skills related to "incorporating both qualitative and quantitative methods" in the same report or to non-academic audiences (Guetterman et al., 2017), the current study created a few *new* items assessing integrated competencies specific to MMR, such as MMRCS-3, "*determine MMR mixing strategies (merging, connecting, embedding)*," MMRCS-14, "*describe writing structure to reflect different MMR design*," and MMRCS-15, "*identify suitable journals for MMR publication*." Finally, the MMR-COMT also included two new overall assessment items, MMRCS-OV1, "*increased confidence in the MMR field*" and MMRCS-OV2 ,"*quipped with important MMR skills and competencies for future career*" to capture the overall course impact.

The current study is limited to its one group before and after study design with no comparison groups; thus, it's subject to related threats to validity, including collecting qualitative data during a single group trial. In addition, the relatively modest sample size prohibited more sophisticated psychometric testing, such as rigorous factor analyses beyond the current reliability testing. However, the strong convergent evidence of significant MMR competency learning outcomes from both quantitative and qualitative data assessed throughout the course period (before, during, and after) and over time (2016–2020) across five cohort groups of students provides strong validity and credible evidence on the significant outcome impact. The current findings also showed significant MMR values appreciation and even actions taken to advocate and transform own fields.

This study provides a research-tested and validated mixed methods assessment tool to assess the effectiveness of MMR training on MMR competencies, as well as practical guidance on the competency-based course design with real-life MMR hands-on, project-based learning for faculty and instructors who teach MMR. Special attention should be given to the four critical MMR competency deficiency areas identified *prior* to the course training (mixing strategies, creating joint displays, integrating quantitative and qualitative data, and MMR writing structure). In addition, the new items assessed merging integrated MMR competencies (mixing strategies, MMR writing, and journal publishing) which warrant future training attention and further empirical studies. Guetterman (2017) notes that skill on how to integrate qualitative and quantitative is the key that distinguishes a novice from an expert. Integration is viewed as a defining feature of mixed methods (Fetters & Freshwater, 2015; Guetterman, 2017). The MMR field calls for more training opportunities (e.g., workshops) for both students and faculties to enrich MMR experiences and create an MMR learning environment for students to work on MMR dissertations and faculty to work on MMR grant proposals (Guetterman et al., 2018; Poth, 2014). Research shows the continued need to advance MMR teaching and provide quality MMR education to equip the overall proficiency among MMR researchers and educators (Bazeley, 2003; Christ, 2009; Frels, 2012; Hou, in press). Faculty and instructors who plan to teach MMR are encouraged to use the integrated course design with database project applications for students to practice hands-on mixed methods data analyses and integration, as well as consider using the research-tested MMR-COMT mixed methods tool to evaluate MMR competency outcomes. This study provides a comprehensive mixed methods measurement tool and an empirical mixed methods analyses framework for assessing student learning outcomes and MMR competencies.

Conclusion

While the scope of this study was small with only six volunteer participants, it set out to explore assignments for my own teaching practice. I wanted to understand how students approach an assignment and the strategies they use to decode and work through it. I also wanted to apply my findings to my teaching. To that end, the data are informative. They require that I consider my assumptions about what students do as they read an assignment. They further suggest that I make my assignments clearer in terms of vocabulary, but that, depending on the goal of the assignment, I also have room to help students draw on more background schema in order to broaden their

thinking. Doing so means that assignments will need to be more intentional.

If students are to be successful in the move to remote learning (regardless of how enduring it may be), they will be required to read more. Understanding those reading processes, particularly how they change from one professor to another, will help students gain the skills they need to meet some of the changing demands of higher education and beyond. While this study primarily sought to understand how my students process information in order to facilitate my own teaching, I am confident that a broader study of how students read assignments (particularly how they adapt to the demands of various assignments or shift between genres) would benefit faculty everywhere as they attempt to write assignments that get at the best thinking and draw out students' best work.

References

Bazeley, P. (2003). Teaching mixed methods. *Qualitative Research Journal*, *3*(Special Issue), 117–126. https://rosma212.files.wordpress.com/2010/08/bazeley-p-2003-teaching-mixed-methods.pdf

Christ, T. W. (2009). Designing, teaching, and evaluating two complementary mixed methods research courses. *Journal of Mixed Methods Research*, *3*(4), 292–325.

Council on Education for Public Health (2018). *Accreditation criteria—Schools of public health and public health programs.* https://media.ceph.org/wp_assets/2016.Criteria.redline.4-26-18.pdf

Creswell, J. (2016). *Thirty essential skills for the qualitative researcher.* Sage.

Creswell, J., & Clark, V. L. (2018). *Designing and conducting mixed methods research* (3rd ed.) Sage.

Creswell, J., & Clark, V. L. (2011). *Designing and conducting mixed methods research* (2nd ed.) Sage.

Cronbach, L. J. (1951). Coefficient alpha and the internal structure of tests. *Psychometrika*, *16,* 297–334.

Dedoose (Version 8.3.21). (2020). Dedoose Web app.

Earley, M. A. (2007). Developing a syllabus for a mixed-methods research course. *International Journal of Social Research Methodology*, *10*, 145–162. https://doi.org/10.1080/13645570701334118

Fetters, M. D., & Freshwater, D. (2015). The 1 + 1 = 3 integration challenge. *Journal of Mixed Methods Research, 9*(2), 115–7.

Frels, R. K., Onwuebguzie, A. J., Leech, N .L., & Collins, K. M. T. (2012). Challenges to teaching mixed research courses. *The Journal of Effective Teaching*, *12*(2), 23–44. http://files.eric.ed.gov/fulltext/EJ1092126.pdf

Guetterman, T. C. (2017). What distinguishes a novice from an expert mixed methods researcher? *Quality & Quantity*, *51*(1), 377–398.

Guetterman, T. C., Creswell, J. W., Deutsch, C., & Gallo, J. J. (2018). Skills development and academic productivity of scholars in the NIH mixed methods research training program for the health sciences. *International Journal of Multiple Research Approaches*, *10*(1), 373–389.

Guetterman, T. C., Creswell, J. W., Wittink, M., Barg, F. K., Castro, F. G., Dahlberg, B., Watkins, D. C., Deutsch, C., & Gallo, J. J. (2017). Development of a self-rated mixed methods skills assessment: The NIH mixed methods research training program for the health sciences. *The Journal of Continuing Education in the Health Professions*, *37*(2), 76–82.

Guetterman, T. C., Creswell, J. W., Deutsch, C., & Gallo, J. J. (2019). Process evaluation of a retreat for scholars in the first cohort: The NIH mixed methods research training program for the health sciences. *Journal of Mixed Methods Research*, *13*(1), 52–68.

Hou, S.-I. (2009). Measuring the infusion of service-learning on student outcomes—The Service-Learning Self-Efficacy Scale on Program Planning Competencies (SL-SEPP). *California Journal of Health Promotion, 7*(2), 12–128.

Hou, S.-I. (2021). A mixed methods process evaluation of an integrated course design on teaching mixed methods research. *International Journal of Scholarship of Teaching and Learning,* 15(2) Article 8.

Hou, S.-I. (2022a). A mixed methods evaluation on teaching evaluation: Innovative course-based service-learning model on program evaluation competencies. *Journal of Scholarship of Teaching and Learning,* 22(1).

Hou, S.-I. (2022b). Advancing a competency-based mixed methods tool to assess a course-based service-learning model integrating real-world experience. *Integration in Complex Mixed Methods Evaluation Designs*, *Canadian Journal of Program Evaluation* (Special Issues) 36(3), 391-407.

Hou, S.-I., & Pereira, V. (2017). Measuring the infusion of service-learning (SL) on student outcomes —Validating an assessment suite on Program Development and Implementation Competencies (SL-SEPPoth, C. (2014). What constitutes effective learning experiences in a mixed methods research course? An examination from the student perspective. *International Journal of Multiple Research Approaches*, *8*(1), 74–86.

Poth, C., Searle, M., Aquilina, A. M., Ge, J., & Elder, A. (2020). Assessing competency-based evaluation course impacts: A mixed methods case study. *Evaluation Program Planning*, *79,*101789. https://doi.org/10.1016/j.evalprogplan.2020.101789.

Stevahn, L., King, J., Ghere, G., & Minnema, J. (2005) Establishing essential competencies for program evaluators. *American Journal of Evaluation*, *26*(1) 43–59.

SU-I HOU is Professor and Founding Director of the School of Global Health Management and Informatics at the University of Central Florida, Orlando, FL in the USA. She serves as the health-coordinator of UCF's interdisciplinary Doctoral Program in Public Affairs since 2015. Hou is the Founding Director of the Taiwan Study Abroad Program on Asian Culture, Healthcare, & Aging Society at two large state universities since 2011. Her research and teaching expertise includes mixed-methods research, program evaluation, communitybased participatory research, scholarship of teaching and learning, and aging in community. She is a Fulbright Specialist and global faculty of Stanford CARE.