Journal of the Scholarship of Teaching and Learning, Vol. 24, No. 2, June 2024, pp.1-17.
doi: 10.14434/josotl.v24i2.28972

Bridging Learning Value Gaps in a New Project Economy

Katrenia Reed Hughes
Purdue University
kreedhug@purdue.edu

Khushboo Kapadia
Purdue University
kkapadia@purdue.edu

Brandon Sorge
Purdue University
bsorge@purdue.edu

Abstract: The current study used Blomquist's Project Management Self-Efficacy assessment to collect data about student's perceived project management competence before taking a graduate level project management course. The research utilized the PMSE assessment to measure actual and retrospective pre-course project management self-efficacy. No industry is immune to the need for skilled project managers. Our question is "how do you know…they know…what they say they know?" In recent years, PMI's focus was The Project Economy. In the new project economy individuals need to transform ideas into reality and deliver value to stakeholders by collaborating in teams to successfully complete projects and support organizational value streams. Findings showed that individuals with previous project management experience were more likely to overestimate their skillset before taking the class than those without previous project management experience. This gap in project management skill insight puts employers at risk for missed opportunities and unrealized cost savings. Through the application of project management tools and templates, the students learn project life-cycle approaches used in industry today and demonstrate application through completion of actual projects in a team-based setting. The real-world application of ideas allows students to bridge the gap between their conceptual knowledge and their ability to effectively manage a project.

Keywords: Project Management Self-Efficacy; Response Shift; Learning Value Gap; Retrospective Assessment; Action Research; Organizational Value Creation

Introduction

Those in the project management industry know the value a skilled project manager can bring to an organization. The value of project management skills is also becoming more widely understood among business leaders. Today, organizations must be nimble to compete in a global economy. Project managers can help them extract maximum value from their people, processes, and technology. The project management skillset has become so valuable that the number of trainings, certifications, and educational programs offering to develop project management skills and competencies has exploded (Harrin, 2018; Poston & Richardson, 2019). Jugdev and Muller (2005) took a retrospective look at project success literature over the previous 40 years and found that project success dimensions include benefits to the organization and preparing for the future, which would include innovating and developing core competencies. However, holding the traditional project management technical competences is not sufficient to achieve success on projects anymore (Magano et al., 2020).

Blomquist, Farashah, and Thomas (2016) reviewed the usefulness of the construct in understanding manager performance and suggested how adopting this concept in the context of project management will lead to better understanding of project manager behavior. In order to properly evaluate learning interventions, many educational programs have used self-assessments to measure student learning (Levinson, Gordon, & Skeff, 1990; Skeff, Stratos, & Bergen, 1992; Thomas et al., 2018). However, the use of traditional pretest-posttest designs for self-assessments has been shown in the literature to produce a response shift bias (Drennan & Hyde, 2008; Howard et al., 1979). Little et al., (2020) described the retrospective pretest–posttest (RPP), as an underutilized design for repeated-measures research that asks respondents to rate survey items twice during the same posttest measurement occasion from two specific frames of reference: "now" and "then." This design asks individuals to first report their current attitudes or beliefs following a given intervention, and next they are prompted to think back to a specific time prior to the given intervention and rate the item again retrospectively (Little et al., 2020). The design addresses many of the validity concerns that plague the traditional pretest–posttest design. RPP design allows participants to gauge the degree of change that they experience with greater awareness and precision than a traditional approach (Little et al., 2020). The retrospective pretest design for evaluation of learning has been shown to find significantly greater impact on outcomes than the traditional pretest-posttest design. This is because students overestimate their ability at the beginning of an educational program (Drennan & Hyde, 2008) resulting in an inflated pretest score. The Learning Value Gap (LVG) is the knowledge gain that is missed when a pretest, posttest measurement design is used.

This research investigates the variation between students' pre-course project management self-efficacy and their retrospective project management self-efficacy. Utilizing a project management self-efficacy (PMSE) survey developed and validated by Blomquist et al. (2016), students were given an opportunity to evaluate their project management skills. A pretest, retrospective and posttest self-assessment design was employed. A course culture focused on self-efficacy building curriculum utilized team project-based learning experiences to improve students' project management self-efficacy. This paper will review the literature on project management education, self-efficacy, method of education evaluation, response shift, and learning impact variance.

Review of the Literature

To create a learning environment conducive to building project management self-efficacy, the current paper focused on the works of Bandura (1977, 1986, 1997), and Blomquist et al. (2016). The PMSE assessment focused on different aspects of project management. The retrospective evaluation design was an important aspect of this learning experience as it allowed students to reflect upon initial knowledge from a more informed position.

Self-Efficacy

Self-efficacy refers to an individual's belief in his or her capacity to execute behaviors necessary to produce specific performance attainments (Bandura, 1977, 1986, 1997). Kodden (2020) indicates that self-efficacy plays a crucial role in motivation and performance. High self-efficacy can lead to setting more challenging goals and, upon achieving these goals, can enhance the likelihood of setting and achieving even higher goals in the future (Kodden, 2020). Project management learning experiences that focus on self-efficacy to improve project management competencies provide students with a safe environment to try and fail without the fear of long-term negative consequences (Blomquist et al., 2016). The learning environment itself plays a role in determining whether students will take the necessary risks to build their project management self-efficacy.

Bandura (1977) hypothesized that expectations of personal efficacy determine whether coping behavior will be initiated, how much effort will be expended, and how long it will be sustained in the face of obstacles and aversive experiences. Providing students with an opportunity to build confidence while pursuing competence helps them see themselves functioning in the role of leading projects within their current or future positions.

Bandura (1977) noted that this model of simulated threat in safe environments produces, through experiences of mastery, further enhancement of self-efficacy and corresponding reductions in defensive behavior. Students were provided with several project management self-efficacy building team-based learning experiences anchored in "performance accomplishments, vicarious experience, verbal persuasion, and physiological states" (Bandura, 1977).

Project Management Self-Efficacy

Self-efficacy has been shown to be the best indicator of future performance in many areas of management for decades. Blomquist et al. (2016) created a PMSE scale with 22 elements to evaluate what part self-efficacy plays in assessing project management competencies. This scale is both reliable and valid (Blomquist et al., 2016). Their work proposes that a domain specific measure of self-efficacy could be used as an alternative, cost effective way to assess a project manager's capability (Blomquist et al., 2016). Ultimately, Blomquist et al. (2016) concludes that the PMSE scale might be useful for recruitment, assessing training needs, assessing educational transfer, and developing career plans.

Project Management Skills and Competencies

According to Pant and Baroudi (2008), successful project management includes proper leadership skills along with interpersonal ability, technical competencies, and cognitive aptitude. Hanif and Tariq (2014) highlighted the importance of skills and competencies in their work as they relate to success and failure of project managers. Hanif and Tariq (2014) described skills as something that could be easily defined and learned through activities. Competencies, on the other hand, could be difficult to understand as they are catalyst to skills that managers may already possess and help leaders behave or react a certain way in tough situations (Hanif & Tariq, 2014). Hanif and Tariq (2014) also highlighted communication, decision making, organizational skills, leadership, and teamwork as examples of competencies.

Moradi, Kähkönen, and Aaltonen, (2020) conducted a comprehensive literature review, covering previous studies and related project management standards of practice and found the top five key competencies for project managers were communication, leadership, teamwork and cooperation, flexibility, and problem solving. Goal orientation, developing others, impact and influence, stakeholder management, cost management, and resource management were identified as the remaining key competencies of project managers (Moradi, Kähkönen, & Aaltonen, 2020).

Competencies are extremely important as they help project managers in performing their roles efficiently (Alvarenga, Branco, Guedes, Soares, & Silva, 2019). Specifically, problem-solving expertise, context knowledge, leadership, communication, decision making and the ability to meet objectives have been identified as core competencies (Brill, Bishop, & Walker, 2006; Lei & Skitmore, 2004). There are several training programs as well as educational programs that have been developed to increase competencies among project managers.

Training and Education

There are several different ways project managers are being trained to perform functions necessary to manage successful projects. Many receive on-the-job training provided by managers who have project management experience within their organization (PMI, 2017). Others attend Project Management Professional (PMP) certification classes, advertised in different business or project heavy industry magazines as well as project management websites locally and internationally. There are non-credit baring and for-profit project management workshops that do not focus on certification, but instead focus on skill development. It is common for these workshops to be sponsored by local PMI chapters (PMI-CIC, 2019).

It is vital that organizations develop or outsource training and education curriculum that cater to their organization's specific needs while improving their project managers' soft and hard skills. As the number of certifications in professional project management is increasing, organizations' interest in competencies for effective project management is also rising (Starkweather & Stevenson, 2011). National and international project management associations value competency-based frameworks for project managers (AIPM, 2008; ICB–IPMA, 2006; PMI, 2007). Takey and de Carvalho (2015) suggested that the frameworks created by project management associations revolve around hard and soft skills, but they put more emphasis on hard skills. Along with this, PMBOK has been around since 1987. Initially, PMBOK was largely focused on hard skills while overlooking the soft skills necessary for effective project management (Pant & Baroudi, 2008), but there has been increased interest regarding soft skills (Clarke, 2010a, 2010b; Dainty, Cheng, & Moore, 2005; Müller & Rodney Turner, 2010; Skulmoski & Hartman, 2010; Stevenson & Starkweather, 2010). In addition, in 2020 the PMP certification exam shifted its focus to 42% people skills (PMI, 2019).

It is also important to know that some job descriptions for project managers detail soft skills and competencies much differently than the literature does (Ahsan, Ho, & Khan, 2013). By 2027, employers will need nearly 88 million individuals in project management-oriented roles (PMI, 2017). This raises the question of how proficient new talent will be in the most important project management competencies.

Evaluation

Many of the aforementioned project management (PM) training programs have some form of post learning evaluation. Organizations with strong learning and development programs will have performance reviews for all employees and may choose to evaluate their employee's skill level before and after sending them to train (Razanaufal & Lantu, 2019). Certification classes and for-profit PM training programs discuss course/program evaluation but not changes in participants perceived skill level. It is also extremely important to assess and/or analyze the perceived knowledge transfer acquired as a result of training and the positive impact and change in competency levels. This allows educators and researchers to focus on strengths and weaknesses of their educational programs.

Building a sustainable project-based culture requires that organizations embed project planning and evaluation within their organizational development strategy (Gómez et al., 2019). Hill and Nelson (2019) facilitated a project-based course on project management which delivered up on its learning objectives. However, there was no standardized evaluation of learning to measure students' improvements. In many trainings and/or educational programs, self-assessments are utilized (Levinson, Gordon, & Skeff, 1990; Skeff, Stratos, & Bergen, 1992; Thomas et al., 2018).

Self-assessments are frequently used to evaluate the effectiveness of education programs. Brown, Dewey, and Cox (2014) highlighted the importance of self-assessment by stating that: "(1) it

can be cost-effective and relatively easy to design, administer, and score; (2) it can promote greater learner awareness and self-regulation; and (3) it can motivate students by adding variety to, as well as increased participation in, the assessment process". Low-rigor competence assessment typically involves casual self-assessment, or informal assessment of the competence criteria; its primary use is in personal development planning and improvement (PMI, 2007). Cartwright (2008) noted another disadvantage of self-assessment is in each person's self-perception, because some people know themselves very well, others do not. In their work, Takey and de Carvalho (2015) mention that self-assessment does not put respondents under a lot of pressure which could possibly deliver more authentic responses and provide data rather quickly for research purposes.

Retrospective Pre/Post Test Design vs. Traditional Pretest/Posttest Design

According to Levinson, Gordon, and Skeff (1990), "the educational intervention may change the learners' understanding or awareness of the dimension being rated and hence change the criteria or standard they use for self-ratings". There are several studies (Chinowsky et al., 2006; Drennan and Hyde, 2008; Hill & Betz, 2005; Skeff, Stratos, & Bergen, 1992) that support the use of retrospective and post assessments to measure change in learning than the traditional pre- and post- assessments. Chinowsky, Brown, Szajnman, and Realph (2006) stated that over three decades of research has clearly supported the post-retrospective method over the traditional pretest-posttest method. Hill and Betz (2005) recommend a use of retrospective pretest if the goal is to show change which was experienced by participants subjectively.

Skeff, Stratos, and Bergen (1992) noted that compared to traditional pre/post self-assessments, retrospective pre/post ratings may provide a more sensitive and valid measure of the effects of educational interventions. Changes in traditional pre- to post-intervention self-ratings may reflect changes in the standards participants used for self-rating as well as effects of the intervention (Skeff et al., 1992). A study by Drennan and Hyde (2008) suggested the retrospective pretest as an option to instructors in order to identify the level of change within their students, "especially students who have previously been exposed to the constructs being delivered". The retrospective pretest provides a precise evaluation of change in self-reported behavior, saves valuable time as it can be administered at one time, and does not require complicated data management (Pratt, McGuigan, & Katzev, 2000).

Response Shift

Change in learning is an extremely valuable aspect of any education or training intervention. Response shift is identified as the change that occurs as a result of training having an influence on participants' criteria for their self-ratings (Levinson et al., 1990). Geldhof et al. (2018) noted that quantitative analysis of true pretest and retrospective pretest data showed positive participant changes, but the differences between participant scores highlighted the fact that retrospective pretest scores are consistently lower than actual pretest responses. More recently, response shift bias research has shifted its focus to quality of life (QOL) measurements in healthcare settings (Skrzypek, Kowal, Marzec, & Wdowiak, 2018; Rapkin, & Schwartz, 2021). Response-shift has been cited as an important measurement consideration when assessing patient reported quality of life (QoL) outcomes over time among patients with severe chronic conditions (Ilie, Bradfield, Moodie, Lawen, Ilie, Lawen, Blackman, Gainer, & Rutledge, 2019).

Previous studies suggest that a response shift, where retrospective scores are lower than pre-scores, may account for the difference between pre and retrospective PMSE scores (Howard, Dailey,

& Gulanick, 1979; Skeff et al., 1992). According to Levinson et al. (1990), "the response shift is the change in self-ratings that reflects a difference in participants' awareness or understanding of the dimensions being rated and thus the use of different criteria or standards for self-rating, rather than an actual gain in skills or knowledge". Pratt et al. (2000) believed that by using the pretest-posttest design, the possibility of having a response shift could be overlooked. Rohs and Langone (1997) and Rohs (2002) argued that a retrospective-post method is more effective as participants are "evaluating themselves with the same standard of measurement or level of understanding on both their posttest responses (how they feel now) and how they felt before the program (then)" (p.156; p.6). Thomas et al. (2019), studied response shift in a graduate-level leadership program (p. 194). The study suggested there was a response-shift bias and that their retrospective pretest method appeared to minimize the response-shift bias (p. 197).

Thomas, et al. (2019) findings suggested that retrospective pre-tests were a cost-effective way to control response-shift bias and evaluate trainee change. While the Thomas, et al. (2019) study focused on an interdisciplinary leadership program, their methodology could be useful in interdisciplinary training and has potential for use in broader training initiatives.

Response Shift Bias

In some cases, the traditional pre- and post-test data could be confusing as participants use a "changed frame of reference" to rate themselves after going through an intervention (Howard et al., 1979). Pratt et al. (2000) identified the response shift bias as "change in an individual's frame of reference because of program participation". On pre-intervention self-ratings, subjects may have only a partially developed conceptualization of the dimensions on which they are asked to report about themselves (Skeff et al., 1992).

Skeff et al. (1992) assert that response shift bias results from changes in the standards that participants are asked to assess themselves on before and after an activity, which in turn reduces the accuracy and validity of the results. Drennan and Hyde (2008) explained the reasoning behind response shift bias as participants gaining a higher knowledge of dimensions that are under investigation. This knowledge can "lead them to alter their frame of reference on the construct being measured and calls into question the internal validity of measurements taken using traditional pretest-posttest designs" (Howard et al., 1979; Rohs, 2002). This is due to the fact that participants may only be partially aware of concepts, competencies, and their true agility in the subject. It is evident that the use of retrospective test design would lead to more accurate data while increasing validity and decreasing bias.

Methodology

This study examined how the method of evaluation (traditional pre-course assessments versus retrospective pre-course assessments) holds the key to identifying previously unrecognized positive impact. This is done by examining changes in student's self-assessment of project management skills on actual pre and retrospective self-evaluations, before and after an advanced project management graduate course. The use of the retrospective course assessment that mirrors the initial pre-course assessment should give significantly more insightful and accurate data regarding the knowledge project managers gained over the duration of the course.

This research project was guided by the following research questions:

1. Are there differences in pre- and retrospective-PMSE survey scores for students with and without previous project management experience?
2. If a difference does exist, in which competencies are they more prominent?

Course

During the current research study, instructors provided a safe learning environment by focusing on building trust through team development, effective communication, and STAR/AR feedback learning activities before teams began to work on their projects. This helped students to persist in team-based activities that simulated real world threats and resulted in real stress.

Instrument

Blomquist et al. (2016) validated a Project Management Self-Efficacy (PMSE) measure of 5 sub-competencies with 22 indicators: Team Management (3 questions), Stakeholder Management (3 questions), Project Planning (3 questions), Project Execution (10 questions), and Project Evaluation (3 questions). Each question utilized a Likert Scale ranging from 1, cannot do the task (0% confident), to 5, totally confident to manage the task effectively (100% confident) and asked students to rate themselves based on how confident they were that they could effectively manage different situations that commonly arise in projects.

Students were required to complete the PMSE assessment before and after completing a project management course that focused on providing the fundamentals of project management through application of basic project approaches in a team-based setting. The PMSE survey was administered *before* taking the course as well as *after* completion of the course. At the beginning of the project management course, students were sent the survey and were required to complete it. The survey collected students' project management competency level. At the end of the course, the same survey was sent out again for students to reflect on what they believed they knew compared to what they actually knew. Again, it was required for students to complete it in order to fulfill the course successfully.

Cronbach's alpha (Cronbach & Furby, 1970) was calculated for each competency both pre and retrospective which can be found in Table I. All competencies but the pre-Team met the standard. However, given the reliability of all other competencies as well as the Team on the retrospective, no changes were made to the survey.

Table I. Cronbach's Alpha (Internal Reliability)

Competency	Pre	Retrospective
Team	.671	.825
Stakeholder	.822	.930
Planning	.751	.910
Execution	.941	.960
Evaluation	.895	.918

Participants

As previously stated, students came from two different semesters' offerings of a graduate level Project Management course. There were 35 students, who participated in the Spring of 2019, and 24 students, who participated in the Summer of 2019 for a total of 59 students. Four additional students who started the course were excluded from this research because two of the students did not complete the course and the other two did not complete one of the surveys. The demographic information of students as it relates to gender and ethnicity can be found in Table II.

Table II. Student Population's Demographics

Demographics	Spring 2019	Summer 2019
Gender		
Male	18	9
Female	17	15
Race/Ethnicity		
White	25	14
Black/African American	2	5
Hispanic	2	-
Asian	6	5

Data Collection

Data were collected using online survey software Qualtrics (Qualtrics, 2013). For each survey, students received an email containing a unique web-link for the online questionnaire. The pre-survey, given at the beginning of the course, focused on student self-efficacy in performing tasks associated with project management. At the end of the course, same survey was sent to students asking them to reflect on their perceived PM self-efficacy before taking the course as well as their current level of PM self-efficacy. This allowed us to observe the difference of PMSE prior to the class, and after completion of class activities designed to increase students' competence and confidence in their project management skillset. Participants were allowed to skip open-ended questions only. The survey was open for a one-week time-period in which three email reminders were sent to those who had not completed the survey. The survey was obligatory for completion; therefore, the response rate was 100%.

Results

Paired-sample t-tests were run using SPSS v26 comparing the mean competency scores among those who had no project management experience, those who had project management experience, and combined. Data met all the criterion for this type of analysis. Figure I. provides a bar graph representing the mean Team score for both pre and retrospective surveys. While all groups showed a decrease in mean score for this competency from pre to retrospective survey, only the mean score for combined students was statistically significant [$t(58)=2.341$, $p<.05$].

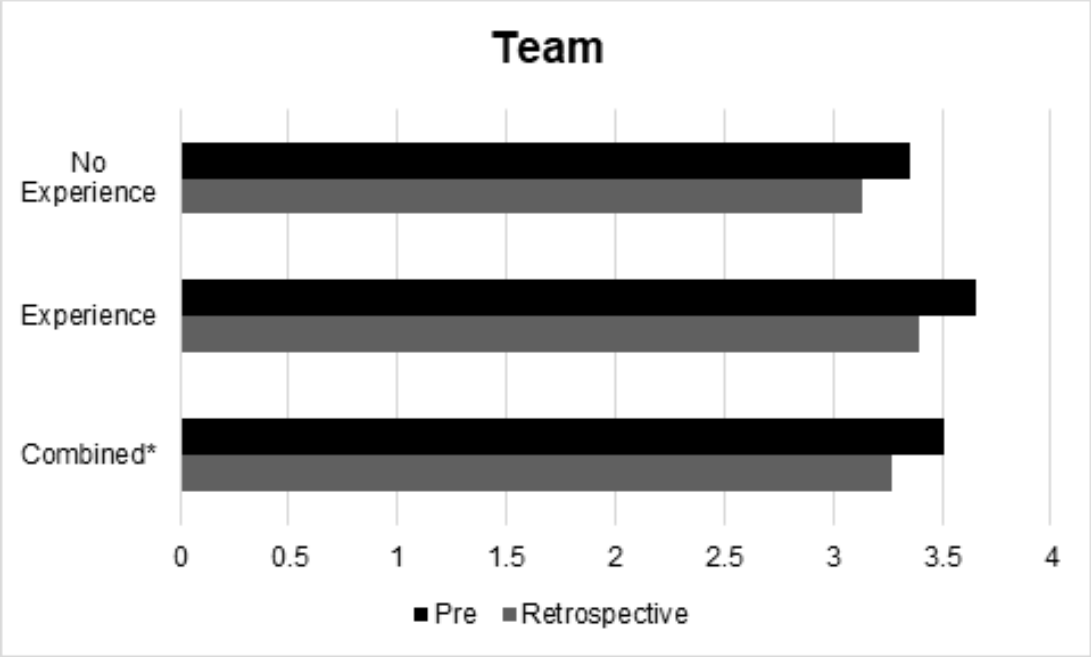

Fig I. Team mean scores.
Note: p<.05*, p<.01**, and p<.001***

For the Stakeholder competency, no statistically significant difference was found for any of the three groups though all groups did show a decline in their mean scores from pre to retrospective survey (see Figure II).

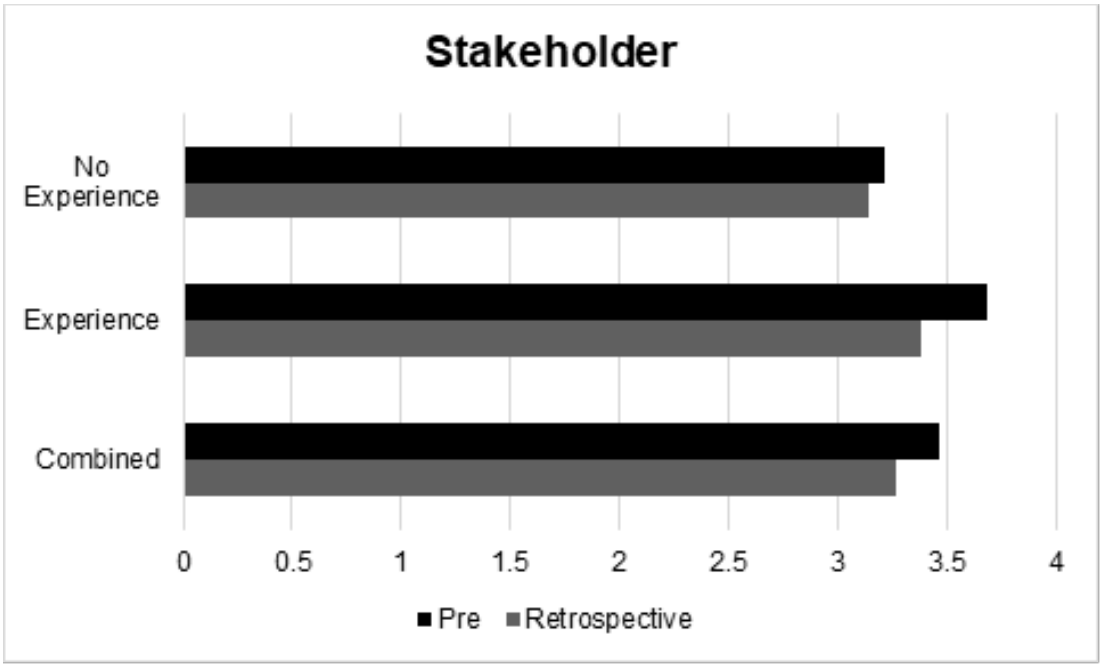

Fig II. Stakeholder mean scores.
p<.05*, p<.01**, and p<.001***

On the Planning competency, as with the previous ones, all groups had a decrease in mean scores from the pre to the retrospective survey. Both the group with PM experience [t(30)=2.097, p<.05] and the combined group [t(58)=2.771, p<.01)] were statistically significant.

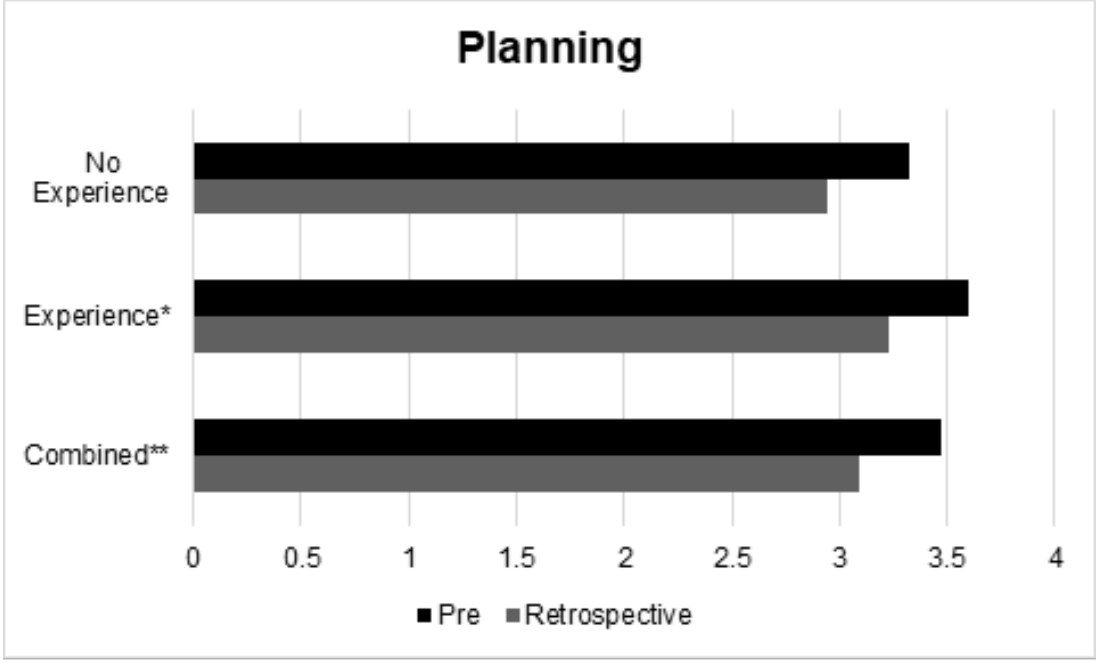

Fig III. Planning mean scores
p<.05*, p<.01**, and p<.001***

On the Execution competency, as with the previous ones all groups, had a decrease in mean scores from the pre to the retrospective survey. Like the Planning competency, both the group with PM experience [t(30)=2.313, p<.05] and the combined group [t(58)=3.050, p<.01)] were statistically significant.

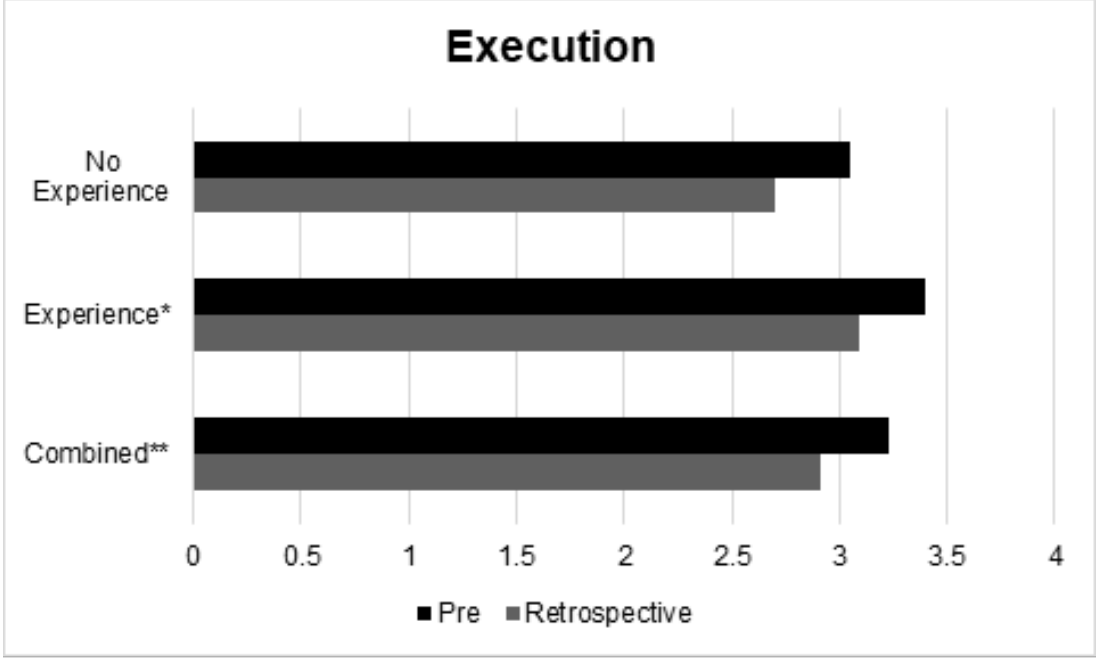

Fig IV. Execution mean scores.
p<.05*, p<.01**, and p<.001***

For the Evaluation competency, as with the others, all groups showed mean score decreases from pre to retrospective survey. However, none of these differences were statistically significant.

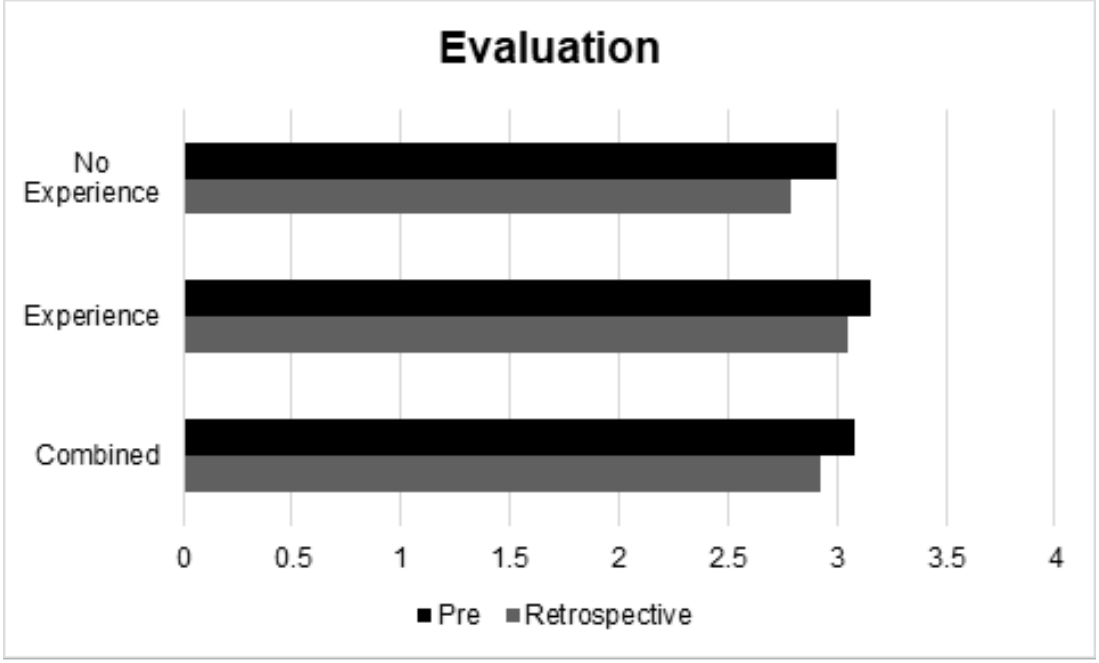

Fig V. Execution mean scores.
p<.05*, p<.01**, and p<.001***

Because many of the differences between pre and retrospective survey scores were not statistically significant at the .05 level but were close. Tables include complete details of the analysis for students with no experience (Table III), students with previous project management experience (Table IV), and the combined group (Table V).

Table III. Student with no PM experience

			Std Error	95% Confidence Int of Difference				Sig (2-
Competency	Mean	Std Dev	Mean	Lower	Upper	t	df	tailed)
Team	0.226	0.827	0.156	0.094	0.547	1.448	27	0.159
Stakeholder	0.071	0.940	0.178	0.293	0.436	0.402	27	0.691
Planning	0.381	1.121	0.212	0.054	0.816	1.798	27	0.083
Execution	0.346	0.913	0.172	0.007	0.700	2.009	27	0.055
Evaluation	0.214	0.991	0.187	0.170	0.598	1.145	27	0.262
Overall	0.279	0.803	0.152	0.032	0.591	1.840	27	0.077

Table IV. Students with PM experience

			Std Error	95% Confidence Int of Difference				Sig (2-
Competency	Mean	Std Dev	Mean	Lower	Upper	t	df	tailed)
Team	0.258	0.783	0.141	0.029	0.545	1.836	30	0.076
Stakeholder	0.301	0.904	0.162	0.031	0.633	1.854	30	0.074
Planning	0.376	0.999	0.179	0.010	0.743	2.097	30	0.044
Execution	0.300	0.722	0.130	0.035	0.565	2.313	30	0.028
Evaluation	0.097	0.862	0.155	0.219	0.413	0.626	30	0.536
Overall	0.277	0.660	0.119	0.035	0.519	2.338	30	0.026

Table V. Total student population

Competency	Mean	Std Dev	Std Error Mean	95% Confidence Int of Difference Lower	Upper	t	df	Sig (2-tailed)
Team	0.243	0.797	0.104	0.035	0.451	2.341	58	0.023
Stakeholder	0.192	0.921	0.120	0.048	0.432	1.603	58	0.114
Planning	0.379	1.049	0.137	0.105	0.652	2.771	58	0.008
Execution	0.322	0.811	0.106	0.111	0.533	3.050	58	0.003
Evaluation	0.153	0.919	0.120	0.087	0.392	1.276	58	0.207
Overall	0.278	0.725	0.094	0.089	0.467	2.948	58	0.005

Further, to examine the effect size of all analyses, statistically significant or not, Cohen's d (see Table VI) was calculated for all groups and competencies. The effect sizes for all statistically significant differences were small, ranging from .30 to .42.

Table VI. Cohen's d (Effect Size)

Competency	No Experience	Experience	Overall
Team	0.27358	0.32970	0.30478
Stakeholder	0.07599	0.33300	0.20866
Planning	0.33980	0.37670	0.36069
Execution	0.37958	0.41549	0.39701
Evaluation	0.21633	0.11245	0.16608
Total	0.34778	0.41996	0.38373

Discussion

This study explored the variation in pre and retrospective PMSE scores for students who had project management experience, those who did not, and the combined student group. It was found that students without previous project management experience had no significant differences between pre and retrospective scores on the PMSE assessment. One possible explanation of no change in pre and retrospective scores is that the course would have been their first exposure to the five competencies of project management including working with teams, managing stakeholders, planning, execution, and evaluation. However, there were several competencies for these students that were significant at the .10 level. Given the N being less than 30 for this group, further research on this group of students with no project management experience is merited.

Students with previous project management experience had significantly higher overall pre PMSE scores than those without experience. Additionally, their retrospective PMSE scores showed a statistically significant lower score than their pre-score in the competencies of Execution, Stakeholder, and Overall. There are several reasons why this might be the case. Students who had previous project management experience may have recognized the terminology within each competency, however, they may have overestimated their competence level in each area.

Students with and without project management experience had similar changes in pre and retrospective competency scores for Team, and Stakeholder, which are concepts widely discussed and developed within and outside of project management. However, there was no statistically significant difference on the Evaluation competency. While the results of statistical analysis for all three competencies were similar, the reasoning behind the scores differs. Team and Stakeholder scores are impacted by a higher level of familiarity due to its frequency of use in business and industry. Evaluation

scores are impacted by a lower level of experience, as cited by most students' evaluation, as it is not commonly utilized within their projects. This suggests that prior to taking this course, students with project management experience would not have recognized the importance of Evaluation.

The learning intervention provided in this graduate level project management course was designed to increase students understanding of the five sub-competencies being rated as well as the students' insight into their own level of functioning on the twenty-two project management indicators. Skeff et al. (1992) noted that response shift is more significant when the learning intervention aims to define more clearly the concepts in question. Consistent with the research and data analysis presented in this paper, a newly coined term, "Learning Value Gap" (LVG), refers to the difference between the pre- and retrospective PMSE scores. LVG reveals the true value created by project management education and it is an undervalued contributor to successful project outcomes in higher education as well as industry. LVG is a concept that highlights the discrepancy in perceived knowledge gain measurement between two different assessment designs. When applied to the professional development of project managers, the impact of high and low LVG can be significant in several ways.

The first potential outcome is underestimation of learning. High LVG suggests that a significant amount of learning is not being captured by traditional pretest-posttest designs. For project managers, this could mean that the full extent of their professional development and skill acquisition is underreported. This could lead to a misunderstanding of their true competency levels, potentially affecting their career progression and opportunities for more challenging projects. Another potential risk involves misguided training efforts. If learning gains are not accurately measured, organizations might invest in training programs that appear less effective than they truly are. This could result in the discontinuation of beneficial programs or the failure to address specific learning needs of project managers. A third risk associated with high LVG is reduced motivation. Project managers might feel less motivated if they do not see a quantifiable improvement in their skills and knowledge. This could impact their engagement with ongoing learning and development opportunities, as well as their overall job satisfaction.

Low LVG suggests more accurate assessment of learning and indicates that the measurement design is effectively capturing the learning gains. For project managers, this means that their growth and development are accurately recognized, providing a clear picture of their strengths and areas for improvement. This can lead to more targeted professional development efforts and better alignment with career goals. Another benefit of low LVG is enhanced training programs. With a more accurate measure of learning gains, organizations can fine-tune their training programs to be more effective. This could lead to the development of initiatives that are closely aligned with the actual needs of project managers, thereby enhancing their skills and competencies in a more meaningful way. A third benefit of low LVG is increased motivation and engagement. Knowing that their learning and development are being accurately measured and valued can boost the motivation of project managers. This recognition can encourage them to engage more actively in professional development activities, leading to continuous improvement and innovation in their roles.

To mitigate the negative impacts of high LVG and capitalize on the benefits of low LVG, organizations can implement a pretest, retrospective, and posttest measurement design to capture a more accurate picture of learning gains. Another suggestion would be to encourage reflective practices among project managers, allowing them to recognize and articulate their learning more effectively. Organizations should use a variety of assessment methods to capture different dimensions of learning and development, and foster a culture of continuous learning and development, where the process of gaining knowledge and skills is valued as much as the outcomes. By addressing LVG in professional development programs, organizations can ensure that the growth and development of their project managers are accurately assessed and supported, leading to improved performance and outcomes.

In project management, measuring the skill level of project managers is an important practical and academic question (Blomquist et al., 2016). Perceived self-efficacy is defined as a person's belief about their ability to produce designated levels of performance that exercise influence over events that affect their lives (Bandura, 1997). Limiting a student's self-evaluation of PMSE to before and after a course may reduce the accuracy of the results due to the possibility that student may only be partially aware of the project management body of knowledge and overestimate their true agility in each competency.

Measures of project success often focus on metrics that are easily quantifiable: scope, budget, schedule, and quality. However, other measures such as team satisfaction, customer satisfaction, and employee burnout are often overlooked. Educators need to consider the role that self-efficacy has on improving the competencies that have been found to be predictors of successful project managers such as adaptability\flexibility, ability to handle ambiguity, persistence\perseverance, emotional intelligence, and resilience (Jacobs, & Kamohi, 2014).

Recent studies on the success rates of modern-day projects have shown that the project management community needs to go beyond merely achieving the current levels of excellence and become more relevant to the needs of the modern business environment (Jacobs & Kamohi, 2017). The critical importance of people and process over product and technology in project management places HR managers as a key driver to ensure project success (Thite & Bhatta, 2019). Demilliere (2014) noted that project success requires success in team project management, which is the HR function with the three main processes being: selecting, training, and managing. Anderson (2019) stated:

> Once they start structuring their entire organisation around the portfolio of projects that deliver the most value to their customers and partners, they have much more flexibility in terms of how they hire, how they train, how they assign, how they schedule, understand, and retain the workforce (p.3).

Within the realm of PMSE research, grasping and utilizing the Learning Value Gap (LVG) is crucial for improving the quality of project management education and training. By accurately assessing PMSE scores, we can pinpoint specific areas where project managers may overestimate or underestimate their capabilities, enabling targeted educational interventions. This approach enhances alignment with industry needs, supports precise project assignment based on true competencies, and encourages ongoing professional development. Addressing the LVG effectively ensures a more competent, efficient, and adaptable project management workforce, crucial for navigating the challenges and dynamics of today's project-driven economy.

Declaration of Interest Statement

No potential conflict of interest was reported by the authors. The authors alone are responsible for writing the content of this article.

Funding

This work was co-supported by Indiana University Purdue University – Indianapolis, Office of the Vice Chancellor for Research and Office for Women under the Enhanced Mentoring Program with Opportunities for Ways to Excel in Research (EMPOWER) grant.

References

Ahsan, K., Ho, M., & Khan, S. (2013). Recruiting project managers: A comparative analysis of competencies and recruitment signals from job advertisements. *Project management journal, 44*(5), 36-54.

AIPM, A. (2008). Professional Competency Standards for Project Management. *Parts A to D, Ver, 1*.

Alvarenga, J. C., Branco, R. R., Guedes, A. L. A., Soares, C. A. P., & Silva, W. d. S. e. (2019). The project manager core competencies to project success. *International Journal of Managing Projects in Business*, *13*(2), 277-292.

Anderson, C. (2019). Investing in 21st century skills: Preparing young people for the project economy. *Newstatesman,* 1-8. Retrieved from https://www.newstatesman.com/.../investing-21st-century-skills-preparing-young-people-project-economy

Bandura, A. (1977). Self-efficacy: toward a unifying theory of behavioral change. *Psychological review, 84*(2), 191.

Bandura, A. (1986). Social foundations of thought and action. *Englewood Cliffs, NJ, 1986*.

Bandura, A. (1997). *Self-efficacy: The exercise of control*: Macmillan.

Blomquist, T., Farashah, A. D., & Thomas, J. (2016). Project management self-efficacy as a predictor of project performance: Constructing and validating a domain-specific scale. *International Journal of Project Management, 34*(8), 1417-1432.

Brill, J. M., Bishop, M., & Walker, A. (2006). An investigation into the competencies required of an effective project manager: A Web-based Delphi study. *ITLS Faculty Publications*, 10.

Brown, N. A., Dewey, D. P., & Cox, T. L. (2014). Assessing the validity of can-do statements in retrospective (then-now) self-assessment. *Foreign Language Annals, 47*(2), 261-285.

Cartwright, C. (2008). Using the Project Management Competency Development Framework to Improve Project Management Capability. Paper presented at PMI® Global Congress 2008—Asia Pacific, Sydney, New South Wales, Australia. Newtown Square, PA: Project Management Institute.

Chinowsky, P. S., Brown, H., Szajnman, A., & Realph, A. (2006). Developing knowledge landscapes through project-based learning. *Journal of professional issues in engineering education and practice, 132*(2), 118-124.

Clarke, N. (2010a). Emotional intelligence and its relationship to transformational leadership and key project manager competences. *Project management journal, 41*(2), 5-20.

Clarke, N. (2010b). The impact of a training programme designed to target the emotional intelligence abilities of project managers. *International Journal of Project Management, 28*(5), 461-468.

Cronbach, L. J., & Furby, L. (1970). How we should measure" change": Or should we? *Psychological bulletin, 74*(1), 68.

Dainty, A. R., Cheng, M.-I., & Moore, D. R. (2005). Competency-based model for predicting construction project managers' performance. *Journal of Management in Engineering, 21*(1), 2-9.

Demilliere, A.-S. (2014). The Role of Human Resources in Project Management. *Romanian Distribution Committee Magazine, 5*(1), 36-40.

Drennan, J., & Hyde, A. (2008). Controlling response shift bias: the use of the retrospective pre-test design in the evaluation of a master's programme. *Assessment & Evaluation in Higher Education, 33*(6), 699-709.

Geldhof, G. J., Warner, D. A., Finders, J. K., Thogmartin, A. A., Clark, A., & Longway, K. A. (2018). Revisiting the utility of retrospective pre-post designs: the need for mixed-method pilot data. *Evaluation and program planning, 70*, 83-89.

Gómez, L., Jaramillo, A., Halpaap, B., Launois, P., Cuervo, L. G., & Saravia, N. G. (2019). Building research capacity through "Planning for Success". *PLoS neglected tropical diseases, 13*(8), e0007426-e0007426. doi:10.1371/journal.pntd.0007426

Hanif, A., & Tariq, S. (2014). *An evaluation of personal and interpersonal competencies of project managers*. Paper presented at the 2014 International Conference on Emerging Technologies (ICET).

Harrin, E. (2018). Project Management Training Options. Retrieved from https://www.thebalancecareers.com/training-options-for-project-managers-4113891

Hill, & Nelson. (2019). Application of the Project Management Body of Knowledge (PMBOK) in an Interdisciplinary Capstone: The AISC Steel Bridge Competition. *International Journal of Engineering, 3*(1), 17-24.

Hill, L. G., & Betz, D. L. (2005). Revisiting the retrospective pretest. *American Journal of Evaluation, 26*(4), 501-517.

Howard, G. S., Dailey, P. R., & Gulanick, N. A. (1979). The feasibility of informed pretests in attenuating response-shift bias. *Applied Psychological Measurement, 3*(4), 481-494.

ICB–IPMA, I. (2006). Competence Baseline. In: IPMA.

Ilie, G., Bradfield, J., Moodie, L., Lawen, T., Ilie, A., Lawen, Z., Blackman, C., Gainer, R. & Rutledge, R. D. (2019). The role of response-shift in studies assessing quality of life outcomes among cancer patients: a systematic review. *Frontiers in oncology, 9*, 783. https://doi.org/10.3389/fonc.2019.00783

Jacobs, A., & Kamohi, L. (2014). The effect of self-efficacy improvement on the effectiveness of project managers in contemporary organisations. *Journal of Leadership and Management Studies (JOLMS), 1*(1), 76-86.

Jacobs, A., & Kamohi, L. (2017). The effect of self-efficacy improvement on the effectiveness of project managers in contemporary organisations. *Universal Journal of Management 5*(8): 404-411.

Jugdev, K., & Müller, R. (2005). A retrospective look at our evolving understanding of project success. *Project management journal*, *36*(4), 19-31.

Kodden, B. (2020). The Impact of Self-efficacy. In: The Art of Sustainable Performance. Springer Briefs in Business. Springer, Cham. https://doi.org/10.1007/978-3-030-46463-9_5

Lei, W. W., & Skitmore, M. (2004). Project management competencies: a survey of perspectives from project managers in South East Queensland. *Journal of Building and Construction Management, 9*(1), 1-12.

Levinson, W., Gordon, G., & Skeff, K. (1990). Retrospective versus actual pre-course self-assessments. *Evaluation & the Health Professions, 13*(4), 445-452.

Little, T. D., Chang, R., Gorrall, B. K., Waggenspack, L., Fukuda, E., Allen, P. J., & Noam, G. G. (2020). The retrospective pretest–posttest design redux: On its validity as an alternative to traditional pretest–posttest measurement. *International Journal of Behavioral Development, 44*(2), 175-183.

Magano, J., Silva, C., Figueiredo, C., Vitória, A., Nogueira, T., & Pimenta Dinis, M. A. (2020). Generation Z: Fitting Project Management Soft Skills Competencies—A Mixed-Method Approach. *Education Sciences, 10*(7), 187.

Moradi, S., Kähkönen, K., & Aaltonen, K. (2020). Comparison of research and industry views on project managers' competencies. *International journal of managing projects in business*, *13*(3), 543-572. https://doi.org/10.1108/IJMPB-04-2019-0085

Müller, R., & Rodney Turner, J. (2010). Attitudes and leadership competences for project success. *Baltic Journal of Management, 5*(3), 307-329.

Pant, I., & Baroudi, B. (2008). Project management education: The human skills imperative. *International Journal of Project Management, 26*(2), 124-128.

PMI. (2007). *Project manager competency development (PMCD) framework*: The Institute.

PMI. (2017). *Project Manager Competency Development Framework.*

PMI. (2019). *Project Management Professional (PMP)® Examination Content Outline.*

PMICIC. (2019). Welcome to the Project Management Institute Central Indiana Chapter (PMICIC). Retrieved from https://pmicic.org/

Poston, R. S., & Richardson, S. M. (2019). Designing an academic project management program: A collaboration between a university and a PMI chapter. *Journal of Information Systems Education, 22*(1), 6.

Pratt, C. C., McGuigan, W. M., & Katzev, A. R. (2000). Measuring program outcomes: Using retrospective pretest methodology. *American Journal of Evaluation, 21*(3), 341-349.

Qualtrics, I. (2013). Qualtrics. *Provo, UT, USA.*

Rapkin, B. D., & Schwartz, C. E. (2021). What should progress in response-shift research look like?. *Quality of Life Research, 30*(12), 3359-3361.

Razanaufal, M. W., & Lantu, D. C. (2019). Evaluation of Leadership Training Program Using Kirkpatrick Model Case Study in Telkom Corporate University. *Evaluation, 10*(4).

Rohs, F. R. (2002). Improving the evaluation of leadership programs: Control response shift. *Journal of Leadership Education, 1*(2), 1-12.

Rohs, F. R., & Langone, C. A. (1997). Increased accuracy in measuring leadership impacts. *Journal of Leadership Studies, 4*(1), 150-158.

Skeff, K. M., Stratos, G. A., & Bergen, M. R. (1992). Evaluation of a medical faculty development program: a comparison of traditional pre/post and retrospective pre/post self-assessment ratings. *Evaluation & the Health Professions, 15*(3), 350-366.

Skrzypek, M., Kowal, K., Marzec, A., & Wdowiak, A. (2018). The phenomenon of response shift in studies on the health-related quality of life in clinical medicine. *European Journal of Medical Technologies (EJMT), 2*(19), 51-58

Skulmoski, G. J., & Hartman, F. T. (2010). Information systems project manager soft competencies: A project-phase investigation. *Project management journal, 41*(1), 61-80.

Starkweather, J. A., & Stevenson, D. H. (2011). PMP® certification as a core competency: Necessary but not sufficient. *Project management journal, 42*(1), 31-41.

Stevenson, D. H., & Starkweather, J. A. (2010). PM critical competency index: IT execs prefer soft skills. *International Journal of Project Management, 28*(7), 663-671.

Takey, S. M., & de Carvalho, M. M. (2015). Competency mapping in project management: An action research study in an engineering company. *International Journal of Project Management, 33*(4), 784-796.

Thite, M., & Bhatta, N. (2019). 3 Soft systems thinking approach to e-HRM project management. e-HRM: Digital Approaches, Directions & Applications.

Thomas, E. V., Walls, R., Baumann, S. D., Graybill, E., Roach, A., Truscott, S. D., Crenshaw, M., & Crimmins, D. (2018). Comparing traditional versus retrospective pre-/post-assessment in an interdisciplinary leadership training program. Maternal and Child Health Journal 23,(2) 191-200. https://doi-org.proxy.ulib.uits.iu.edu/10.1007/s10995-018-2615-xT