# Core Competencies Critical to Create Communications Required in Construction Discipline: Perception of the Global Academia

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**Abstract**: Construction is a critical player in the U.S. economy. Construction contributed $884 billion to the nation's GDP in 2019, employing more than 7.5 million people in the United States. Despite its prominent role in the national economy, the construction industry still deals with long-standing problems. Construction project managers (CPMs) are critical to resolving many of these problems. Identifying training gaps in construction project management requires a deep awareness of the necessary competencies. The authors identified 21 skills required for CPMs and revealed essential knowledge areas and personality characteristics critical to each skill. A survey including 672 ranking questions was developed to explore the global construction academics' perception of the importance of each knowledge area/personality characteristic to each skill. Each participant ranked the importance of two universal knowledge areas, two domain-specific knowledge areas, and three personality characteristics to three skills. The data was collected from 2,016 construction academics worldwide. This paper focuses on the ability to create written and oral communications appropriate to the construction discipline. The findings can assist the construction academia in directing their efforts toward key competency development areas, and scaffolding courses and planning curricula to the real needs of the worldwide workforce.

**Keywords:** Communication, Construction project management, Knowledge, Personality characteristic, Skill

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## Introduction

The construction industry plays a crucial role in the global economy. Approximately 7% of the global labor force is employed in the construction sector, contributing to approximately 13% of the world's Gross Domestic Product (MGI, 2017). The construction sector plays a vital role in the economy of the United States and substantially impacts the lives of a significant portion of the population. In 2019, the construction industry made a significant contribution of $884 billion to the GDP of the United States (BEA, 2019) while providing employment opportunities for over 7.5 million individuals in the country (BLS, 2019). The construction industry in the United States faces a range of new realities and challenges due to various factors, such as global market competition, disruptive technologies, environmental restrictions, an aging workforce, and evolving regulatory requirements. These factors, combined with the industry's extensive scope and complex nature, cause ongoing challenges for the construction sector in the United States (Ahn et al., 2012; WEF, 2016). Many construction jobs and processes are transforming as a result of advancements in automation and robotics, big data and predictive analysis, industrialized construction, the Internet of Things (IoT), digital transformation, new project delivery methods, and additive manufacturing, etc. (Aghion et al., 2019; Debra & Anil, 2019; MGI, 2017; Salehi et al., 2023a; Salehi et al., 2023b). Based on the 2013 construction workforce survey conducted by the Associated General Contractors of America, 74% of construction firms experienced difficulties in finding an adequate labor force (AGC, 2018).

According to Debra and Anil (2019), the future of construction work brings challenges and opportunities that require collaboration between the industry and academia. By working together, they can focus on educating and preparing the future workforce to address the evolving needs and demands of the construction industry (Boroughani, Behshad, et al., 2023; Boroughani, Xodabande, et al., 2023; Rezaei et al., 2013). For effective collaboration between the construction industry and academia, it is essential to assess how the competencies developed by educational institutions align with the demands of the future built environment. Specifically, examining how these competencies can adapt to the transformative changes brought about by industrialized construction is crucial (Pariafsai & Behzadan, 2021; Pariafsai & Pariafsai, 2021). The performance of construction projects greatly relies on the workforce, particularly the role of construction project managers, as they are instrumental in achieving improved project outcomes (Ahn et al., 2012). Given their critical role, construction project managers should possess various competencies to enhance team performance and attain desired project outcomes.

The objective of this study is to identify the importance of ten universal knowledge areas, ten domain-specific knowledge areas, and twelve personality characteristics to the ability to create written and oral communications

appropriate to the construction discipline. Determining the importance of construction project management (CPM) competency components provides options for addressing the training of the future CPM workforce. In addition, this work contributes to establishing strategies for management development policies that construction organizations may adopt.

## Literature Review

### Conceptual Model for CPM Competencies

According to McClelland, competencies are best described as an iceberg (Vazirani, 2010). Knowledge and skills represent the iceberg's visible tip, while the underlying and enduring personal characteristics represent the large portion of the iceberg hidden below the waterline (Juneja, 2019; Sanghi, 2007; Vazirani, 2010). In addition, the paths for developing the two levels of competencies are distinct. Training and skill-building exercises can quickly improve knowledge and skills. On the other hand, behavioral competencies are difficult to assess and enhance (Juneja, 2019; Sanghi, 2007).

Literature includes different competency models. Generally, a competency model consists of innate and acquired aspects (Sanghi, 2007). Personal and professional competencies are essential components of the quality of human capital (Bogoviz et al., 2020). Applications of the concept of competencies for education and training assume competencies as a cluster of trainable skills, knowledge, and attitudes (van Klink & Boon, 2003). A competency model developed for effective management considers that the qualities of an effective manager fall into three levels: basic knowledge and information, skills and attributes, and meta-qualities. Meta-qualities help develop the situation-specific skills needed in particular contexts (Pedler et al., 2013). Competencies have also been classified into the categories of input and personal competencies. Input competencies are limited to the information, comprehension, skills, and capabilities an individual brings to a job. Personal competencies are the essential characteristics that distinguish a person's job capacity (Chai, 2016). Competencies have also been clustered into essential professional skills/talents, personal skills/talents, and behavioral patterns (Blašková et al., 2014). In another model, competencies have been grouped into interrelated knowledge, skills, and personal attributes required to perform a job properly. This model also divides knowledge and skills into soft and hard subcategories (Alroomi et al., 2012). Soft skills indicate who people are, and hard skills reflect what they know (Jena & Satpathy, 2017). Soft skills and knowledge are challenging to develop, whereas hard skills and knowledge can be developed easily (Alroomi et al., 2012). The other conceptual model divides competencies into two levels: behavioral and technical. Behavioral competencies include abilities and soft skills, while technical competencies are categorized into knowledge and hard skills in this model (Mohammad et al., 2016). The other competency model developed for crisis management clusters competencies into two levels: functional and personal. Functional competencies are a set of abilities focused on tasks. Personal competencies denote the ability of managers to keep themselves professionally ready to do the tasks effectively (Lovecek et al., 2015). In the standard International Project Management Association (IPMA) Competence Baseline 3.0, competency elements are defined under three ranges: technical, behavioral, and contextual competencies (Association, 2006;

Omidvar et al., 2011). Technical competencies are required for project deliverables. Behavioral competencies are needed for the personal relationships among all parties involved in a project, and contextual competencies are necessary for the interrelation of the project team within the context of a project (Omidvar et al., 2011).

Figure 1 presents the competency model used in this study for CPM into personal and input competencies. This model divides the competencies required for CPM into personal and input competencies. Personal competencies encompass core personality characteristics that are difficult to assess and enhance. Input competencies, on the other hand, include skills required for CPM. The skills are grouped into hard and soft skills. This model considers hard skills as a function of knowledge and soft skills as a function of core personality characteristics and knowledge. In addition, this conceptual model groups knowledge into two categories: universal and domain-specific. Universal knowledge areas are those required of all project managers. Domain-specific knowledge areas, on the other hand, are needed for project managers in the field of construction. This model considers skills as a function of knowledge and personality characteristics.

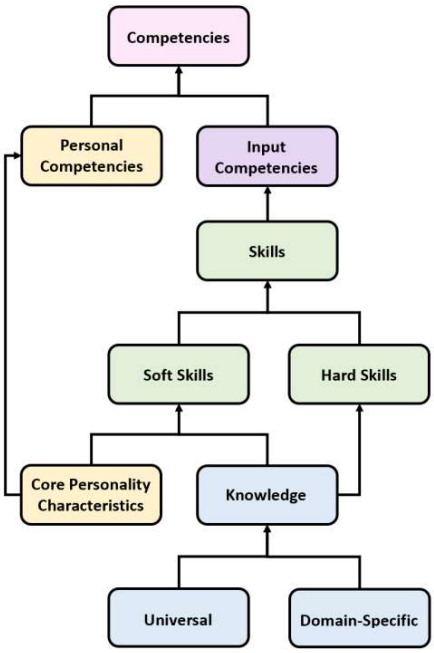


Figure 1. Conceptual competency model for CPM education and training

*Identification of Skills, Knowledge Areas, and Personality Characteristics*

The literature uses different terms to refer to a specific skill. The skills identified from the literature could be grouped into 21 categories based on their nature. This study focuses on the skill defined as the ability to create written and oral communications appropriate to the construction discipline.

Moreover, the Project Management Institute (PMI) has developed a list of ten knowledge areas as the body of

knowledge required in project management (PMI, 2007). This study used these ten elements as the universal knowledge areas (UKAs) required in CPM. They are as follows: project communications management (UKA1), project cost management (UKA2), project integration management (UKA3), project procurement management (UKA4), project quality management (UKA5), project resource management (UKA6), project risk management (UKA7), project schedule management (UKA8), project scope management (UKA9), and project stakeholder management (UKA10) (PMI, 2007).

To provide the list of knowledge areas required for CPM, PMI has added the following elements to the previous list: (a) Project health, safety, security, and environmental management and (b) Project financial management (PMI, 2016). The literature utilizes various phrases to mention a specific knowledge area needed in CPM. The identified domain-specific knowledge areas (DKAs) were grouped into ten categories based on their similarities: construction operation (DKA1), culture and ethics management (DKA2), legal and contractual management (project claims, conflicts, and dispute management) (DKA3), project change management (DKA4), project environmental management (DKA5), project financial management (DKA6), project health and safety management (DKA7), project leadership management (DKA8), project security management (DKA9), and project value management (DKA10).

The literature uses different terms to refer to a specific personality characteristic. The personality characteristic identified from the literature were grouped into 12 categories based on their nature to avoid redundancy: ambition, charisma, creativity, curiosity, determination, leadership, maturity, organization, patience, reasoning, team player, and trustworthiness.

## Methodology

### Survey Design

A design framework was used to divide the lengthy questionnaire to investigate the importance of the knowledge areas and personality characteristics to the skills. The survey includes 672 ranking questions:

- 210 ranking questions regarding the importance of 10 universal knowledge areas to 21 skills
- 210 ranking questions regarding the importance of 10 domain-specific knowledge areas to the 21 skills
- 252 ranking questions regarding the importance of 12 personality characteristics to the 21 skills

The aim was to randomly and evenly present 21 ranking questions to each participant. Each participant ranked the importance of two universal knowledge areas, two domain-specific knowledge areas, and three personality characteristics to three skills. Qualtrics, a popular web-based survey tool, was used to design the survey.

*Data Collection*

The website https://www.topuniversities.com/universities was used to find top Civil and Structural Engineering

departments in different countries worldwide. Next, 35,928 professors, post-docs, and students from 86 countries whose email were available on their department's website were invited to participate. Among the invited people, 2,016 individuals tried the survey.

## Analysis

### Statistical Test

The one-sample sign test compares values to a given default value for ordinal data. The null hypothesis is that the population median from which the sample was drawn equals the default value. In addition to descriptive analysis, the one-sample sign test was used to investigate whether the corresponding five-point Likert scores were statistically significantly different from the default score of 3, representing the important option.

*Required Sample Size*

G * Power has been used to compute the required sample size based on the given α, power, and effect size. For the sign test, G * Power uses the following effect size conventions defined by Cohen in 1969: small g = 0.05, medium g = 0.15, and large g = 0.25 (Buchner et al., 2017). In addition, it is generally accepted that power should be 0.8 or greater (Zint, 2021). For α = 0.05, power = 0.8, and effect size = 0.25, G * Power computed 30 for the sample size of each ranking question.

## Results

Using the split questionnaire design, at least 36 participants identified the importance of each universal knowledge area, domain-specific knowledge area, and personality characteristic to the ability to create written and oral communications appropriate to the construction discipline. Based on the descriptive analysis, all ten universal knowledge areas are either very important or important to this skill (see Table 1). In addition, most participants perceived project communications management, project cost management, project procurement management, project resource management, project risk management, and project scope management as the universal knowledge areas very important to the skill. However, the one-sample sign test results revealed that, unsurprisingly, the participants perceived Project Communications Management as the only universal knowledge area more than important for this skill and the rest as important (see Table 2).

Table 1. Descriptive Analysis: Importance of Universal Knowledge Areas

| UKA | Importance | | | | | Total |
|---|---|---|---|---|---|---|
| | Very Important | Important | Moderately Important | Of Little Importance | Not Important | |
| UKA1 | 22 | 12 | 5 | 1 | 0 | 40 |
| UKA2 | 19 | 8 | 6 | 5 | 1 | 39 |
| UKA3 | 11 | 20 | 9 | 3 | 0 | 43 |

| | | | | | | |
|---|---|---|---|---|---|---|
| UKA4 | 15 | 11 | 9 | 6 | 0 | 41 |
| UKA5 | 10 | 17 | 10 | 3 | 0 | 40 |
| UKA6 | 14 | 12 | 7 | 4 | 0 | 37 |
| UKA7 | 15 | 12 | 4 | 5 | 1 | 37 |
| UKA8 | 9 | 22 | 5 | 1 | 1 | 38 |
| UKA9 | 13 | 12 | 10 | 3 | 0 | 38 |
| UKA10 | 13 | 18 | 6 | 2 | 0 | 39 |

Table 2. One-Sample Sign Test Results for Universal Knowledge Areas

| UKA | p-value | Median - Score | | | |
|---|---|---|---|---|---|
| | | Negative Differences (Median < Score) | Positive Differences (Median > Score) | Ties (Median = Score) | Total |
| UKA1 | .007 | 19 | 5 | 17 | 41 |
| UKA2 | .832 | 12 | 10 | 19 | 41 |
| UKA3 | .824 | 9 | 11 | 20 | 40 |
| UKA4 | 1.000 | 11 | 10 | 18 | 39 |
| UKA5 | .584 | 17 | 13 | 10 | 40 |
| UKA6 | .115 | 14 | 6 | 19 | 39 |
| UKA7 | .000 | 22 | 3 | 14 | 39 |
| UKA8 | .210 | 15 | 8 | 18 | 41 |
| UKA9 | .238 | 12 | 6 | 21 | 39 |
| UKA10 | .839 | 11 | 13 | 15 | 39 |

Based on the descriptive analysis, except for culture and ethics management and project security management, all other ten domain-specific knowledge areas are either very important or important to the ability to create written and oral communications (e.g., presentation, report, negotiation, marketing) appropriate to the construction discipline (see Table 3). However, the one-sample sign test results revealed that the participants perceived project security management as the only domain-specific knowledge area less than important for this skill and the rest as important (see Table 4).

Table 3. Descriptive Analysis: Importance of Domain-Specific Knowledge Areas

| DKA | Importance | | | | | Total |
|---|---|---|---|---|---|---|
| | Very Important | Important | Moderately Important | Of Little Importance | Not Important | |
| DKA1 | 10 | 18 | 4 | 4 | 1 | 37 |
| DKA2 | 11 | 11 | 12 | 5 | 0 | 39 |
| DKA3 | 15 | 14 | 5 | 4 | 1 | 39 |
| DKA4 | 11 | 17 | 7 | 4 | 0 | 39 |
| DKA5 | 9 | 16 | 8 | 3 | 1 | 37 |

| | | | | | | |
|---|---|---|---|---|---|---|
| DKA6 | 17 | 10 | 6 | 3 | 1 | 37 |
| DKA7 | 9 | 14 | 10 | 5 | 0 | 38 |
| DKA8 | 14 | 13 | 9 | 3 | 0 | 39 |
| DKA9 | 7 | 10 | 12 | 6 | 1 | 36 |
| DKA10 | 12 | 15 | 10 | 2 | 0 | 39 |

Table 4. One-Sample Sign Test Results for Domain-Specific Knowledge Areas

| DKA | p-value | Median - Score | | | |
|---|---|---|---|---|---|
| | | Negative Differences (Median < Score) | Positive Differences (Median > Score) | Ties (Median = Score) | Total |
| DKA1 | .006 | 23 | 7 | 8 | 38 |
| DKA2 | 1.000 | 10 | 11 | 18 | 39 |
| DKA3 | .307 | 15 | 9 | 13 | 37 |
| DKA4 | .541 | 14 | 10 | 14 | 38 |
| DKA5 | .441 | 16 | 11 | 12 | 39 |
| DKA6 | .678 | 13 | 10 | 16 | 39 |
| DKA7 | .000 | 22 | 3 | 13 | 38 |
| DKA8 | .124 | 18 | 9 | 13 | 40 |
| DKA9 | .571 | 16 | 12 | 11 | 39 |
| DKA10 | .541 | 14 | 10 | 14 | 38 |

Based on the descriptive analysis, curiosity and leadership were very important personality characteristics for the skill. In addition, ambition was the only personality characteristic moderately important for the skill, and the rest were important (see Table 5). However, the one-sample sign test results revealed that reasoning was the only personality characteristic the participants perceived as more than important for this skill. The one-sample sign test results also indicate that the participants perceived ambition and charisma as less than important for this skill. Based on the one-sample sign test results, the participants perceived the rest of the personality characteristics as important for the skill (see Table 6).

Table 5. Descriptive Analysis: Importance of Personality Characteristics

| Personality Characteristic | Importance | | | | | |
|---|---|---|---|---|---|---|
| | Very Important | Important | Moderately Important | Of Little Importance | Not Important | Total |
| Ambition | 8 | 13 | 15 | 9 | 3 | 48 |
| Charisma | 9 | 18 | 17 | 2 | 2 | 48 |
| Creativity | 13 | 21 | 9 | 5 | 0 | 48 |
| Curiosity | 14 | 13 | 12 | 5 | 3 | 47 |
| Determination | 12 | 16 | 12 | 6 | 2 | 48 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Leadership | 21 | 16 | 7 | 2 | 2 | 48 |
| Maturity | 17 | 19 | 9 | 2 | 0 | 47 |
| Organization | 15 | 26 | 6 | 1 | 0 | 48 |
| Patience | 8 | 25 | 12 | 3 | 0 | 48 |
| Reasoning | 20 | 24 | 2 | 1 | 0 | 47 |
| Team player | 10 | 20 | 12 | 5 | 0 | 47 |
| Trustworthiness | 14 | 19 | 10 | 4 | 0 | 47 |

Table 6. One-Sample Sign Test Results for Personality Characteristics

| Personality Characteristic | p-value | Median - Score Negative Differences (Median < Score) | Positive Differences (Median > Score) | Ties (Median = Score) | Total |
|---|---|---|---|---|---|
| Ambition | .001 | 7 | 27 | 12 | 46 |
| Creativity | .265 | 11 | 18 | 20 | 49 |
| Determination | .855 | 16 | 14 | 18 | 48 |
| Organization | .007 | 19 | 5 | 22 | 46 |
| Charisma | .067 | 12 | 24 | 12 | 48 |
| Team player | .728 | 18 | 15 | 15 | 48 |
| Leadership | .556 | 11 | 15 | 22 | 48 |
| Reasoning | .327 | 16 | 10 | 20 | 46 |
| Patience | .728 | 15 | 18 | 15 | 48 |
| Maturity | .735 | 19 | 16 | 12 | 47 |
| Curiosity | .000 | 3 | 27 | 16 | 46 |
| Trustworthiness | .361 | 18 | 12 | 18 | 48 |

## Conclusion

The findings of this study revealed that the academia perceived project project communications management as the only universal knowledge areas more than important to the ability to create written and oral communications (e.g., presentation, report, negotiation, marketing) appropriate to the construction discipline and the rest of the 9 universal knowledge areas as important to the skill. The results also indicated that the academia perceived project security management as the only domain-specific knowledge area less than important for this skill and the rest as important. In addition, reasoning was the only personality characteristic the academia perceived as more than important for this skill. The academia also perceived ambition and charisma as less than important for the skill. Based on the one-sample sign test results, the participants perceived the rest of the personality characteristics as important for the skill.

The already employed and the newly hired construction project managers must acquire critical competencies on time. Accordingly, a strategic plan is essential to keep construction project managers' competencies up to date and enable them to manage the ever-increasing complexity of the construction industry. The primary steps to reexamine how construction project managers should be educated and trained is to determine the most critical competencies to fill the existing gaps. This study is a step forward in identifying the most critical knowledge areas and personality characteristics required for the ability to create written and oral communications (e.g., presentation, report, negotiation, marketing) appropriate to the construction discipline.

The findings of this study contribute to improving CPM training programs and assessment criteria. The results can also assist in refining recruitment criteria and sustainable employability in CPM. Overall, the findings of this study make recommendations for forging the path ahead by assisting the construction industry in directing its efforts on core competency development areas and catering training and professional development to the real needs of the future workforce.

## References

AGC. (2018). *The Workforce Development Plan 2.0* (AGC of America's New Plan to Address Growing Construction Workforce Shortages, Issue. T. A. G. C. o. America. https://www.agc.org/sites/default/files/Files/Communications/Workforce_Development_Plan_2.0_FINAL.pdf

Aghion, P., Antonin, C., Bunel, S., Coyle, D., Qureshi, Z., O'Mahony, M., Böhm, M. J., Ritzer, G., Shell, E. R., Woodcock, J., Moore, P. V., Muñiz, M., Andrés, J., Doménech, R., Serra, C. P., Gleason, N. W., Maitland, A., Ciulla, J. B., & Lee, K.-F. (2019). *Work in the Age of Data*. BBVA https://www.bbvaopenmind.com/en/books/work-in-the-age-of-data/

Ahn, Y. H., Annie, R. P., & Kwon, H. (2012). Key competencies for US construction graduates: Industry perspective. *Journal of Professional Issues in Engineering Education and Practice*, *138*(2), 123-130.

Alroomi, A., Jeong, D. H. S., & Oberlender, G. D. (2012). Analysis of cost-estimating competencies using criticality matrix and factor analysis. *Journal of Construction Engineering and Management*, *138*(11), 1270-1280.

Association, I. P. M. (2006). ICB-IPMA competence baseline version 3.0. *International Project Management Association, Nijkerk*.

BEA. (2019). *Gross Domestic Product by Industry: Second Quarter 2019*. U.S. Bureau of Economic Analysis. Retrieved October 29 from https://www.bea.gov/system/files/2019-10/gdpind219_2.pdf

Blašková, M., Blaško, R., & Kucharčíková, A. (2014). Competences and Competence Model of University Teachers. *Procedia - Social and Behavioral Sciences*, *159*, 457-467. https://doi.org/https://doi.org/10.1016/j.sbspro.2014.12.407

BLS. (2019). *Construction: NAICS 23*. U.S. Bureau of Labor Statistics. Retrieved December 13 from https://www.bls.gov/iag/tgs/iag23.htm#iag23emp1.f.p

Bogoviz, A. V., Suglobov, A. E., Maloletko, A. N., Kaurova, O. V., & Lobova, S. V. (2020). *Frontier Information Technology and Systems Research in Cooperative Economics* (Vol. 316). Springer Nature.

Boroughani, T., Behshad, N., & Xodabande, I. (2023). Mobile-assisted academic vocabulary learning with digital flashcards: Exploring the impacts on university students' self-regulatory capacity. *Frontiers in Psychology*, *14*, 1112429. https://doi.org/10.3389/fpsyg.2023.1112429

Boroughani, T., Xodabande, I., & Karimpour, S. (2023). Self-regulated learning with mobile devices for university students: exploring the impacts on academic vocabulary development. *Discover Education*, *2*(5). https://doi.org/https://doi.org/10.1007/s44217-023-00028-z

Buchner, A., Erdfelder, E., Faul, F., & Lang, A.-G. (2017). *G * Power 3.1 manual*. Heinrich Heine University Düsseldorf. https://www.psychologie.hhu.de/fileadmin/redaktion/Fakultaeten/Mathematisch-Naturwissenschaftliche_Fakultaet/Psychologie/AAP/gpower/GPowerManual.pdf

Chai, A. H. R. (2016). *Competencies of Construction Manager* UTAR].

Debra, P., & Anil, S. (2019). *Future of work in construction*. A. a. RICS. https://www.rics.org/globalassets/rics-website/media/knowledge/20200603_autodesk_whitepaperconstruction_web.pdf

Jena, A., & Satpathy, S. S. (2017). Importance of soft skills in project management. *International Journal of Scientific Research and Management*, *5*(7), 6173-6180.

Juneja, P. (2019). *Competency Based Assessment*. Management Study Guide (MSG). https://www.managementstudyguide.com/what-are-competencies.htm

Lovecek, T., Ristvej, J., Sventekova, E., Mika, V., & Zagorecki, A. (2015). Currently required competencies of crisis and security managers and new tool for their acquirement—The eSEC portal. 2015 13th International Conference on Emerging eLearning Technologies and Applications (ICETA),

MGI. (2017). *Reinventing construction: A route to higher productivity*. M. Company. https://www.mckinsey.com/~/media/McKinsey/Industries/Capital%20Projects%20and%20Infrastructure/Our%20Insights/Reinventing%20construction%20through%20a%20productivity%20revolution/MGI-Reinventing-construction-A-route-to-higher-productivity-Full-report.ashx

Mohammad, H., Yaman, S. K., Hassan, F., & Ismail, Z. (2016). Determining the technical competencies of construction managers in the Malaysia's construction industry. MATEC Web of Conferences,

Omidvar, G., Jaryani, F., Samad, Z. B. A., Zafarghandi, S. F., & Nasab, S. S. (2011). A proposed framework for project managers' competencies and role of E-Portfolio to meet these competencies. *International Journal of e-Education, e-Business, e-Management and e-Learning*, *1*(4), 311.

Pariafsai, F., & Behzadan, A. H. (2021). Core Competencies for Construction Project Management: Literature Review and Content Analysis. *Journal of Civil Engineering Education*, *147*(4), 04021010.

Pariafsai, F., & Pariafsai, S. (2021). Classification of Key Competencies for Construction Project Management: Literature Review and Content Analysis. *International Journal of Scientific Research in Science, Engineering and Technology (IJSRSET)*, *8*(3), 211-234. https://doi.org/https://doi.org/10.32628/IJSRSET218334

Pedler, M., Burgoyne, J., & Boydell, T. (2013). *A Manager's Guide to Self-development*. McGraw-Hill Education (UK).

PMI. (2007). *Project manager competency development (PMCD) framework* (P. M. I. (PMI), Ed.). Project Management Institute (PMI).

PMI. (2016). Construction Extension to the PMBOK' Guide.

Rezaei, A., Boroghani, T., & Rahimi, M. A. (2013). Reflectivity/Impulsivity as an Important Individual Factor and Effectiveness of Awareness Raising Activities.

Salehi, F., Pariafsai, F., & Dixit, M. K. (2023a). How Human Spatial Ability is Affected by the Misalignment of Idiotropic and Visual Axes. In D. D. Schmorrow & C. M. Fidopiastis, *Augmented Cognition* Cham.

Salehi, F., Pariafsai, F., & Dixit, M. K. (2023b). The impact of misaligned idiotropic and visual axes on spatial ability under altered visuospatial conditions. *Virtual Reality*. https://doi.org/https://doi.org/10.1007/s10055-023-00859-z

Sanghi, S. (2007). *The Handbook of Competency Mapping: Understanding, Designing and Implementing Competency Models in Organizations* (2nd ed.). SAGE Publications Pvt. Ltd. https://www.amazon.com/Handbook-Competency-Mapping-Understanding-Organizations/dp/0761935983

van Klink, M. R. d., & Boon, J. (2003). Competencies: The triumph of a fuzzy concept. *International Journal of Human Resources Development and Management*, *3*(2), 125-137. https://doi.org/https://doi.org/10.1504/IJHRDM.2003.002415

Vazirani, N. (2010). Review paper: competencies and competency model–a brief overview of its development and application. *SIES Journal of management*, *7*(1), 121-131. http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.469.7219&rep=rep1&type=pdf#page=123

WEF. (2016). *Shaping the Future of Construction: A Breakthrough in Mindset and Technology* (220416). W. E. Forum. https://www.weforum.org/reports/shaping-the-future-of-construction-a-breakthrough-in-mindset-and-technology

Zint, M. (2021). *Power Analysis, Statistical Significance, & Effect Size*. My Environmental Education Evaluation Resource Assistant (Meera). https://meera.snre.umich.edu/power-analysis-statistical-significance-effect-size