

Informing Future Learning Pedagogy towards Integrated Project Delivery (IPD) in the UK

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As a concept, method of work, and a process, integrated project delivery (IPD) within the construction industry has had, and continues to occupy, a vital role in the successful delivery of projects. Over the years, embedding integrated project delivery within construction teaching has ultimately focused on tools and techniques that support stakeholders' collaboration, data/information management and overcoming various complexities at different project stages. However, there has been limited research has focused on the impact and role of stakeholders' skills on integrated delivery. This paper aims to inform future pedagogical approaches towards integrated project delivery in the UK. Evidence was obtained using a questionnaire survey on existing final year students at a UK-based university and a case study of a project where integrated project insurance (IPI) as one of the modern procurement routes in the UK was applied. Findings show that the procurement route applied has supported eliminating the blame culture among different stakeholders, mitigated many unexpected risks, and prevented overrunning costs. Findings imply the need to pedagogically embed skills such as behaviour, management, adapting to change within the future construction teaching curriculum.

Keywords: Integrated Project Delivery (IPD), Integrated Project Insurance (IPI), Students, Skills, Pedagogy.

Introduction

Integrated project delivery (IPD) is seen as a robust process, which improves productivity and reduces waste streams through integrating people, systems, and practices collaboratively for construction projects (AIA California Councils, 2007). According to Kent and Gerber (2010), one of the main cores of IPD is having an integrated project team (Park et al., 2011) in terms of people collaboration, systems, business structures, and more importantly, practices that support process improvement. Compared with many existing models of procurement, IPD offers potential improvements as it promotes a collaboratively more intense collaborative approach from an early design stage.

In fact, according to AIA and AGC (2011), IPD embeds both contractual and behavioural principles. Contractual principles include elements such as shared risk, liability waivers, fiscal transparency and collaborative decision-making between key participants in a project whereas behavioural principles focus on participants' attributes such as mutual respect, trust, willingness to collaborate and open communication. IPD-based case studies showed that projects were done on time, within or under the assigned budget, and established positive relations among the project team (Franz & Leicht, 2012). A quantitative study by Hanna (2016) proposed a performance metrics to gauge whether a project qualifies for a superior IPD/near-IPD or non IPD. The metrics included communication, change management, business, cost, quality, safety, schedule, and labour performance area. While the study emphasised evaluating the success of an IPD project based on the metrics proposed, it was argued that key stakeholders' attributes including communication, change management and business performance play a significant role towards performance of an IPD-based project. Other research has looked into the importance and value of such attributes for IPD-based projects. For instance, a recent study conducted by Ariffin et al. (2018) identified that incapability of delivering the required input by a stakeholder to a project can result in problem arising during the commencement of the project. Furthermore, it stated that the stakeholders' skill sets and expertise in the field will have an impact on the deliverability of quality. The same study also discussed the significance of stakeholders in ensuring timely communicating, updating and

transferring information. A study by Brochner & Badenfelt (2011) highlighted that flexibility of all project parties appear to be critical in order to form an effectively integrated project team. In addition to the previous attributes, research has also examined the principles that form an integrated project team. Some of the principles identified include trust, motivation, and morally social interactions (Thomsen et al., 2010). With relation to important principles for integrated project team, Zhang et al. (2013) have considered the role of knowledge sharing, and how it contributes towards the success of an IPD-based project. Kent & Becerik-Gerber (2010) have attempted to outline the pillars that underline IPD projects, which are multiparty agreement, early involvement of all parties, shared risk and rewards. Despite this research in IPD, it may be argued that there does not exist a unified definition of IPD that construction industry can adopt.

As a process, the use of Building Information Modelling (BIM) is seen as an avenue where different stakeholders can collaborate from an early phase to all building lifecycle phases (Oraee et al., 2017). According to Tahrani et al. (2015), BIM is seen as a robust mechanism that supports information integration into design schematics. The processes can be standardised and contribute towards quality assurance through accommodating different data/information into virtually much accessible models. Research identifies that BIM embeds IPD features including collaboration and team working amongst the main parties. For example, Chang et al. (2017) conducted a study that looked into the application of BIM process in terms of facilitating IPD in terms of incentivisation, communication and collaboration within the Chinese construction industry. The study found that working in BIM-enabled environment can make practitioners appreciate the importance of incentivisation, and that BIM can have a positive impact on communication and collaboration quality.

Similarly, within the construction teaching curriculum, the concepts and practices of IPD are embedded within BIM education. For instance, Becerik-Gerber et al. (2011) have mapped the BIM-related areas that are taught to construction engineering and management (CEM) programmes in the United States. Another study by Molavi & Shapoorian (2012) developed a framework for enhancing BIM education to bridge the gap between industry needs and university education. In fact, a study by Pikas et al. (2013) that categorised BIM-related content based on processes and general knowledge, related technology and applications/functionalities concluded that the need to embed more soft skills such as collaboration and integration into the BIM teaching curricula. The study concluded with suggesting a procedure to integrate BIM through six steps: analysis of existing courses and curricula, selection of courses for BIM integration, involvement of educators, development of BIM content for selected courses, defining the expected levels of achievement, implementation and monitoring, and finally continuous improvements. However, such an approach, along with many others, often facilitates the learning curve of integrated project delivery through BIM lenses, and does not elaborate on the main principles that underline IPD. An article by MacDonald & Mills (2013) touched on the importance of distinguishing whether education institutions are training or educating construction students on IPD through BIM in Australian universities. The study highlighted pressures imposed by both the clients and various governments (BEIIC, 2010) towards embedding the culture of collaborative working through the use of BIM. Furthermore, the study involved interviewing senior construction academics from a range of European countries, and proposed an IMAC (illustration, manipulation, application and collaboration) framework to support incorporating collaborative design principles in the construction teaching curriculum. However, the proposed framework has suggested improving the culture of collaboration through BIM which, although it reflects the main essence of IPD, does not elaborate on other principles highlighted in the literature (e.g. Hanna, 2016; Brochner and Badenfelt, 2011; Thomsen, 2010) that impact the success of IPD-based projects. More importantly, the studies did not reflect the students' understanding and knowledge of stakeholder-related attributes required in an IPD-based projects.

In 2012, the UK Government introduced new models of construction procurement to improve efficiencies through reforming procurement practices, effecting behavioural and cultural change (Cabinet Office, 2014). The new procurement models are integrated project insurance (IPI), cost led procurement (CLP) and two stage open book (2SOB). Amongst these new procurement models, IPI was trialled on a number of small projects, as it was collaboratively developed by Integrated Project Initiatives Ltd in conjunction with brokers Griffiths & Armour; promoted by the Specialist Engineering Alliance with the support of 30 practices as well as companies across the industry (IPI, 2014). IPI is seen as a way that supports aligning interests of different team members, assuring that solutions are both achievable and affordable, and ensuring the outcomes for a project. This paper will look into the value and impact of IPI's procurement practices, and also evaluating current students' understanding of the IPD principles on improving learning pedagogies to inform future learning pedagogy towards IPD.

Method

This study used a mixed method approach using a questionnaire survey and one semi structured interview. The questionnaire survey was conducted on 50 final year students taking construction management and quantity surveying undergraduate programmes at a UK university because these two disciplines are interrelated, and their collaboration begin during the tendering process: thus, it is important to perceive their understanding of stakeholder-related skills, which are necessary for IPD. The groups included a mix of full-time (little to no relevant experience) and part-time (relevant experience) students. It is important to indicate that the participating students have BIM as an integrated part of their teaching curriculum. The questionnaire was developed based on the hard and soft skills identified in Rainsbury et al. (2002). Hard skills require the acquisition of knowledge to perform, thus influenced by an individual's Intelligence Quotient (IQ) whereas soft skills refer to interpersonal, human, people, or behavioural skills, and is influenced by the individual's Emotional Intelligence (EQ). The identified skills by Rainsbury et al. (2002) touch upon many (if not most) of the stakeholders-related attributes that are required in an integrated environment. For each of the skills (quotients), a scale of 1 – 7 (1 being least important and 7 being the most important) was put in place and students were asked to rate the importance of each of the skills. The semi-structured interview was conducted face-to-face with a senior quantity surveyor who worked on a recent project that was procured through the Integrated Project Insurance (IPI) model. The project aimed to deliver a new college building in the UK using integrated project delivery with the support of BIM level 2. Interview questions targeted various aspects that align with the usefulness of IPI as a new procurement model, the value of IPI towards integrated project delivery and how such project should influence future construction curricula. Findings are presented in tabular form.

Results

This section documents the results gathered using the questionnaire survey followed by the responses received from the interview. The responses gathered of the 50 questionnaire surveys sent out were 43 responses, which encompassed 32 students with relevant experience and 11 with no relevant experience. Results from the questionnaire surveys are presented using radar graphs where they allow a more pragmatic representation towards identifying similarities and differences between the two groups of students. Each graph is presented with the related skills based on Rainsbury et al.'s (2002) classification of skills. For each of the graphs, the percentages represent number of students who viewed the presented skills as very important from both groups. For the analysis, two radar graphs were produced: one that compares the emotional quotients (see figure 1) whereas the other compares intelligence quotients (see figure 2) between the two groups.

Part One – Questionnaire Results

The responses relating to emotional quotient are shown in figure 1. It is realised that, on the one hand, that both groups had shared perspective on the importance of teamwork & cooperation (91% for both groups), and very similar perspectives on many other skills (e.g. flexibility, relationship building and team leadership). For instance, 73% of students with no relevant experience and 66% of students with relevant experience emphasised that flexibility is considered as one of the very important skills, and similarly, 81% and 91% of both groups respectively chose team leadership as another important skill. Likewise around half of the students (45 – 66%) from both groups had similar preferences on skills such as developing others, organisational commitment and interpersonal understanding. However, less than half of the students (36 – 44%) from both groups chose impact and influence on others as an essential skill. On the other hand, their perspectives were divergent on other skills including self-control and customer service orientation. In terms of self-control, for example, 81% of students with relevant experience emphasised its importance when compared with only 36% of students of the group who felt that this skill is essential. In contrast, only 38% of students with relevant experience saw customer service orientation as an important skill when compared with majority (73%) of the other group who thought that this skill is crucial.

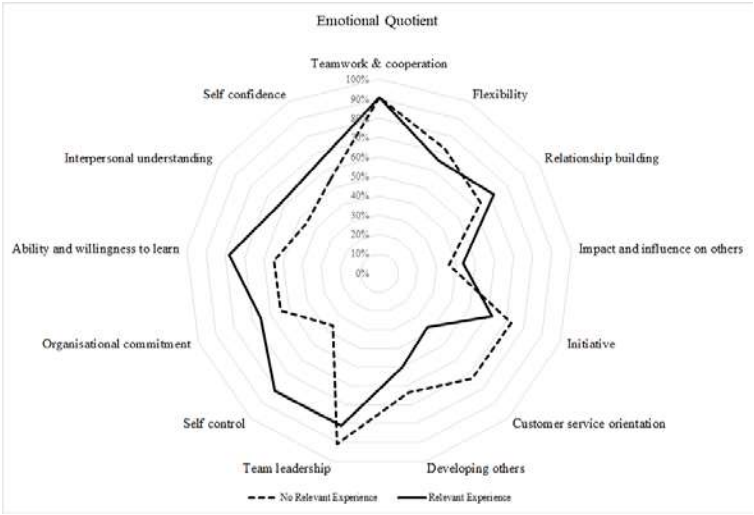

Figure 1: Emotional Quotient level of importance based on students with no relevant experience and relevant experience.

Responses (see figure 2) towards intelligence quotients show that both groups had almost identified views on some skills. For instance, in terms of personal planning and organisational skills as well as analytical thinking, students with relevant experience and no relevant experience had 81 – 82% and 72 – 73% respectively. Similar results (72 – 82% & 81 – 91%) were obtained for information seeking and concern for order, quality and accuracy where majority of both groups had similar perspective on their importance. In addition, although written communication was viewed as an important skill by both groups, many students with relevant experience did not view it as an important skill when compared with the majority of students with no relevant experience. However, on the one hand, almost half the students in both groups had a moderated view on some other skills such as achievement orientation and conceptual thinking, which ranged between 55 – 63%. On the other hand, both groups had more contradictory views in comparison to views on emotional quotients (see figure 1) on many other skills. Technical expertise, for example, was perceived as a very important skill by all students with no relevant experience, which was not the case for half of those with relevant experience. In contrast, although less than half of students with relevant experience saw computer literacy as an important skill, none of the students with relevant experience viewed it as an important skills. Similarly, directiveness was seen as an essential skill by the majority (60%) of the students with relevant experience whereas only 27% of those with no relevant experience viewed it as an important skill.

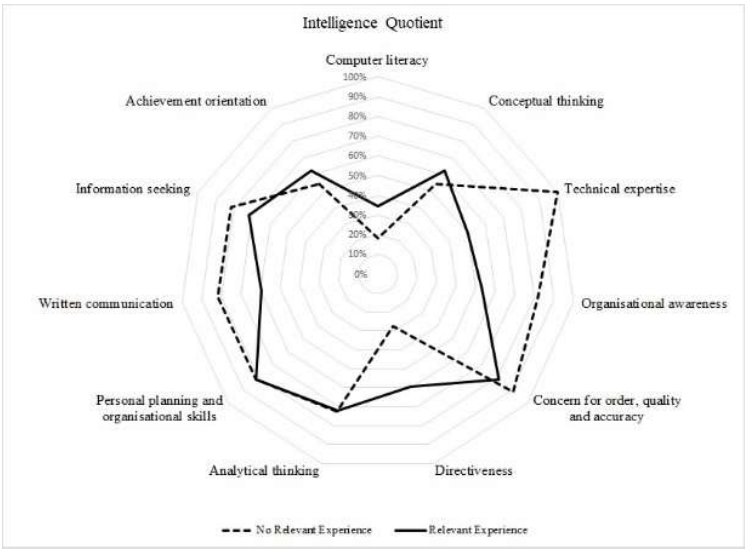

Figure 2: Intelligence Quotient's level of importance based on students with no relevant experience and relevant experience.

Part Two – Interview Results

The following table (table 1) represents the responses received from the interview conducted with the senior quantity surveyor. In terms of usefulness of IPI, it contributed towards overcoming many of the transparency-related issues as well as avoiding the blame culture, which often are present in an IPD-based projects. This was clarified within the following questions where the interviewee indicated the key role of behavioural and communication workshops that were used as approaches to recognise potential complexities amongst stakeholders. In terms of the role of BIM within the project, it was indicated that IPI has allowed a better application of BIM. However, the interviewee has also argued that the significance of IPD principles is limited, as it is still seen that IPD is only enabled through the BIM process. For the construction curricula, importance of stakeholders' related intangible problems was highlighted and that future approaches towards IPD should go beyond the technicality of the process to encompass people's side.

Table 1

Summarised responses received from the interview

Interview Question	**Response**	**Themes Identified**
In your opinion, how useful and practical is IPI as a procurement route?	"For the project that we executed, IPI allowed us to overcome many of the potential conflicts, issues and risks that often arise from different stakeholders at different points in the project. This is because IPI begins with a success criteria, which allows better transparency between project stakeholders and eliminate blaming culture, limit risks on different members of the team and prevent potential overrunning costs".	Transparency and blaming culture as one of the intangibles influencing IPD.
How did IPI support integrated project delivery at the recently executed project?	"With the project that we did, a series of behavioural and communication workshops were conducted to actually get to know both culture and skills of the stakeholders involved. Although it was perceived as lengthy process, it benefited realising both opportunities and risks involved in that project."	Approaches used to recognise potential complexities between different stakeholders.
In your opinion, did BIM influence the success of integrated project delivery?	"I know that BIM is about collaborative working, but actually IPI has enabled a better application of BIM for this project. I also think that integrated project delivery is still shadowed by BIM, which limits its holistic understanding and significance of its principles".	Current limitations of IPD principles within the BIM process.
In your opinion, how can IPI, for example, influence construction curriculums?	"IPI provided a great opportunity into exploring many of the intangible problems, which often are caused by stakeholders in a project. Having taught integrated project delivery myself at a university, the focus often shifts towards the technicality of the process than the people's side. In my opinion, IPI as well as the newly introduced procurement models in the UK can be a solid platform into forming better foundation to understand and appreciate the principles of integrated project delivery better".	IPI role in identifying stakeholders' related intangible problems. Limitation of current approaches towards teaching IPD at universities in the UK.

Discussion

From the analysis of the questionnaire survey, and responses from the interview results, it can be claimed that careful consideration of integrated project delivery is needed, but more importantly, ensuring that its elements are embedded pedagogically within the future construction teaching curricula. The following sections discuss the intangible elements of integrated project delivery and how integrated project delivery could be more holistically embedded in the future of construction curricula.

Intangibles' impact on Integrated Project Delivery

It may be argued that considerable research has examined integrated project delivery, and attempted to exemplify its value and support for the construction industry. Many of these efforts elaborated the principles (e.g. Franz & Leicht, 2012; Zhang et al., 2013; Ariffin et al., 2018) while others have categorised/classified the implementation of IPD (e.g. Hanna, 2016; Yee, 2017), but the focus on 'people' side has been limited. Within the majority of existing research, the people's side within integrated project delivery is referred to as the 'behavioural' side. For example, resistance to change, flexibility, lack of confidence and organisational culture (Azhar et al., 2014). When reviewing the analysis, and referring to responses on the emotional quotients (see figure 1), the majority of both student groups did not choose impact and influence on others as an essential skill. Flexibility and self-confidence were also not viewed as very important by many of the students from both groups. This can perhaps explain many of the difficulties faced by recent graduates in an integrated project delivery environment. From another angle, and taking into account responses on intelligence quotients (see figure 2), the majority of students did not view computer literacy as an important skill, which can demonstrate another side of the difficulty faced within an integrated delivery environment such as BIM-enabled projects. Although most of students with no relevant experience chose organisational awareness as an important skill, almost half of the students who already have relevant experience did not view it as an important skill. Thus, from the analysis, it can be argued that many of the challenges faced when implementing IPD are due to the lack of many soft skills which, although they may seem intangible, are nevertheless essential in order to operate in an integrated delivery environment. From the interview responses (see table 1), it was stated that "IPI begins with a success criteria, which allows better transparency between project stakeholders and eliminate blaming culture, limit risks on different members of the team". This can demonstrate the role of a transparent procurement route towards overcoming some of the potential intangibles outlined previously. Yee et al. (2017) illustrated that philosophically IPD is viewed from a contractual, structural, behavioural and technological perspective by industry. The contractual side was claimed to be the approach that bonds project teams, but the focus on this was limited to its impact (e.g. contingencies, risk allocation, etc.) rather than focusing on nature of the contract itself. In other words, previous works did not look into what should be part of the contract process in order to eliminate potential issues that affect later stages in the project. As a response to this, the interviewee stated that "a series of behavioural and communication workshops were conducted to actually get to know both culture and skills of the stakeholders involved". This shows the importance of focusing on stakeholder-related complexities during at an early procurement phase in order to overcome many of the potential intangibles that influence the success of an IPD-based project.

Improved Learning Pedagogies = Better Awareness of IPD

Drawing on the analysis presented in figures 1 & 2, it is evident that students with no relevant experience and those with relevant experience have contrasting views on importance of skills. This can be spotted when looking at some of the emotional quotients such as self-control and customer service orientation, and also some of the intelligence quotients including technical expertise, directiveness and written communication. Perhaps these differences can be explained by the nature of the teaching curriculum, but also by the work environment in the case of students with relevant experience. However, it can be argued that the pedagogical approach has a major key role in terms of directing students' thinking, problem-solving and idea processing. Although the current programme studied by the participants embeds integrated delivery as part of the curriculum based on the analysis (see figures 1 & 2), few have identified the importance of many skills when they were questioned. Thus, and based on Ryan and Tilbury's (2013) idea of flexible pedagogies, which discussed six ideas (learner empowerment, future-facing education, decolonising education, transformative capabilities, crossing boundaries and social learning), a pedagogy based on transformative capabilities is proposed, as it supports the learner in deploying their abilities in both familiar and unfamiliar circumstances. Figure 3 presents such an improved learning pedagogy that aligns with the concept of transformative capabilities. The proposed learning pedagogy encompasses three main elements: stakeholders, technology and process. The stakeholder side elaborates on the collaboration and professional practice aspects, which perhaps reflects the interviewee's statement the "IPI provided a great opportunity into exploring many of the intangible problems, which often are caused by stakeholders in a project". The process side is concerned with communication and associated complexities, and the

need for this was highlighted by the interviewee who stated that "the focus often shifts towards the technicality of the process than the people's side". The technology side focuses on automated solutions, which partly encompasses, for example, BIM-based applications as well as adoption and implementation. On this, the interviewee highlighted "I also think that integrated delivery is still shadowed by BIM, which limits its holistic understanding", which reflects that BIM is still seen as the technology driving IPD than being a process enabler for IPD-based projects. Through deployment of the proposed learning pedagogy (figure 3), it is anticipated that a better understanding of different processes (technology-based and people-based) can encompass and support many of the skills that underpin effective delivery of IPD. It can be concluded that the application of IPI has supported revealing many of the complexities found within this research; and further research could usefully explore the application and evaluation of the proposed pedagogy across different construction curricula and more thoroughly explore the industry's perspective.

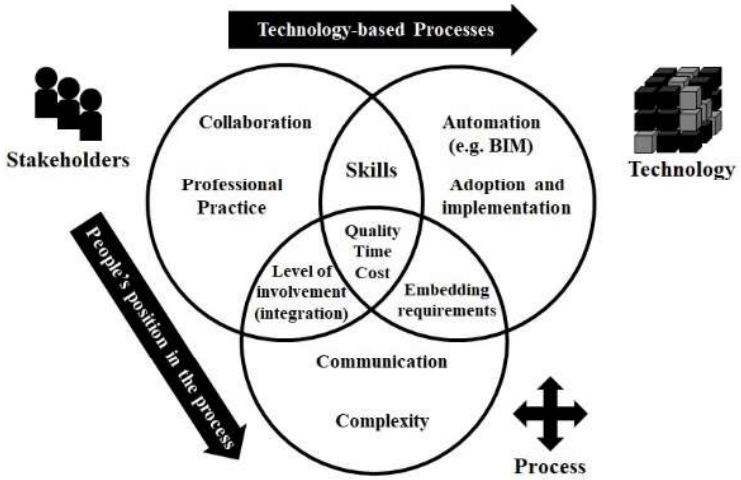

Figure 3: Proposed Learning Pedagogy to Improve IPD-related Considerations in the Construction Curriculum

References

AIA (American Institute of Architects) & AGC (American General Contractors) (2011). *Primer on Project Delivery*. Washington: AIA.

AIA California Councils (2007). *Integrated Project Delivery: A Guide*. California: AIA.

Ariffin, H. L. T., Raslim, F. M., Mustafa, N. E., Rahiman, N. A. & Chun, K. C. (2018). The factors concerning procurement selection for building information modeling (bim) based project. *International Journal of Civil Engineering and Technology*. *9* (8), 1706-1714.

Azhar, N., Kang, Y. and Ahmad, I. U. (2014). Factors influencing integrated project delivery in publicly owned construction projects: An information modelling perspective. *Procedia Engineering*. *77*, 213-221.

Becerik-Gerber, B., Gerber, D. J. & Ku, K. (2011). The pace of technological innovation in architecture, engineering, and construction education: Integrating recent trends into the curricula. *Journal of Information Technology Construction*. *16* (3), 411-432.

Built Environment Innovation and Industry Council (2010). *Productivity in the buildings network: Assessing the impacts of building information models.* Report to the BEIIC. Retrieved from: https://www.industry.gov.au/Indsutry/BuildingandConstruction/BEIIC/Documents/BIMProductivity_FinalReport.pdf. (Accessed on: 03.01.2019).

Brochner, J. & Badenfelt, U. (2011). Changes and change management in construction and IT projects. *Automation in Construction*. *20* (7), 767-775.

Cabinet Office (2014). *New Models of Construction Procurement: Introduction to the Guidance for Cost Led Procurement, Integrated Project Insurance and Two Stage Open Book*. London: Cabinet Office.

Chang, C-Y., Pan, W. & Howard, R. (2017). Impact of Building Information Modeling Implementation on the Acceptance of Integrated Delivery Systems: Structural Equation Modeling Analysis. *Journal of Construction Engineering and Management*, *143* (8), 1-10.

Franz, B. and Leicht, R. M. (2012). Initiating IPD concepts on campus facilities with a collaboration addendum. *Construction Research Congress*. West Lafayette, IN, 61-70.

Hanna, A. S. (2016). Benchmark Performance Metrics for Integrated Project Delivery. *Journal of Construction Engineering and Management*. *142* (9), 1-9.

Integrated Project Initiatives (2014). *The Integrated Project Insurance (IPI) Model: Project Procurement and Delivery Guidance*. London: Construction Excellence.

Kent, D. C. & Becerik-Gerber, B. (2010). Understanding Construction Industry Experience and Attitudes toward Integrated Project. *Journal of Construction Engineering and Management*. *136* (8), 815-825.

MacDonald, J. & Mills, J. (2013). An IPD Approach to Construction Education. *Australian Journal of Construction Economics and Building*. *13* (2), 93-103.

Molavi, J. & Shapporian, B. (2012). Implementing an interactive program of BIM applications for graduating students. *Proceedings of the International Conference on Sustainable Design, Engineering, and Construction 2012*. ASCE, Reston, VA, 1009-1016.

Oraee, M., Hosseini, M. R., Papadonikolaki, E., Palliyaguru, R. & Arashpour, M. (2017). Collaboration in BIM-based construction networks: A bibliometric-qualitative literature review. *International Journal of Project Management*. *35* (7), 1288-1301.

Park, H., Han, S. H., Rojas, E. M., Son, J. W. & Jung, W. (2011). Social network analysis of collaborative ventures for overseas construction projects. *Journal of Construction Engineering and Management. 137* (5), 344-355.

Pikas, E., Sacks, R. & Hazzan, O. (2013). Building Information Modeling Education for Construction Engineering and Management. II: Procedures and Implementation Case Study. *Journal of Construction Engineering and Management*. *139* (11), 1-10.

Rainsbury, E., Hodges, D. & Burchell, N. (2002). Ranking Workplace Competencies: Student and Graduate Perceptions. *Asia-Pacific Journal of Cooperative Education*. *3* (2), 8-18.

Ryan, A. & Tilbury, D. (2013). *Flexible Pedagogies: new pedagogical ideas*. York: Higher Education Academy.

Tahrani, S., Poirier, E. A., Aksenova, G. & Forgues, D. (2015). Structuring and the adoption and implementation of BIM and integrated approaches to project delivery across the Canadian AECO industry: Key drivers from abroad. *Proceedings of the International Construction Speciality Conference of the Canadian Society for Civil Engineering*, Vancouver.

Thomsen, C., Darrington, J., Dunne, D. & Lichtig, W. (2010). *Managing integrated project delivery*. White Paper. Mclean: Construction Management Association of America, Mclean.

Yee, L. S., Saar, C. C., Yusof, A. M., Chuing, L. S. & Chong, H-Y. (2017). An Empirical Review of Integrated Project Delivery (IPD) System. *International Journal of Innovation, Management and Technology*. *8* (1), 1-8.

Zhang, L., He, J. & Zhou, S. (2013). Sharing Tacit Knowledge for Integrated Project Team Flexibility: Case Study of Integrated Project Delivery. *Journal of Construction Engineering and Management*. *139* (7), 795-804.