

## AMELIORATING EMPLOYABILITY IN CONSTRUCTION THROUGH BIM INNOVATION

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**Abstract.** *Low-skilled labor makes a significant part of the construction sector, performing daily production tasks that do not require specific technical knowledge or confirmed skills. Today, construction market demands increasing skill levels. Many jobs that were once considered to be undertaken by low or un-skilled labor, now demand some kind of formal skills. The jobs that require low skilled labor are continually decreasing due to technological advancement and globalization. Jobs that previously required little or no training now require skilful people to perform the tasks appropriately.*

*The study aims at ameliorating employability of less skilled manpower by finding ways to instruct them for performing constructions tasks. A review of exiting task instruction methodologies in construction and the underlying gaps within them warrants an appropriate way to train and instruct low skilled workers for the tasks in construction. The idea is to ensure the required quality of construction with technological and didactic aids seeming particularly purposeful to prepare potential workers for the tasks in construction without exposing them to existing communication barriers. A BIM based technology is considered promising along with the integration of visual directives/animations to elaborate the construction tasks scheduled to be carried on site.*

## 1 INTRODUCTION

The global construction industry is currently observing a growing mismatch between skills that employers want and what the global labor markets can supply, resulting in growing unemployment, shortage of skills and polarization of wages among its labor. The high unemployment rate usually occurs in an industry due to its high dependency on low skilled workers [1] where construction section is no exception. An illustration of it can be perceived through the two populous construction industries of China and India, where low and un-skilled labor in construction sector sums to at least three-fourth of their total construction workforce [2, 3]. The shortage of skilled workers have been a known concern in the construction sector with studies predicting their need in high numbers to meet the expected turnover and growth expectations for future [4, 5]. The polarity is the wages has also been observed, where the less skilled labor in the construction sector earns very less than that of a skilled. This in turn can result into less motivation for these less skilled labors to end their occupation in not so brightly imaged construction sector.

One of the underline causes for these growing mismatches include the much globalization and technological change. On one hand it has resulted into immense benefits to economies and construction workers, where increased construction technology with more automation and new sources of low cost labor has driven a path to productive growth. However, on the other hand it has also change the employment pattern significantly where for now the sector's demand for labors has moved away from less skilled to high skilled jobs [6]. Other causes could be the lack of training provision in the construction sector [7], aging construction workforce [8], increasing pressures of indulging local people as labor force [9] and less educated labor [10]. To overcome these, the study looks to find ways of educating and training the existing less skilled construction manpower through virtual instructions in order to contribute towards their employability.

## 2 EMPLOYABILITY OF LESS SKILLED

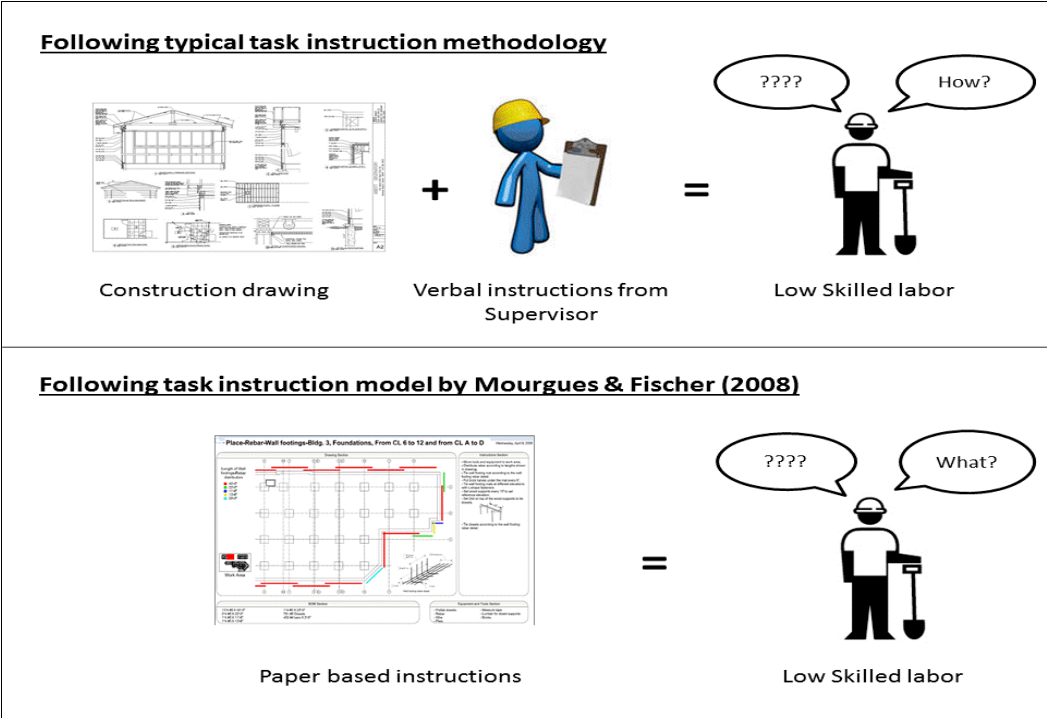
The construction industry plays an important role in regard to creating employment opportunities. The long-standing figure of more than 111 million for the total construction workforce revealed in 2001[11] backs the fact of construction as a big employer, although the old figure must have been augmented highly in recent times. Taking the social role, the construction industry also bears the potential of employing world's poorest and most vulnerable people [9]. The sector creates prospects for low-skilled or entry-level workers and to those migrating from the countryside in addition to absorbing those with few academic qualifications [11]. These less skilled labors, that have sufficient knowledge of the particular trade to do respective work and simple job with the help of simple equipment and tools, look for employability in construction to satisfy basic needs of their families with low demands of professional qualifications [12].

A study pertaining to low skilled workers defined 'employability' in the year 2004 as *the capacity and the willingness to be and to remain attractive in the labor market by anticipating changes in tasks and work environment and reacting to these changes in a proactive way* [13]. The same can be transformed for the construction sector by treating construction as the work environment. To achieve the goal of the employability for these low skilled labors in the construction sector, the imminent challenge in hand is to deal with their existing and probable communication barriers on the construction site.

### 3 INEFFECTIVE COMMUNICATION

Effective communication between all parties involved in a project is a must for successful project completions and high profitability [14]. Likewise, effective communication has always been a key success factor for a construction project. In construction, the complex communication patterns make the interaction between stakeholders very difficult to achieve appropriately [15]. Problems like conflicts and low productivity are caused due to a broken communication among construction workers [16]. Lack of understanding and misunderstanding of instructions are common examples which arise in construction owing to language differences [17]. Among others, poor communication of task instructions is one of the major delay factors to a project. According to [18], typical methodology to produce highly inefficient and difficult to understand tasks instructions result into delays, poor quality and compromised safety.

Construction contractors rely upon using verbal instructions for instructing tasks to labors on sites due to their limited capacity and resources [19]. This reliance on human-variable verbal instructions along with the poor quality of construction drawings leads to situations like inadequate productivity, workface questions, rework and unsafe conditions on the site [20, 21, 22]. To overcome the shortcomings lying under the typical instruction methodology, [19] came up with the idea of paper based field instruction template. The aim was to make the human variable process uniform with written instructions alongside relevant construction drawings on a piece of paper.



**Fig. 1: Existing Task Instruction Practices Among Low Skilled Construction Labor**

However, communication with the low skilled construction labor will still remain ineffective after following either the typical verbal instructions or the recently developed field instructions template methodology as shown in Fig. 1. The reason could be lack of knowledge among these low skilled workers about particular tasks and the instances of multiple languages barriers in this globalized construction world. Video based instruction with no language use might perhaps be a useful tool for educating and training these less skilled workers. A study conducted for

designing of computer based safety training for language barrier affected Hispanic construction workers shows that among the use of video, audio and images, videos enhanced the memorability of a training module.

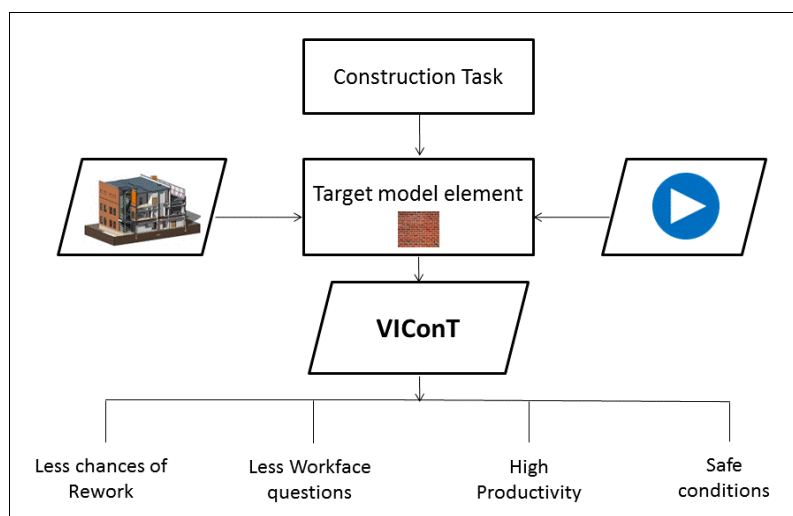
#### 4 BIM POTENTIAL

Building Information Modeling (BIM) has been a widely research area in recent times. With its intelligent and object-oriented parametric models having capabilities of parametric digital representation, decision making process has been greatly improved. Sharing of knowledge and communication between project participants in the Architecture, Engineering and Construction industry has been the important traits of BIM [23]. Besides various benefits of BIM utilized by the industry, its use as a teaching and learning platform has also grown in the universities and colleges. One study with BIM based knowledge repository has also revealed prospects for teaching residential construction courses to Construction Engineering and Management (CEM) students [24]. One more study has also proposed a BIM based teaching approach to prove the effectiveness of BIM as an integrated learning tool in construction [25]. A study focused on measuring benefits of BIM as a learning tool envisaged that BIM provides less expensive virtual environment for learning by doing for project management and physically repetitive construction tasks [26].

However, less has been investigated for using the potential of BIM as a learning tool for construction labors specifically those under the less skilled category. Through the exploration of the knowledge integration subject within BIM, less skilled construction labors could also be educated for performing construction tasks easily as compared to much random and disorganized present practice.

#### 5 CONCEPT FOR VIRTUAL CONSTRUCTIONS

To elaborate the video based construction tasks to the low skilled workers, this paper proposes a framework for a digital instructing environment. The idea is to first prepare the 3D animations of construction tasks for elaborating the steps required to execute a particular task. These video based task instructions in a 3D animated environment with ‘how-to-do’ theme will elaborate the sequential steps to those workers for easily following on the ground.



**Fig. 2: Approach Intended for Virtual Instructions for Construction Tasks**

These easily understandable videos will then be connected digitally in a BIM model. The idea is to relate the videos to that model object in a BIM model with which the relevancy is high and admissible. Fig. 2 represent the approach wherein for an individual construction task, video based instructions are connected to relevant BIM model object to develop a digital product 'VIConT' (Virtual Instructions for Construction Tasks). This approach will perhaps lead to less chances of rework, less workforce questions, increased productivity and safer conditions for labors to work with.

## 6 CONCLUSION

The study reinforces the idea of using 3D animation videos for elaborating construction tasks to low skilled construction labor. Labors with high illiteracy level as well as communication barriers like language and reading will get benefits due to high probability of easy understandings from 3D animated task tutorials. These videos linked with relevant objects of a BIM model will ease the path of having a digital instructing environment on project site. The approach of 'VIConT' can be used by construction contractors where their representatives like supervisors, with little knowledge of operating BIM tools, can elaborate the tasks to their workers. This inexpensive process will not only lead to lesser field mistakes and inefficiencies but will also increase the prospects of higher employability of low skilled manpower in the construction sector. Through this practice, the social commitment of the construction industry will surely be enhanced. The idea will be taken forward to the next step by the development of 3D animations pertaining to construction tasks usually performed by low skilled labors.

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