WHIOCE PUBLISHING PTE. LTD.
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2026 Volume 4, Issue 3
Contemporary Education Frontiers
ISSN:3029-1879 (Online)
ISSN: 3029-1860 (Print)

Research on the Training Mechanism for Skilled Talents in Smart Buildings under the Integration of Industry and Education

Xinyang He*
Hainan Vocational University of Science and Technology, Haikou 571126, Hainan, China

****Author to whom correspondence should be addressed.***

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Abstract: In the midst of a tide of digital and intellectual change in the building sector, the Intelligent Architecture Department is constantly growing, generating a growing need for a versatile, practical expert. The integration of industry and education is a key way of bringing VET into line with industry and optimising the training patterns of talented people. Based on the status quo of intelligent construction and the theory of industrial and educational conformity, this article analyses the present challenges, which are not appropriate for developing talented people, obsolete courses, shallow cooperation between school and business, and lack of practice. Based on demand and problem orientation, the organization has developed an integrated human resource development scheme that includes the training plan, the course plan, the practice resource, the staff group, and the administration system. The purpose of this framework is to improve the actual work ability and the related profession, and to offer sustained technical support for the development of intelligent construction.

Keywords: Industry-education integration; Smart buildings; Skilled talents; Talent development

Online publication: March 26, 2026

1. Introduction

Construction is speeding up the transition to intelligent, digital, and sustainable. Extensive use of the latest technologies - BIM, Intelligent Architecture Management Systems, Internet of Things, Smart Building Places, and Intelligent Running and Servicing Solutions - has radically changed the conventional manufacturing patterns and labor patterns. The characteristic of an intelligent building is that it has a cross-disciplinary and technological character, which requires the front-line personnel to have a high level of digital literacy, systematic operating techniques, and overall ability to practice. At present, the majority of higher education institutions retain a fairly conventional approach to intelligent building projects, with a slow pace of updating courses, too much focus on theory, shallow cooperation between the industry and the academic world, and a lack of practice facilities. As a result, the quality of graduates often does not match real business needs. Under these circumstances, it is necessary to deepen the integration of industry and education, build up a cooperative talented person development platform, and set up a strong training system.

2. The practical needs of smart buildings, cultivating skilled talents with industry-education integration

2.1. Smart building industry's development needs for intelligent positions

Along with the realization of the Intelligent Town and Intelligence Building Idea, the building profession is speeding up the whole intellectualization reform. The new functions of Intelligent Architecture Management, Intelligent Architecture Installation, Automatic Control of Architecture, BIM Techniques, and Intelligent Site Management are coming into being. The traditional front-line job is no longer focusing on manual work but is instead focusing on the integration of data manipulation, intelligence testing, and information management. In the process of transforming and updating, the construction companies are in urgent need of qualified personnel who are good at smart construction devices, digitized software and modern architectural techniques to catch up with the progress of the industry.

Smart transition in building is an ongoing and long-term process. The development of all kinds of smart software and hardware equipment, as well as the construction management system, has been continuously upgraded, along with the dynamic adjustment of the industry competence criteria. Reliance on autonomous education in schools is hard to keep up with the fast development of technology in the sector, which usually leads to obsolete skills and a lack of adaptability of professionals.

2.2. Skilled talents: Comprehensive professional competency development needs

Intelligent Architecture is a multi-disciplinary complex industry. In addition to basic occupational skills, the department requires more integrated expertise from front-line technicians. The development and running of modern smart architecture demands that the practitioners have a good team spirit, adhere to the standard process, have a sense of security management, and be able to study independently. As smart devices are rapidly being upgraded and technological iterative cycles are short, experts need to show that they have the ability to carry out independent research and ongoing training in order to quickly adjust to changing needs in the workplace.

Industrial and academic integration is an effective way to overcome the constraints of conventional educational methods by making use of real business settings, allowing learners to immerse themselves in the dynamics of the workplace, the management system, and the norms of the profession. Through the company's training and cooperative learning, the students have built up a strict code of conduct and a high level of accountability, as well as improved their ability to solve problems and respond to emergencies.

2.3. The Reform Needs of Vocational Education Collaborative Industry-Education Talent Development

The key task of VET is to train technicians and technicians for the front line of industry, and the combination of industry and business is the basic orientation of VET. The traditional architecture subject education mode is still a relative closed-off, restricted to the school room, with the limitations of practice and the real industry. The smart building discipline encompasses multiple fields, including architecture, the Internet of Things, automation, and information technology, featuring wide disciplinary coverage and high practical applicability. Reliance on institutions for teaching staff and facilities alone is a difficult task in providing a coherent and high-quality vocational education, thus hampering the quality of the programme [1].

The further development of the integrated industry and education can make use of the resources and the mutual superiority of the education organizations and the building companies. The company will be able to supply sophisticated smart devices, technology know-how, and site engineering resources to overcome the shortage of actual training facilities in schools. Taking advantage of their intrinsic educational advantages, the organization provides a pool of talented people and basic technological support for businesses, creating a model of mutual benefit.

3. Major existing issues in smart buildings training skilled talent

3.1. Inadequate matching of personnel development goals with the needs of the sector

At present, the training targets for intelligent building projects in certain vocational schools are still quite unclear. Their general design is still based on a conventional architecture educational framework, but it is not tailored to meet the intelligence of an intelligent building. Many organizations have emphasized basic architecture teaching, but have ignored BIM, Smart Architecture Control, and Smart Architecture Systems, which has led to a lack of emphasis on skills-based education. Due to the absence of periodic industrial studies and specialized communication in the preparation of personnel training programs, this results in a poor knowledge of the duties, qualifications, and trends in the field of Intelligent Construction, resulting in significant obsolescence in their training methods.

The divergence of education goals has caused the imbalance of the competence of the pupils, which has caused the common problems of the graduates, for example, the lack of literacy, the lack of familiarity with the use of intelligent equipment, and the lack of adaptability to work. Once a company has hired new staff, it will have to spend a great deal of time and money on the second level of skill training, which will lead to higher operating costs and lower productivity.

3.2. Learning systems fall behind iterative developments in intelligent construction

The Intelligent Architecture sector is undergoing rapid technical progress, with the constant updating of smart devices, IT systems, and new building technologies. But the majority of schools have long courses that are regularly renewed, which leads to the rigidity of the whole system. Obsolete curricula like conventional architectural techniques and architectural techniques continue to make up the bulk of the curriculum, but new core curricula, including Intelligent Architecture, Web Technology, Large Data Analytics, and Smart Security Systems, are poorly provided, and classroom time is not properly allocated.

The speed of updating the curriculum has been extremely slow, with the primary focus on fundamental theoretical issues and a lack of advanced industry research and the application of new technologies, resulting in significant differences between learning and actual business processes. Courses remain straightforward and rigid, with most of them being taught in the basics of the simulation rather than Smart System Integration, Intelligent Building Running, or Smart Building Maintenance.

3.3. The degree of integration between schools and firms in training and collaboration is still quite shallow

At present, the cooperative pattern among the majority of colleges and building companies is still shallow, with limited and repeated cooperative patterns. Most of these partnerships are centered around core activities like student placements and short-term company talks, but they are short of deep projects such as team development, cooperative courses, common training bases, and cooperation between teachers. Partnerships between universities and businesses mostly consist of short-term arrangements, with no long-term, solid programming or coordination. This type of cooperation is usually ad-hoc, so it is hard to set up a regular and systemic training system for talented people.

Because of operating expenses and administrative stress, companies are seldom involved in the key elements of the system's HR plan, including curriculum design, curriculum development, and on-the-job training, leading to the absence of primary accountability. Similarly, the organization does not make full use of the technology, facilities, and projects of the company, and the actual instruction is limited to virtual practice on the campus. There is a lack of clarity in the allocation of responsibilities among the two sides, the lack of effective communication mechanisms, the allocation of resources and the lack of cooperation in the sector and the training sector[2].

4. Talent development optimized path of smart buildings based on an industrial and educational combination

4.1. Jointly developing the higher education and business training programme

Education agencies shall actively improve their interaction and cooperation with intelligent construction companies and trade unions by carrying out periodic labour market surveys and field trips to determine the key skills required, competence criteria, and future directions for all types of intelligent buildings. Based on the needs of the profession, the organization will work together with the technology and the profession to modify and improve the personnel development plan, specifying the specific training goals, competence requirements, education priorities, and the way forward.

Making use of the industrial and educational cooperative system, we have incorporated our work standards, technical standards, and production requirements into our staff's training, so that we can overcome the traditional closed-learning mode. In order to follow the pace of technological iteration in this department, we have established a dynamic adjustment regime for the training program, which will enable periodic optimisation of the training content, progressive elimination of outdated knowledge blocks, and an emphasis on intellectual and digital skills.

4.2. Rebuilding the job-course integration smart building curriculum system

With emphasis on the competence required for the Intelligent Architecture Role, we have facilitated the incorporation of work needs into course design and certification schemes, as well as re-engineering a modular, comprehensive course. Conventional theory lessons that have become obsolete have been simplified. There have been fewer unnecessary theory lessons, but advanced core courses like BIM, Smart Architecture, Architecture of the Internet, Intelligent Architecture, and Architectural Energy Management have been introduced.

The JV will work together to produce school books, modules, and practice manuals that integrate real business design examples, state-of-the-art techniques, and operating criteria to overcome the deficiencies of the old uniform curriculum. Appropriate improvements have been made in the number of actual time spent in the field, incorporating the theory lessons in the classroom, the simulation in the field, and the field work in the field of enterprise into a coherent theory and practical learning model [3].

4.3. Integrated practical training teaching resources: jointly developing and sharing

The organization works in close cooperation with the leaders of the Intelligent Architecture Companies to set up an Intelligence Training Base at the School and outside the School, so that the Institute can share the Facilities, Techniques, and Resources in a two-way way. The on-campus facilities include the Intelligent Building Simulation Lab, BIM Training Centre, and Intelligent Building Field Simulator with Main Industrial Intelligent Equipment and Digitized Software for Everyday Instruction. Making use of the company's manufacturing workshops and the ongoing Intelligent Construction Program, an off-site training facility is set up that will give the students an authentic, hands-on learning environment that will improve their actual work skills.

Through the integration of the two sides' natural resources, companies will supply smart devices, technological assistance, and front-line technicians, whereas organizations will provide facilities, teachers, and educational administration. They will work together to develop their own skills, as well as to develop their own projects. In order to overcome the security and space constraints that are inherent in field training, a digital training platform that integrates both virtual and physical components has been set up to reproduce complex operations of intelligent buildings.

5. Long-term training and support mechanism for smart building professionals

5.1. Setting up a bi-directional cooperation and communication system among universities and businesses

The construction of double-qualified teachers is the key basis to guarantee the combination of industry and education.

Both sides of the organization shall set up a system of mutual communication between the two sides of the business, and the regular arrangement of the specialized teachers to carry out the on-job training and project-based practice. This allows them to get a deeper knowledge of the latest techniques, devices and techniques in intelligent construction, as well as to increase their hands-on learning skills and professional knowledge. In addition, it is recommended that the company's technology specialists, advanced engineers, and other experienced specialists be assigned as part of the team, taking part in the teaching of the curriculum, guiding the training, and practicing the techniques.

Improvement of Teacher Training & Assessment Management System through the integration of commercial and professional knowledge into the Teacher Appraisal Frame, thereby encouraging teachers to actively participate in industry practice and technological advancement. To establish an education and science communication platform where the university and the commercial college students can conduct periodic seminars, technical exchanges and research projects.

5.2. Improving the management and assessment systems for cooperation in education

With the help of industrial and educational integration, we are moving away from traditional single-exam to more diversified and comprehensive methods that include formative evaluation, practical testing, and corporate feedback. Overall evaluation includes lessons, daily exercises, skills, implementation of projects and exercises, and evaluation of the students' competence in doing tasks, problem-solving, and other tasks. Clarification of standards and establishment of quantitative standards for Intelligent Building Knowledge, Digital Techniques, Security Protocols and Team Leadership will enhance the completeness and scientific quality of assessments.

Undertakings shall be appointed as assessment bodies. While they are away from school and in the workplace, corporate coaches give a composite rating of their work, which is then integrated into their total marks. Through a clear definition of the roles of each institution and the business, standardization of the procedures for managing the practice, the management of the students, and the supervision of the instruction in order to guarantee an orderly cooperative learning [4], the optimization of the educational management system will be achieved. By means of a variety of cooperative evaluation systems, it is possible to move from over-emphasis on theory to the detriment of practical application, and to direct students to develop skills and enhance their overall competence.

5.3. Setting up a school-enterprise cooperation long-term incentive mechanism

In order to guarantee the long-term steady progress of the integration of industry and education, we should set up an integrated long-term operating mechanism and motivation system. It is necessary to make clear the respective rights and obligations of each other, the extent of cooperation, the allocation of benefits and responsibilities, and the need for a long-term cooperative agreement to prevent short-term or shallow partnerships. The industry regulators, education agencies, and companies will work together to set up a regular exchange and coordinating platform, organize regular cooperative conferences, and deal with all kinds of problems that may occur during the process of developing cooperative human resources, including administration, education, and on-the-job training, to make sure that these partnerships run smoothly.

Setting up a rational motivation system, offering policy benefits and resources for those who are active in cultivating talented people, setting up a training base, and providing technology teachers, to increase their initiative and passion in integrating industry and education. The organization needs to improve its internal motivation policies to promote the involvement of teachers in school and business partnerships, collaborative learning and research projects, and corporate services. Through the combination of system restraint and active motivation, our goal is to set up a steady and sustained cooperative educational framework, to further integrate industrial and educational sectors, to enhance the long-term training of qualified personnel in intelligent construction techniques, and to guarantee the continuous provision of qualified personnel to the sector.

6. Conclusion

The fast growth of intelligent buildings has spurred an overhaul of the structural architecture of the building sector, forcing the construction sector to speed up its reform. Industrial and educational integration is one of the most important actions to tackle the barriers to the training of qualified personnel. The current challenges for the development of intelligent construction workers are unclear educational goals, obsolete courses, lack of hands-on teaching, and poor cooperation between schools and businesses, all of which have a direct effect on job performance and the viability of the sector. Through the alignment of the training plan with the real requirements of the industry, the optimization of the curriculum, the reorganization of the modern curriculum, the joint establishment of a common training platform, the enhancement of dual qualifications of teachers, and the refinement of assessment and motivation mechanisms, a comprehensive improvement of the overall framework for industrial and educational personnel.

Disclosure statement

The author declares no conflict of interest.

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