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Malaysian Chinese Education in the Era of the Fourth Industrial Revolution

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Abstract

In the course of human history, industrial revolutions have been an important driving force in the development and transformation of society. There have been three such revolutions since the eighteenth century and each has had profound effects on human society. They not only improved productivity, but also promoted major changes in social development, economic structure, people's lifestyle, and the education system especially in training talents needed by a country. The idea of the Industrial Revolution (IR) 4.0 was first put forward at the Hannover industrial exposition in 2011. Subsequently the World Economic Forum of 2016 focused its theme on the impact of this latest IR. Its defining features are the integration and interaction of a range of high technological developments such as artificial intelligence, robotics and Internet of Things across a spectrum of industries.

The impact of IR 4.0 is inevitably leading to changes in all sectors of the economy and society including education. This study will focus on its possible implications on Chinese education in Malaysia. Chinese education is largely a community enterprise and began 200 years ago. It has shown much tenacious vitality and has undergone continual reforms and qualitative improvement to keep abreast of changing needs and the latest trends in technological advancements. This study will discuss IR 4.0 and examine and the nature of its impact on Chinese education in Malaysia.

Key words: The Fourth Industrial Revolution, technological changes and innovations, Malaysian Chinese education

Introduction

Technological advancements in the form of IR 4.0 are encroaching inevitably into all aspects of human endeavour. Profound changes and possible impacts on human society will pose many challenges as well as bring immense opportunities. In the area of education, the likely impact of IR 4.0 and the concomitant focus on nurturing talents will directly affect how society approaches the future of learning.

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With respect to education, it is necessary to clarify the concept of the latest IR and its possible impacts and challenges. As IR 4.0 will cause radical disruptions to existing economic and social life, it is necessary to devise appropriate response strategies on how to survive the inevitable disruptions and to seize new opportunities to elevate the standard of Chinese education in Malaysia in keeping with the principles of sustainable development. Following the introductory explanation of the concept of IR 4.0, the discussion will examine its possible impacts on Chinese education, followed by suggestions on the nature and direction of necessary reforms to enhance the functional and social relevance of these schools to the country.

The Fourth Industrial Revolution

It was in the 1860s that first IR began in Britain and quickly spread to France, Germany, and the United States. This revolution was driven by "mechanization" that was made possible by the invention of the steam engine. As machine production replaced manual labour, and economic and social development gradually shifted from agriculture to industry its effect was to accelerate the transition from the agricultural to an industrial civilization. This process became technologically more advanced to become IR 2.0 in late nineteenth century and continued into the middle of the twentieth. It marked the use of power in the form of electricity to drive large-scale production and laid the foundation of mass production. New energy sources of electricity and oil made possible rapid means of transportation such as the railways and automobiles. New modes and networks of transportation in turn quickened the pace of internationalization of economic, cultural, and educational developments. By the 1960s, the era of automation ushered in IR 3.0 that was marked by the development of semiconductor technology, mainframe computers, personal computers and the Internet all of which collectively ushered in the age of information technology. The power and versatility of information technology and network connectivity hastened the process of globalization. Although some scholars argue that the current progress of human society is in fact a continuation of IR 3.0, more and more studies show that it is the beginning of a new phase of IR. It is characterized by features and developments that are distinctly unique and, in terms of speed, breadth, depth and systemic impact, have surpassed those of earlier revolutions.

The concept of IR 4.0 was introduced at the Hannover industrial exposition in 2011 to depict the accompanying transformation of the global value chains. This phenomenon that emerges at the turn of the twentieth century is based on the digital revolution that is driven by computer networks. These networks are becoming ubiquitous and powered by ever smaller and less expensive chips. The arrival of Artificial Intelligence (AI), online learning and "smart factories" has enable IR 4.0 to create a world in which virtual and physical systems of manufacturing globally interact seamlessly with each other. Among the many possibilities is the absolute customization of products and the creation of new operating models (Schwab, 2017: 20-22). The possibilities of achieving deeper "intelligence" and "customization" will position

IR 4.0 as fundamentally different from the previous revolutions and hence promises to enable human society to experience profound changes in a diverse field of activities.

The Major Characteristics of IR 4.0

From the perspective of technology, IR 4.0 is not just about smart and connected machines and systems but, more significantly, it is the integration of simultaneous waves of breakthroughs in areas ranging from gene sequencing to nanotechnology and from renewables to quantum computing (Schwab, 2017: 22). This latest development is the introduction of the information society to a new productivity and production platform. Several principal features differentiate this current IR from earlier ones.

Artificial Intelligence

Featuring as a major component of IR 4.0, AI has become a key technological innovation that has attracted worldwide attention and generated debates over its possible impacts on society and the economy. The implications of AI on human life are still unfolding. The potent influence of AI is its capacity to absorb "intelligence" to perform complex functions better than humans. In 2016, the Go artificial intelligence "AlphaGo" software, which utilizes deep learning technology, defeated the world's top chess player Lee Sedol by four to one, and immediately made Go and AI the focus of global attention. The moves of Go have a variable of 10 to the power of 360, and this chess game is widely believed to be one of humanity's most complex games. AI's ability to overpower the best human brain in Go is an indication of its potent capacity to replace a variety of human functions. From this perspective, given sufficient investment in funds and human resources, AI may be better than humans in various fields that require high-level thinking or decision making. Google has understandably invested heavily to exploit the immense capabilities of AI (*Nikkei News*, 2019: 7).

Networking

The Internet of Things (IoT) is another development made possible by IR 4.0 to provide an all-embracing integration of things of different forms and functions. It is in effect the use of mobile internet and various platforms to build relationships between objects and humans. This intense network linking all things will result in new business operation models, industrial production methods, and social organization and individual interactions (高文杰/Gao Wenjie, 2016: 6). In March 2015, media strategist Tom Goodwin posted an article on the TechCrunch and declares that:

> "Uber, the world's largest taxi company, owns no vehicles. Facebook, the world's most popular media owner, creates no content. Alibaba, the most valuable retailer, has no inventory. And Airbnb, the world's largest accommodation provider, owns no real estate."

These companies have one thing in common, that is, creating platforms based on trust and operating on the concept of matching supply and demand in a manner that is highly accessible and cost effective, at the same time allowing both parties instant interaction and feedback (Schwab, 2017: 39-40). These innovative network platforms have strong disruptive impacts on existing business models. They have effectively reduced transaction costs and friction, changed the way people and objects are connected, led to changes in business practices, and created new enterprises.

Customization

3D Printing is one of the iconic manufacturing technologies of IR 4.0. By using powdered metal or plastic and other adhesive materials, solid objects are then printed layer by layer through digital templates. This is different from the traditional manufacturing method of using materials and quantitative production. 3D printed products are more flexible, faster in production, lower in cost, and highly customizable. The use of 3D printing technology is now widely adopted in processes ranging from large-scale machinery manufacturing to toy production. Future trends will witness 3D printing not only in the printing of goods but also in healthcare in which customized artificial organs, dental implants, artificial vertebrae, fracture clips, heart rhythm regulators and many other items may come into common use. Once widely accepted, the many advantages of 3D printing manufacturing technology will become obvious as it will make possible customization of products at affordable costs.

Cross-Disciplinary Capability

IR 4.0 is a technology that integrates and interacts between implantable technology, artificial intelligence, robotics, IoT, driverless cars, 3D printing, blockchain, nanotechnology, and biotechnology. This series of new technologies are subverting and changing traditional production methods by making possible big data processing technology, which can extract the required information from massive amount of data rapidly with high accuracy, and also new biomedical technology that combines biomedical information and medical imaging technology to combat disease prevention, diagnosis, treatment and rehabilitation services to improve human survival and health (李金华/Li Jinhua, 2018: 81). Similarly, the promotion of smart factories, the networking of business operations, the customization of product manufacturing, and cross-disciplinary co-operation and integration are no longer limited to specific areas. It is the integration of multiple technologies across different disciplines and their disruptive impacts on production processes and human society that distinguish IR 4.0 from earlier ones.

IR 4.0 and Its Impact on the Social Function of Chinese Education in Malaysia

IR 4.0 and its cumulative technological advancements since the emergence of the digital age are bringing about an educational revolution driven basically by the manipulation of information that is intimately linked to social change and technological innovations (Figure 1).

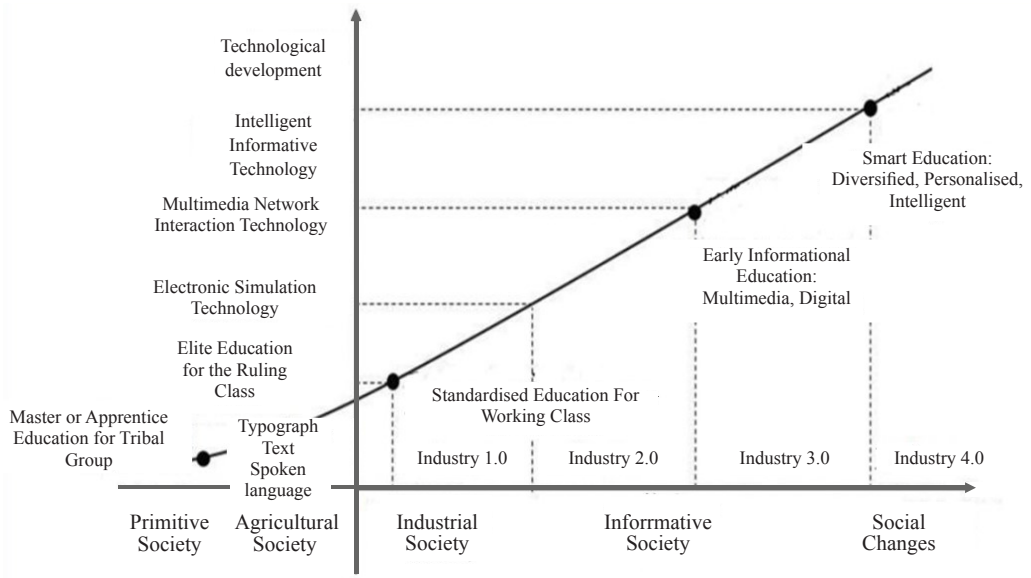

Figure 1. Trends in Educational Change
Source: 胡钦太等/Hu Qintai *et al*., 2019: 2

During IR 1.0 and IR 2.0, human society made the transition from an agricultural to an industrial society. To meet the mass production needs of factories made possible by the invention of machines, education took the form of learning and teaching in the standard setting of the classroom. With the advent of IR 3.0 when human society entered the information age, the computers and information technology, multimedia-assisted teaching, and the application of digital resources began to feature increasingly in the field of education. The advent of IR 4.0 is making available advanced technologies such as AI, blockchain, IoT and many more innovative methodologies. The integration of these information technologies in the teaching and learning environment will become an inevitable reality. The social changes that accompany this revolutionary changes will render education a more diverse, intelligent, customized, and more action-oriented exercise. In short, all countries, whether developed or developing, have to face the profound impacts of IR 4.0 on their education systems.

Changes and developments in the education system of a country and those of its society are often interlinked and exert an influence on each other. As a functional component of the education system of Malaysia, Chinese education is looked upon to play its rightful role to the process of social and national development. The impact of IR 4.0 on the social function of Chinese education is envisaged to manifest itself mainly in the areas of talent development, technology education, and cultural resilience.

Talent Development

Chinese education plays a key role in training human resources to contribute to the economic and social development of the country. While it attempts to reform or adjust the curricular contents to emerging trends arising from IR 4.0, it would also nurture future talents with a focus on areas of cognition, skills, mindset and behaviour, and ethical values. In terms of cognition, students will have to master cutting-edge knowledge across multiple disciplines, and be able to integrate and apply this knowledge to meet the demand for talents with interdisciplinary knowledge instead of the conventional know-how of a narrow specialty. In terms of skills, the trend is veering towards the demand for talents who possess skills in solving complex problems and the ability to manage inter-personal relations, as well as learn necessary skills including in areas of resource management, intellectual and physical competencies (Schwab, 2017: 66). The third focus concerning mindset and behaviour is important because IR 4.0 is a megatrend that opens up many opportunities as well as poses serious challenges to societies and economies alike. Multi-faceted changes will require new mindsets and patterns of behaviour to respond to new openings and encounters. It is imperative that appropriate adjustments be made in the existing education system in order that students are equipped with the positive attitude and behaviour to adapt to unknown but inevitable changes, opportunities, and challenges. Lastly, the advent of disruptive technologies and AI will pose issues on traditional values and ethics. Although Chinese schools give a great deal of emphasis on moral education, hitherto unheard of issues of ethical value and moral judgements arising from technological and innovative novelties are considerations that educational administrators must take into account to ensure standards of fairness and level-headedness to maintain a healthy sense of balance and social harmony. This is an arduous task that Chinese education cannot ignore in the process of talent training.

Technology Education

As IR 4.0 imposes a profound impact on economic production, its influence should at the same time seep into all levels of academic and vocational education. It is through education that the proper channel and the driving force for the teaching and dissemination of science and technology are realized most effectively. Changes due to technological advances occurring on a daily basis cannot be overlooked or ignored by any education system that aspires to keeping abreast of the time. The transfer and reproduction of scientific knowledge go through a prolonged process of planning, investment, and implementation. Practical reforms in organizational structure and teaching methods of schools at different levels will help in the smooth transfer of scientific and technological knowledge and to achieve the social function of imparting to a larger number of students knowledge that is originally mastered by a few. Colleges and universities have to invest in relevant research to advance the frontier of scientific and technological knowledge and innovations. In vocational institutions, the focus should centre on equipping talents with applied skills to adapt to technological transformation and

new production, innovation and management systems. In middle and elementary schools there is a need to popularize science and technology education to encourage the innovation spirit. The mandate of the Chinese education system with respect to IR 4.0 is hence to put in place the mechanism through optimizing allocations of appropriate equipment and learning space, elevating the quality of teachers, and proactive interaction between different components of the education sector to prepare students to engage in new fields of scientific and productive endeavours in their adult life.

Cultural Resilience

Chinese education itself is an embodiment of social values and Chinese culture and its role may be viewed from the perspectives of cultural transmission, selection and integration. Firstly, a prerequisite of Chinese education is the perpetuation of the positive aspects of traditional Chinese culture. That this culture has taken root, grows and spreads in Malaysia is built on its transmission through Chinese education spanning over several generations. The task of imparting knowledge, literacy, and norms of science and culture is the contemporary function of Chinese primary and secondary schools, the colleges and universities. Secondly, in the area of cultural selection, the Chinese education system, through its design of learning objectives, contents and teaching materials, teaching staffs, campus environment and by other means, systematically selects, adapts and presents cultural elements in accordance to the developmental logic of Chinese education. Thirdly, in the setting of a multi-ethnic and multi-cultural Malaysia, Chinese education is mindful of the importance of cultural integration. Like other national cultures, Chinese culture is a living organism that absorbs new elements in the process of exchange and integration with other cultures as well as technological advancements. Contemporary China's open acceptance of the new wave of technology and the innovation spirit is indicative of a cultural adaptability that should inspire local Chinese educators. It is the spirit of accommodation and acceptance of differences that will generate the same positive attitude towards innovative concepts and methods and in the process enhances the purpose and timeliness of cultural fusion and communication.

At the level of national development, Chinese education has trained and contributed talents in various areas of specializations. IR 4.0 is offers a suitable channel and occasion for Chinese education to meet new demands of technological advancements and hence to upgrade its role in nurturing new-age talents for future national development.

Functional Reform in Chinese Education

In the context of IR 4.0 and from the functional perspective of education, Chinese education is enjoined to respond to broad changes by adopting effective measures to disseminate scientific and technological knowledge and to promote industry-academia collaboration. Schools at different stages should, according to the physical and mental characteristics of learners,

enhance their educational goals, curriculum design, adopt innovative teaching environments, and fine-tune teaching and assessment methods. These are functional reforms that are driven by the advent of technological advancements attributed to IR 4.0 and ensuing social changes.

Curriculum Design

The curriculum is a good measure of the goals, teaching contents, methods, and evaluation of an educational system. It will indicate whether schools are effective in transmitting practical and theoretical knowledge and in fulfilling their role in promoting social development and change. As a revolution that integrates multiple technologies, IR 4.0 implies that the demands on talents are no longer confined to those highly trained in single specializations but increasingly more so for talents with versatility in interdisciplinary skills. This trend provides a powerful incentive for Chinese education to explore ways to integrate interdisciplinary courses in its curricular design to incorporate the following factors. The first is related to real-life situations and away from the traditional focus on fixed and run-of-the-mill textbook contents. The next is for the course contents to emphasize contemporary social phenomena and issues to enable students to engage with society and industry as an experimental field of learning to identify, analyse, and solve problems.

Learning Environment

The advent of the digital age has witnessed the progressive penetration of online learning into the classroom environment. It is set to disrupt the traditional learning environment based on the single mode of classroom instruction into a multi-dimensional constraint-free setting, giving rise to a "learning is everywhere" milieu. One benefit to be derived from this switch is the ability to leverage on the advantages of timeliness, convenience, and comprehensiveness of online learning platforms to support and solve teaching needs that offline learning environments fail to meet. It is clear that education providers need to invest more heavily than before to create the infrastructure to popularize this new mode of learning. Furthermore, by making available personalized learning spaces, educators can provide more online learning resources and contents that are generally of interest to learners. This may be achieved by transforming learning outside the classroom in the form of meaningful activities, and to encourage integrating core and non-core subjects, online and offline learning, so as to overcome the constraints of the traditional learning environment. This is also a form of empowering learners in autonomous study and in promoting lifelong learning.

Teaching Method

Under the framework of IR 4.0, the teacher-centric mode of teaching will inevitably change when new technologies are integrated into the teaching and learning method. Classroom teaching featuring the passive one-way knowledge transfer from teachers to learners will move towards inquiry, flipping, collaboration, and co-operation to promote learner-centric models for

the holistic development of learners. The multiplicity of online platforms and learning software have allowed teaching and learning to be customized to match individual needs and learning abilities to provide personalized learning programmes. In short, advancements in AI and Internet modalities have led to greater openness of teaching contents and methodologies that may be carried out free from of the constraints of time and space. The shift towards this trend is yet another reminder that the Chinese education system has to advance with the times.

Teaching Evaluation

Changes in the curricular structure, teaching environment and methods call for compatible modes of assessment. Teaching evaluation implies that the teacher systematically conducts quantitative or qualitative checks on the learning performance of learners to arrive at value judgments based on the results of the mapping against the teaching outcomes. Under the conditions of talent training in keeping with IR 4.0 requirements, the demand for talent capabilities has gone from a single specialized knowledge type to the all-round talents who are capable of critical thinking and independent learning, culturally versatile and articulate, and skilful in the art of collaboration, and being innovative. It is hence necessary to be creative in the evaluation of teaching assessment in keeping with new developments. The current practice of assessment that combines physical and online performance, display of student work, self-learning assessment, peer feedback and mutual assessment is shaping a multi-pronged assessment system away from focusing on knowledge-based assessment to that of the development of learners' multiple abilities.

Conclusion

IR 4.0 and what it implies are gradually seeping into every aspect of human life as an unavoidable reality. The "intimate relationship" between humans and smartphones is indicative of this reality and a clear example of how a new technology is impinging on our daily lives. Indeed, World Economic Forum founder and executive chairman Klaus Schwab's prognostication is that IR 4.0 will completely alter our perceptions of daily life, work pattern and social behaviour. No educational system can be insulated from the trajectory of technological advancements that are disrupting and transforming every imaginable aspect of human activities and behaviour. With the availability of widespread online teaching and learning resources, it is now possible to overcome spatial and temporal limitations. This trend promises to disrupt traditional school and classroom teaching. Consequently, from the perspective of IR 4.0, in the curricular design, learning environment, and teaching assessment, the education system awaits reform to meet the megatrend of meeting the demands for talents. The direction of Chinese education is to change to a more liberal approach, the curriculum to become more diversified and oriented to contemporary needs, and the method of teaching and learning be tailored to satisfy personal aptitudes to enable students to cope with the changing nature of

modern education. The functional reform of Chinese education is not a choice but a necessity. The positive response to changes brought about by IR 4.0 will serve as one of the principal avenues to the continued existence and sustainable development of Chinese education as has been practised in the last 200 years.

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