



The Impact of The Industrial Revolution 4.0 on Non-Formal Education Practice

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This study aims to uncover the extent of the impact of the industrial revolution 4.0 on the development of non-formal education. Furthermore, to explain the programs developed by the PNF unit in the face of the industrial revolution 4.0. This study used a qualitative descriptive explorative approach. The research respondents were managers and educators of non-formal education units that were determined purposively. The study was conducted on the PNF units in the cities of Sleman, Bantul, and Yogyakarta. The results showed the impact of the industrial revolution 4.0 on the practice of non-formal education, included the optimisation of information technology had been widely applied in the academic and administrative fields in the PNF unit.

Keywords: *Industrial Revolution, Life skills, Nonformal Education.*



Introduction

The industrial revolution 4.0 has today become the talk of many parties, both in the level of colleges and practically. In the environment of the academies, the discussion about the industrial revolution 4.0 is a strategic issue because the impact it produces is quite significant in affecting people's lives in the future. The industrial revolution, as a result of the rapid development of information technology, has been able to create opportunities that in the past, were not imagined at all. On the other hand, this condition also raises problems that are no less complicated, primarily when associated with changes in the role of humans who are excluded by technological progress.

Historical facts show that the current industrial revolution is the fourth industrial revolution. According to the European Parliamentary Research Service (Devís-Devís, Beltrán-Carrillo, & Peiró-Velert, 2015), the industrial revolution has occurred four times. The first industrial revolution took place in England in 1784, with the invention of steam engines, and mechanisation began to replace human work. The second industrial revolution took place at the end of the nineteenth century and was marked by the condition of production machinery powered by electricity and used for mass production activities. The third industrial revolution occurred in 1970, which was marked by the use of computer technology for manufacturing automation. Current developments are marked by the rapid development of sensory technology, interconnection, and data analysis which have given rise to the idea to integrate all of these technologies into various fields of industry. This is what supports the emergence of the industrial revolution 4.0 or the fourth industrial revolution.

The industrial revolution 4.0 is a unique phenomenon compared to other industrial revolutions. The term industry 4.0 itself was officially born in Germany, precisely when the Hannover Fair was held in 2011 (Kagermann, Lukas, & Wahlster, 2011). Several other countries also participated in realising the concept of 4.0 but using different terms such as smart factories, industrial internet of things, and smart industry.

The industrial revolution 4.0 has an impact on all aspects of life. Starting from industry, economics, education, the development of scientific disciplines, government, and human society. Besides bringing benefits, the industrial revolution raises challenges that must be faced by society. Drath and Horch (2014), Lasi, Fettke, Kemper, Feld, and Hoffmann (2014), Lee, Bagheri, and Kao (2015), and Rübmann et al. (2015) say that industry 4.0 challenges are the emergence of resistance to changes in demographics and social aspects, instability in political conditions, limited resources, risk of natural disasters and demands for the application of environmentally friendly technologies. This condition encourages educational institutions to be able to adjust to increasingly rapid progress. The curriculum, as far as possible, is no longer only able to face but must be able to predict the competencies that must be possessed by students in the future.



Education, as one of the aspects affected by the development of the industrial revolution, does need to make various adjustments so as not to be eroded by the times. The educational paradigm that encourages educational institutions to compete to produce graduates ready to work in an industry that is always developing, gradually begins to feel its effects. The number of the educated and unemployed who are ready to work but are less creative and innovative, increasingly adds to the concerns of education people. Disruptive education illustrates that for a person to be successful or to be able to survive in a global competition, it is no longer positively correlated with the education he attends. A person can succeed in economics without having to study economics because they master the essence of economic practice from the informal activities they do. The question that arises then is, when formal education can be affected so much by the development of the industrial revolution, then what about non-formal education? Also, what about non-formal education units that run educational programs outside the school system? Can the output of this education system adjust to the development of the industrial revolution? To what extent can non-formal educational institutions facilitate their learning citizens to be able to compete in the era of the industrial revolution?

Coombs (Etling, 1993; La Belle, 1982; LaBelle, 1986; Sudjana, 2004) said that non-formal education is any activity that is organised and systematic, is on the outside of the system of schooling that is established, is conducted by an independent or a part of the activities are more spacious, which is intentionally made to serve peseta learners, particularly in achieving the purpose of learning. According to Ahmed (1989), Coombs (1976), Napitulu (1981), and Taylor (2006), non-formal education is every effort the ministry of education holds outside of the system of the school, it lasts for the entirety of life, is executed with a deliberate, and organised plan that aims to actualise the potential of humans (attitudes, acts and works) that can be realised by the human being who completely loves teaching and learning and is able to improve his standard of living. The reason for the emergence of non-formal education is that it serves the needs of nations that are evolving, to complement and meet the needs of the Ministry of Education and all sectors of society. In detail, the reasons mentioned by Alam (2011), Bethke and Braunschweig (2004), Evans and Kaufman (1981), and Pigozzi (1999) include the existence of the perpetrators of non-formal education, and the existence of the planners of education internationally and their criticism of the school. Non-formal education has a characteristic that is essential to the circuitry needs of groups who are less fortunate, concerned with the category of the particular, and focus on the formulation of objectives are clear and flexible in organisation and methods (Fordham, 1993).

Challenges of non-formal education according to Brennan (1997), Dib (1988), Rogers (2007), and Sudjana (2004) includes: 1) non-formal education needs to be more proactive in reforming the vision, mission and strategy to change the program. Program education, which was initially oriented to produce the graduates from searching for work into effort graduates who have the skills and ability to be independent and creators of conducted fieldwork; 2) The withdraw element system of non-formal education needs to be complete and intact which includes the components, processes and objectives; 3) improve the vision of the mission and strategy of the development of

non-formal education; 4) non-formal education improves orientation alignment to people a lot; 5) non-formal education needs to develop three aspects of internal coaching institutionally with research effort, management, and production; and 6) to improve the mission of non-formal education broadly so that the institutions organising and implementing the programs of education are not able to work alone and without relation to other parties.

Conceptually, non-formal education should be able to survive in this condition, considering that the PNF itself is an educational path that is flexible, fast-changing, pragmatic, and able to adapt to the changing times. However, the main strength of the PNF's survival lies in the ability of the PNF guiding managers to read and predict every trend that develops in the community. As an educational system that benefits from the development of the industrial revolution, of course, it should be not only useful at the time of the teaching and learning process, but also be useful for the citizens of learning when entering into their lives.

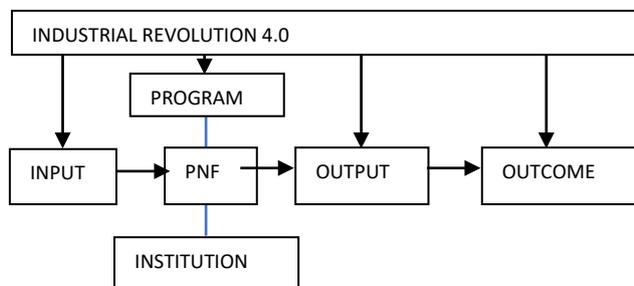


Figure 1. Schema of the Linkage of the Industrial Revolution 4.0 and Education

Based on the problems mentioned above, this study seeks to uncover the extent of the impact of the industrial revolution 4.0 on the development of non-formal education, and to explain the extent to which the programs developed by the PNF unit in the face of the industrial revolution 4.0 are in accordance with the needs of the people. Research into this condition is necessary, given the critical role of education in dealing with the era of the industrial revolution 4.0; primarily, how the stakeholders can facilitate the needs of the society in the current era.

Research methods

This study uses a descriptive explorative qualitative approach to conduct a systematic analysis of the description of the facts and characteristics of the subjects and objects under study. By using explorative studies, this research can find and identify various situations and conditions that arise in the practice of non-formal education in the era of the industrial revolution 4.0. Qualitative research in the field of education that was conducted by the researchers looked at the respondents as the subject, asked about something ordinary, collected data that mostly consisted of sentences emerging from the respondents, explained and analysed the theme of the sentence, and conducted investigations in a more subjective manner (Creswell & Clark, 2017).

The study was conducted during the period of February to June, 2019. The study was conducted in 11 institutions or PNF units in the Sleman Regency, the Bantul Regency, and Yogyakarta City. The data collection techniques used included interviews with the program participants and the program managers. Observations were also made to determine the truth of the answers provided by respondents. The data collected in this study is qualitative data in the form of words or phrases that were obtained during the study. Qualitative data analysis was performed through data reduction procedures, data display, and conclusion drawing. As for the validity of data triangulation techniques, sources and methods will be used in this study.

Research result

Non-formal education, as a subsystem of education nationwide, has a strategic role in the development of sources of power human. Challenges in developing a source of power of the human adult can be found in the development of technology and information, which are overgrowing. The rapid development of technology, especially information technology, has affected the industry era 4.0, which includes four main characteristics; namely, cyber-physical systems, internet, cloud, and cognitive computing (Samani, 2018). The development of technology is often not matched by the abilities that are adequate for its use. In this context, the role of non-formal education becomes critical, bearing in mind that the path of non-formal education allows it to be closer to various layers of society as program targets are in line with the needs of the times. Roles are only realised when the institution of non-formal education has an understanding of both the conditions and situation of the development of the era that was taking place, in addition to the vision of the time before, is it able to predict the development needs of the community in the future that will come.

The data collected aims to achieve the following: reveal the extent of understanding by the management and practitioners of non-formal education regarding the industrial revolution 4.0; gain an understanding of their impact on the program and the implementation of the program of non-formal education; as well as what actions are carried out as an attempt to adjust the practice of non-formal education with the development of age in the era of the industrial revolution 4.0

Based on the research results and the opinions of the respondents, the industrial revolution 4.0 is understood as a significant change in the field of technology that is increasingly sophisticated, which encourages an interaction without boundaries with the influence of digitisation technology. The industrial revolution is also interpreted as a changing era or period from the green revolution to the era of information technology. Technology development information may include the use of computers, the use of smartphones, and the utilisation of digital information technologies and tools in various activities within the society. The industrial revolution has also been realised to make the boundaries of space and time between the physical and the biological increasingly thin and even disappear.



"Revolution of industrial 4.0 automation system of production that utilizes technology weapons information, for example, the use of the internet of things, artificial intelligence that is based on big data. The era is characterized by the use of technology, the Internet and digital are massively starting from industrial-scale large until the activities of a normal human being".

The industrial revolution 4.0 has much influence on the theory and practice in the field of education and non-formal education is no exception. The practice of non-formal education that is more flexible provides advantages because it can adjust to the needs of the times. The development of technology has influenced the whole of human life from various fields, including education, politics, culture, economy, social, law, and so on. Education as a field that is very close to the community, is not free from the influence of the industrial revolution 4.0. This influence encourages and demands educators and students to be able to balance the educational process with information technology. Non-formal education, which was initially carried out with conventional systems, currently demands the capability to compete technologically.

The results showed that the effect of perception by non-formal educational institutions after applying the industrial era 4.0 is a non-formal education institution to become known in the community due to existing technology, and people can more easily access any information relating to non-formal education. This condition is influenced by the increasingly widespread use of the internet, making it easier for the public to access any information in cyberspace. This condition will certainly not occur if the PNF unit manager is not aware of the technology. It can be interpreted that the unit manager has been able to take advantage of available opportunities by optimising the internet network as a means of socialising and marketing non-formal education programs in his or her institution.

The use of the internet and digital technology has also been utilised by managers of PNF units in building networks, marketing non-formal education programs, and implementing its learning. Previously it was common place to introduce non-formal institutions through activities such as socialisation, counselling, invitations and other activities that are physically satisfied. At present, these activities are carried out through the development of an institution's website which is easily accessible to all people who are literate in information technology. Information renewal activities by institutions are also more quickly accepted by the public because the delivery of information can be completed via a computer or smartphone.

In the future, the role of educators in their interactions with students will be increasingly varied and require high creativity so that their role is not replaced by technology which is viewed to be easier for students. As stated by Sukartono: "In the industrial era, 4.0 education experienced a great disruption. The role of the teacher who has been the sole provider of knowledge has more or less shifted away from him" (Kusumo, Sukartono, & Bustan, 2018). The biggest challenge of education is how capable education programs not only emphasise the content of knowledge, but also attitudes and skills. The interaction of non-face-to-face learning (cyber school) in the future



will increasingly occur, eroding the interaction of education between teachers and students. Thus, the values of education are at risk of being lost. Not to mention, the challenges of the program and the content of knowledge offered to students. In the future, humans must be able to compete with the dominance of industrial machines, which increasingly reduce the role of humans. Human resources are encouraged to be smarter and more productive than the machines created by the humans themselves.

Anticipating the preceding factors, non-formal education units have put their full efforts into improving the quality of information technology-based learning. However, this has not been fully implemented because there are some students who still feel comfortable with the conventional learning model (face-to-face) implemented by educators in the classroom. Referring to these conditions, the development of information technology-based learning has not been fully implemented and is still balanced with face-to-face tutorial learning.

The various benefits felt by the managers and educators of the PNF unit with the application of information technology-based learning includes that tutors are more comfortable delivering learning material because they can use video and moving images that can be displayed through the screen. Besides, communication in learning outside the classroom can be achieved through internet conversations on computers and smartphones. Thus, the industrial revolution makes it easier for non-formal institutions to disseminate information in the implementation of the learning process.

The industrial era 4.0 needs to be considered as a challenge to encourage, that people are not easily monopolised by technology. As stated by Tilaar: "A new challenge requires a breakthrough of thinking process if what is desired is quality output that can compete with work in a completely open-world" (Tilaar, 1998).

The results showed that non-formal education programs that have been held and developed in the face of the industrial era 4.0 include the field of skills education (courses), such as computer courses, fashion courses using computers to make patterns, culinary courses through the development of learning material applications, and fields education "kesetaraan" program with package C. For example, the implementation of the equality program package C exams already uses the online system, and the most important thing is that the online learning system (package C in the network) for equality education has now been developed. In the field of administration, it is also not free from the influence of information technology, such as PAUD and PNF accreditation activities that have used online systems, institutional data collection, quality assurance systems, and institutional assessments.

Another area that has been developed is to improve the skills of students by providing a variety of vocational skills and social skills training. Furthermore, by improving the quality of infrastructure in the learning process and improving the quality of human resources in terms of



academics and administration. Broadly speaking, efforts have been made by non-formal educational unit managers in developing the practice of non-formal education in the industrial era 4.0. Such efforts include: the introduction of IT to learners who work through cooperation (partnership); digitising information on the implementation of educational programs published to the public and optimising information technology as a marketing tool; developing media-based learning IT in several certain subjects; pioneering online learning; developing digital-based life skills programs; and the optimisation of technological information to overcome the limitations of access for participants or learners to follow learning because of time constraints, distant location or because one is not allowed to participate in regular learning.

In the era of the industrial revolution today, the education program is expected to be a bridge for the community to survive in global competition. This competition does not only occur between fellow humans but develops into a competition between humans and robots or computers equipped with artificial intelligence. This condition requires the PNF unit managers and the PNF unit associations to have a vision of the future so that the role of human resources remains a priority. Predictive ability is very much needed so that non-formal education programs can anticipate the human resource needs required, per the changes that occur. The results show the program which has been developed by the manager of the PNF in the era of the industrial revolution 4.0, as presented in Table 1. Does it need to be emphasised where the programs that have been developed by the manager of the PNF anticipate the challenges of the industrial era 4.0? Further, whether these programs can facilitate the needs of the community to face the industrial era 4.0? The programs are developed with various considerations based on the results of identifying needs. Often, non-formal education programs are held not only because of the needs that arise externally due to the times, but because of the needs of students. The following are some of the backgrounds that led to the programs being held as a basis for adjustment to the development of the industrial revolution era 4.0.

Table 1. Program Recapitulation in PNF Unit

No	Field	Program
1	Equal Education	Package C with Internet (daring); Vocational e-training
2	Life skill	Tourism Creative industries
3	Woman Empowerment	Waste processing 'anyaman' skill and small food preparation
4	Early Childhood Education	-
5.	Youth	IT Training Computer Course
6.	Literacy	Android Based Literacy Learning Application Development
7.	Elderly Education	-

There were several background factors for organising the program, including: to improve students' skills, driven by the condition of the tourism industry in Yogyakarta, which is growing very fast and requires special skills to be dominated by business actors; people need skills that can be used to compete in the world of work and industry after graduation; there is a need for students to take part in an educational program but it has limitations, so easy access is needed to enable participation in online learning because students are far away and do not have time or opportunities to engage face-to-face; there are opportunities for savings if the program is implemented with an e-training system, as an effort to optimise information technology for education; and the existence of business and market opportunities from producing results that are relevant to the development of creative industries.

Other reasons are specific to the implementation of equality programs online to overcome the problem of limited access to prospective participant learners. For example, because of the limited time and access to distant locations. Participant students also have problems in following the regular activities during the day because of their work commitments, so it can only be completed at night. Meanwhile, the unit of education is far from the location of the participant students. Community enthusiasm for program development is very high. This enthusiasm is evidenced by the attitude and enthusiasm in participating in learning supported by adequate IT skills. Based on the above table, it can be observed that the development of non-formal education programs organised by the PNF unit managers have now attempted to adjust to technological developments. This condition shows that non-formal education programs can adjust to the times. However, if observed, the programs developed are still limited to adjusting to the development

of the times and are not yet leading to efforts to anticipate developments in the future. Adjustment in this context is in the form of using technology for learning activities, as occurred in the equality education program that was developed with an online system.

The programs that have been organised by the PNF today, illustrate the few weaknesses of the programs that have been developed. This is based on several assumptions about the conditions in the industrial era 4.0, where companies will not only face challenges in the search for skilled workers, but there are also other challenges related to the work environment and the development of skills programs related to the following matters (Nayyar, 2016): 1) Up-skilling: companies will have to up-skill their workforce via in-house or external training centres. For example, an assembly line worker involved in manually fitting a part will be required to operate a robot or other tools to do so. He or she should develop the skills to be able to operate the new tools efficiently; 2) Re-skilling: the industry 4.0 is expected to result in a job displacement, to a certain extent. Several jobs will cease to exist. Moreover, several new jobs will be created. Companies will have to invest in the re-skilling of the labour force to prepare for this expected shift; 3) Continuous learning: technologies will become obsolete at a faster rate. Continuous professional development strategies will be required to quickly adapt to the changes that technological advancement brings; 4) Mindset change: given that the labour force will have to adapt to several changes, they will resist and oppose the implementation of newer technologies. This will require companies to plan for mindset changes in their employees to facilitate a smooth transition to advanced manufacturing processes (Attaran, 2004; Ireland & Webb, 2009; Nordin, Deros, Wahab, & Rahman, 2012).

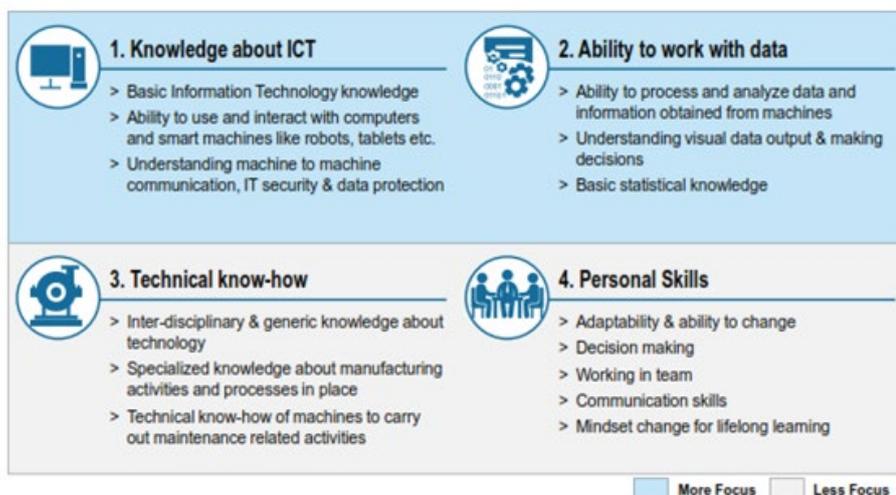
Considering the statement made by Brics, the manager of the education unit and professional associations and institutions need to pay more attention to the needs in the business and industrial world. The needs and challenges can be seen from several perspectives: the development of new types of skills along with the development of information technology; the emergence of new types of jobs along with the loss of old jobs in a company; technological developments that are very fast require ongoing learning activities, especially in the industrial world so that employees can more easily adapt to new technologies; and changes in work methods wherein employees must quickly adopt the use of technology and a new work culture through changes in the mindset of employees. The above condition is a highly potential opportunity for the PNF unit to conduct partnerships with the business world and the industrial world, especially in the field of developing human resource companies to facilitate the needs of the company. On the other hand, non-formal education units can also be the primary source for companies in providing ready-made resources according to the needs of competencies in the industrial world. The low awareness of the community in the increasingly severe challenges of the industrial era 4.0, related to the comprehensive competencies needed to be able to compete in this era, pose a challenge for education. The challenge is in the form of awareness-raising efforts to the general public via the PNF units and through various media. This awareness activity must be balanced with the development of the latest PNF programs that are broadly able to equip the community

with competencies relevant to the changing times. Below are some of the competencies that must be mastered by the community in the industrial era 4.0.



Figure 2. Industry Era Competency Categorisation 4.0

The PNF unit managers should be able to see the potential and future opportunities, so they can design reliable programs according to future market needs. Moreover, if the PNF unit has entered into partnerships with the business world and the industrial world, all educational needs can be easily identified. Listed below are skills and requirements that are important in the industrial era 4.0. The competencies and knowledge presented in the table can be used as a reference for education unit managers as well as professional and institutional associations in developing the minimum standards of non-formal education programs.



: 4.0



When viewed more closely, the programs that have been implemented by the PNF units are still considered to be quite far from the industry 4.0 requirements. Although, most of the programs are developed based on the needs of the learners. The online equivalent program that has been held at the PNF unit is a program that is adjusted to the development of industry 4.0 by utilising technology. Meanwhile, the substance has not yet led to preventive efforts to deal with the impact of industry 4.0.

Nevertheless, these programs have had a good impact on society. Considering the program being carried out is developed based on the needs of the community, current practical problems can be appropriately resolved. The response of the user to the program implementation is also excellent, especially in the circles that are already literate in information technology. However, the obstacles include the issue of network Internet, which is not evenly accessible in some areas, as well as the limited ability to finance the participant students in providing facilities connected to the Internet.

Conclusion

The impact of the industrial revolution 4.0 on the world of education, especially non-formal education, was felt greatly by the managers of the PNF unit. An awareness about the impact of the industrial revolution 4.0 with education has also been seen, evidenced by the development of information technology-based learning facilities and infrastructure by the PNF unit. The optimisation of the function of information technology, in terms of the administration and academic activities in the PNF units, has begun to run in recent years.

The development of the PNF program in the face of the industrial revolution 4.0 era was primarily based on the needs of students. The impact of the program implementation has also been felt by program participants, ranging from facilities in the learning process to their absorption in the world of work. However, the program that has been implemented has not been able to facilitate various potentials and opportunities in the future, in order to produce a reliable program design according to future market needs. The potential and opportunities for non-formal education in the industrial era 4.0 appear in many global companies. Through the strategic partnership mechanism, the PNF unit and the company will trigger the emergence of non-formal education programs in the form of training, workshops, or other similar activities organised by the PNF units in the company.



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