

# Education change in the industry 4.0: Candidate science teacher perspective

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**Abstract.** This is descriptive quantitative research. Research is conducted to show candidate science teachers perception about education change in Industry 4.0. Data collected through a questionnaire which consist of 3 sections. Questionnaire purposed to measure teachers perception about future skills, education trends, and teachers ICT knowledge. Purposive sampling was used in this study and there were 66 candidate science teachers who are having teaching practice in the school. The result of the study showed that the questionnaire has a cronbach alpha score of 0.825 and based on the data, the candidate teachers have shown a positive attitude toward changing in Industry 4.0

**Keywords:** *perception, science teacher, industry 4.0*

## 1. Introduction

The world is facing the vast advancement of information technology (ICT). This condition brought disruption and impacted all aspects of human life, includes education. They called it as Industry 4.0 which first mentioned by Klaus Schwab, an economist. Industry 4.0 is a change, especially in manufacturing system supported by advancing of ICT [1] which included Internet of Thing (IoT), Cyber-Physical System (CPS) and other internet services that made the interconnection between humans and human with the system [2]. Industry 4.0 has led to the loss of certain types of occupation and the emergence of new types of occupation which led to changes in prerequisite skill for workers [3].

Education plays an important role in preparing youth to have the skills needed in work life. World Economic Forum in its report outlines at least 10 top skills in 2020 that must be possessed by workers such as complex problem solving, critical thinking, creativity, people management, coordination with others, emotional intelligence, judgment and decision making, service orientation, negotiation, and cognitive flexibility [4]. The change in work demand led to changes in the education process. There are 9 changing trends in education, namely:

- diverse time and place,
- personalized learning,
- free choice,
- emphasis on project learning,
- field experience,
- drill data interpretation skill,
- change in assessment
- student ownership, and



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- teacher as a mentor [5].

The existence of new trends in education should be answered by teachers properly, who interacts directly with pupils. Hence, teachers should be aware of and responsive about change in education. Since the steam machine was invented there have been four times the industrial revolution, so do education. Education 1.0 set up to full fill society needed in agriculture and knowledge transferred directly using the lecture method from teacher to pupils. Second, education 2.0 focus on preparing pupils in using technology. Third, education 3.0 used technology to enhance interactive learning. Fourth, education 4.0 for fostering using technology to have a long life learning [6]. The inquiry is one of the best ways to teach [7] because it can improve science process skill and motivation of pupils [8]. The inquiry is a learning process where pupils are invited to discover the concept of knowledge as like as a scientist produce discovery through scientific methods in research. In this digital era, science learning more emphasis on finding concepts through direct activities by giving complex problem in the real world. However, in doing so there will be limitations, including 1) not all real-world problems, especially natural phenomena can be presented directly to pupils. For example, pupils in the city cannot directly observe the process of animal husbandry or agriculture; 2) pupils have limited knowledge, so guidance is needed by the teacher so that learning objectives can be achieved [9].

Integrating technology in the learning process can be chosen in overcoming these limitations. At present there are various types of technology, especially educational technology that can support the science learning process, besides that this is where the role of science teachers in providing a learning environment that can bring up complex problems in the real world, emphasizing direct activity and integrated technology [10]. Indonesia is preparing to face the disruptive effect of Industry 4.0 by launching Education 4.0. This program aims to reduce educational disparities and promote the use of technology in education so that pupils will have 21st-century skills (collaboration, communication, critical thinking, and creative thinking). Integrating technology in the learning process becomes the main emphasis in dealing with Industry 4.0 teachers as the spearhead of education must have the skills required. The teacher should also equip themselves with digital skills related to the learning process to meet the needs of pupils [7]. Hussin mentioned there are 9 digital skills should be trained with teachers, i.e. (1) acquire and create sound content (2) making video content (3) obtain and create figure content (4) using social media (5) making word content (6) make site markers and sharing; (7) make a presentation; (8) arrange digital portfolio; (9) online quizzes [11] which each of them can be assisted by technology.

## 2. Research Method

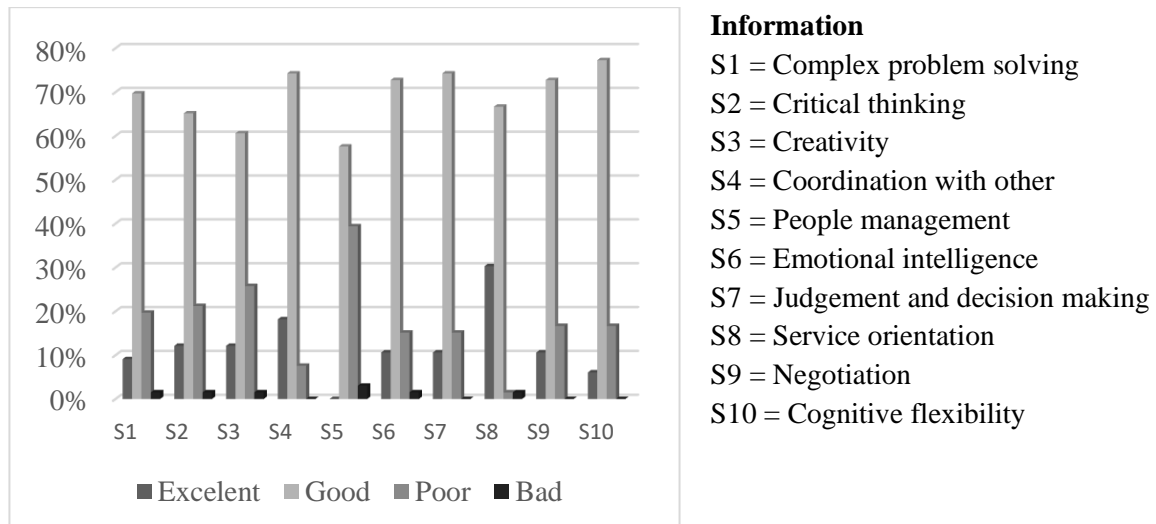
A quantitative descriptive research was conducted and the population of this study is candidate science teacher in Yogyakarta. Purposive sampling was used, for candidate science teacher who is having teaching practice of school. Candidate science teacher perception about changes in education assessed by using a questionnaire. Questionnaire consists of 3 sections to measure teacher perception about teachers skill, education trends and teachers ICT knowledge. There are 76 questionnaire which randomly distributed, but only 66 was processed (86% return scale). The data of questionnaire processed by using SPSS series 21 and showed the result has a cronbach alpha score 0.825.

## 3. Results and Discussion

### 3.1. Teachers Skill

There are 10 main future skills that become important focus in the future, these skills are needed in preparation for entering the workforce. The teacher is forming the nation's generation, it must first have the ability of the skills demanded in order to be able to model and trains the pupils. Based on figure 1, it is known that for the top 10 skills in the 2020, the majority of science teachers rated themselves as having good abilities. The highest percentage for the excellent category is service orientation skills (30%) and the highest percentage for bad category is people management (3%). Skills with codes from S1 to S4 are part of 21st century skills which are also a main goal in the

framework of the national curriculum. The curriculum in Indonesia advises teachers to provide a learning process that supports creativity through observing, questioning, experimenting, associating and networking. The assessment aspect also focuses on efforts to drill HOTS (High Order Thinking Skills) which encompass the reasoning and critical thinking skills.

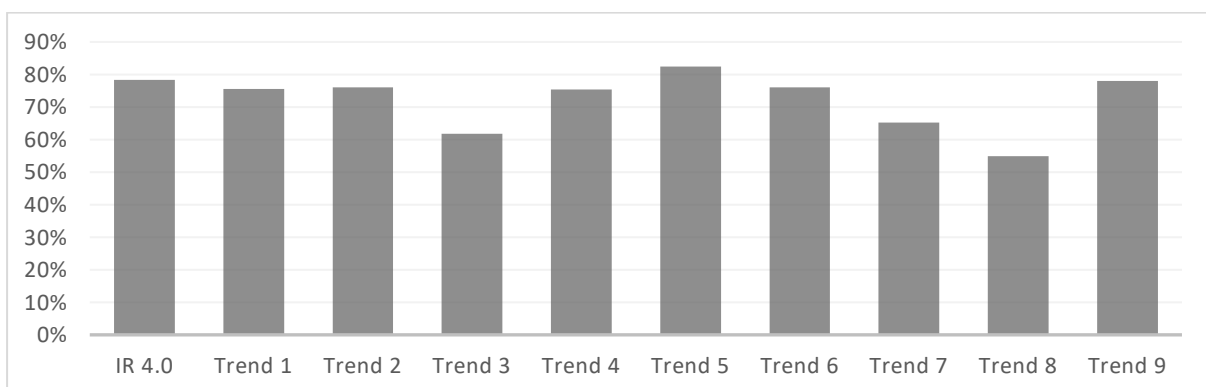


**Figure 1.** Teachers perception towards future skills.

Turiman stated that 21st century skills can be improved through science learning [12], further Windschilt explained that in order to achieve the target of skills that must be possessed by pupils the teacher should do/have the following: 1) deep interconnected content knowledge; 2) engages pupils in specialized classroom discourse; 3) understanding the purposes, context, and full range of assessment strategies; 4) depends for success on monitoring of student thinking about complex problems and relies on ongoing targeted feedback to pupils [13].

### 3.2. Teachers Perception towards Education Trends

The second part of the questionnaire explains the views of candidate science teachers towards educational trends arising from the implications of Industry 4.0. Based on figure 2, it is known that the average candidate science teachers already have an understanding in both categories of the educational trends in Industry 4.0 era. The range of understanding of each trend ranges from 55% -82%. The highest understanding (82%) is towards trend 5, which is about learning which will use more hands-on activities. The lowest understanding (55%) is towards the 8th trend, which is about curriculum that should adjust the needs of pupils.



**Figure 2.** Teachers understanding towards education trends.

Most candidate science teachers interpret Industry 4.0 as technological progress, changes in the process of production of goods, and this progress affects the educational process as conveyed by one candidate science teachers. He said "*Industry 4.0 is a condition in the 21st century in the form of massive changes in various fields including education. This change is in the form of a combination of various technologies so as to reduce the barrier between the physical, digital and biological worlds. This revolution is marked by the emergence of artificial intelligence, robots, nanotechnology, quantum computers*". The other said "*Industry 4.0 is an era where human power will be largely replaced by machines*". But, mostly candidate science teachers state that Industry 4.0 has a positive impact on the education process, makes pupils more motivated to learn and makes learning more varied. A more detailed explanation of each of the changing trends in education is presented in table 1 below.

**Tabel 1.** Teachers perception towards education trends.

Trends	Average (%)	
	Positive	Negative
• Learning is diverse time and place	83	17
• Pupils can personalized their learning	78	22
• Learning is free choice	55	45
• Emphasis on project learning	94	6
• There be more hands-on activity	98	2
• Drill data interpretation skill	96	4
• Change in assessment	80	20
• Student ownership	32	68
• Teacher as a mentor	74	26

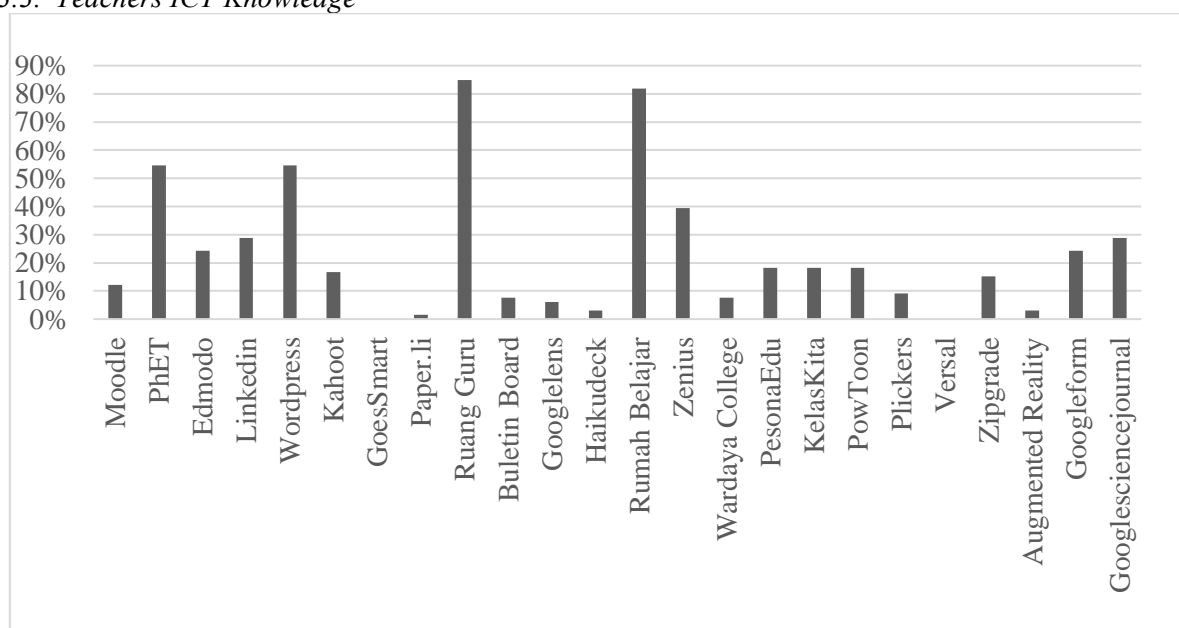
The first trend is a change in the learning process that used to be only direct or face-to-face at a certain time but now it can be done anywhere and anytime. Based on table 1, it is known that 83% of candidate science teachers have positive perception toward this change. Besides in class, science learning can be done outside the classroom, in museums, zoos and botanical gardens [14]. Various studies also show that learning outside the classroom can increase student motivation and learning outcomes, especially related to knowledge of the environment [15]. The second trend is the change in the learning process that can be personalized according to the needs of pupils. Based on figure 2 it is known that the candidate science teachers have a very good understanding that each student has a different way of learning, even though there are 16% of them cannot correctly state the types of student learning styles. Regarding personalization for assessment in learning, candidate science teachers have varied responses about giving remedial and enrichment.

The third trend is that pupils have the freedom to choose how they learn. It is known that 70% of candidate science teachers are familiar with blended learning but only 53% know about flipped classroom. Blended learning is a formal education program in which pupils get material online and pupils have control over the time, place, process, and / or speed of the learning process that they do [16]. Blended learning is preferred by those who are digital native [17] and is known positively can increase student learning outcomes [18]. Flipped classroom is a reversal of the learning process that used to be an understanding of material in the classroom and assignments at home turned into a process of doing work at school and understanding the material at home [19]. The fourth trend characterized by the learning process will be dominated by project activities. Respondents had a very positive assessment related to strengthening project activities in learning. Candidate science teachers agree that project activities have a positive impact on students and are suitable for use in science learning. Study also stated that project activities can improve students learning outcomes [20] and learning motivation [21]. Imania mentioned that using a kind of blended learning or hybrid learning can develop student competencies such as: educational competence, competence for technological, competence in globalization, competence in future strategies, and conselor competence [22]

Only 17% of natural science teacher candidates do not understand the various science projects. There were various project ideas written by respondents, including the manufacture of water filter equipment, conventional biotechnology projects, cell model making and the manufacture of renewable energy applications. The Fifth Trend is that the learning process will be dominated by hands-on activities. Hands-on activities can increase students' interest in learning science [23]. Based on table 1 it is known that 98% of candidate science teachers have a very positive response to hands-on activities for students in science learning.

The sixth and seventh trends relate to assessments in learning and emphasis on aspects of data interpretation. Based on table 1 it is known that, candidate science teachers have a positive response to the demands of the assessment aspects that emphasize the interpretation of data. Candidate science teachers also understand that students must be given a variety of assessment methods. The eighth trend is related to curriculum that should adjust to the needs of students. Only 32% of candidate science teachers showed positive responses due to statements related to the freedom of students in choosing the learning curriculum. Candidate science teachers tend to give negative responses to express disapproval because curriculum changes are rather difficult in Indonesia because the curriculum design in Indonesia still involves the government system through political channels and must proceed with the approval of the law. In the ninth trend, the candidate science teacher shows a positive response to the change in the role of the teacher who was once a source of learning and the distribution of knowledge being a mentor for students.

### 3.3. Teachers ICT Knowledge



**Figure 3.** Teachers ICT knowledge.

Based on figure 3 it can be seen that the average knowledge of candidate science teachers about educational technology is only limited to certain technologies. The most widely known educational technology by teachers is the Ruang Guru [24], Rumah Belajar Kemendikbud, PhET and Wordpress. Educational technologies not yet well known by respondents include Moodle, Goesmart, Paper.li, Bulletin boards, Haikudeck, Wardaya college, Plickers, Versali, and Augmented reality.

### 4. Conclusion

Facing disruptive changes due to Industry 4.0 in education process need teacher readiness and teacher's initial knowledge of changes themselves. Teacher should already have skills that need to be

trained in pupils in the future, teachers must know the changing trends in education and teachers should get to know a lot of education technology because further mostly education process will be integrated with technology. Based on the data found, it is known that prospective science teachers already have a good perception of changes in the world of education due to the Industry 4.0.

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