Vocational Teachers Readiness in Face of the Industrial Revolution 4.0: Vocational Teachers Perceptions in Yogyakarta-Indonesia

Gunadi¹, H Sofyan¹, Muhammad Nurtanto², Z Arifin¹, Putu Sudira¹
¹Universitas Negeri Yogyakarta, Yogyakarta, Indonesia
²Universitas Sultan Ageng Tirtayasa, Banten, Indonesia
Email: gunadi@uny.ac.id

Abstract. Vocational learning requires new reconstruction in accordance with the demands of globalization. As a result, vocational teachers must carry out new concepts in their learning. This study aims to obtain facts from the learning readiness of vocational teachers in the field of automotive engineering expertise in facing industry 4.0 challenges. This study uses a survey method approach. Data generated from the teacher perception instrument in Yogyakarta - Indonesia with a Likert scale. A total of 71 vocational teachers were involved in the study. The results showed that digital transformation, design principles, learning innovations and vocational teacher skills development have a readiness range between 75.00% - 79.8% which is in a good category and needs to increase perceptions widely and deeply. An important finding from the facts of this research is that learning is emphasized on the role of digitalization and technology that is relevant to industry, business, and the world of work (IDUKA).

1. Introduction
The industrial revolution 4.0 has taken place and is causing diffusion. Production activities that were originally human powered [1], will be replaced by automation technology. Even so, especially in Indonesia, there are three characteristics that must be adjusted, namely (1) local industry will continue to maintain human labor with the consideration that the presence of technology is expensive and less human, (2) industry with human and machine labor in a balanced proportion / intermediate proportion; and (3) industry which is entirely operated by sophisticated technological machines. This situation indicates that vocational society must adapt quickly [2].

Changes that occur in the industry are developmentally difficult for the organizers of vocational education to follow. So, several strategies must be carried out including updated skills on the quality of vocational teachers and the implementation of learning must be adjusted to relevant circumstances. Vocational teachers are required to quickly make breakthroughs with industrial parties and be directly involved with their production processes, and students as prospective workers familiarize themselves with industrial changes including demands for high quality and productivity [2] [3]. Thus, the learning outcomes must change [4]. The vocational teachers must carry out learning innovations, apply technology and digitization in the learning process, apply design principles, and develop skills called new contexts in learning.
Based on Figure 1, the new context of vocational learning is the involvement of digitalization and technology into learning. Thus, a new reconstruction will be formed including curriculum, competence and learning resources with the role of technology and digitization of learning implementation more dominant and massive [5]. However, the design principles of digital transformation must be applied, namely (1) Speed, intelligence, agility, and agility; (2) Communication capacity; (3) Visualization in understanding; (4) Decentralization; (5) Real time data management; (6) Service orientation; and (7) integrated business processes [6] [7]. Vocational teachers make new habits that the learning process uses a time reference.

On the other hand, learning innovations must be carried out including design and delivery innovations, approaches, strategies, methods, media, models, management, teacher roles, and content. As an effort to improve the quality of graduates. Furthermore, skills development must be carried out. Previously, vocational learning was directed at 4Cs. However, industry 4.0 challenges have predicted several skills that need to be trained [8], namely complex problem solving, critical thinking, creativity, people management, coordinating with others, emotional intelligence, judgment and decision making, service orientation, negotiation, and cognitive flexibility.

The new context in implementing vocational learning has not been fully implemented. This exploratory research was conducted to find out teachers' perceptions about their readiness to face the challenges of Industry 4.0, especially vocational education in Yogyakarta-Indonesia. Research findings become the basis for consideration for vocational education in terms of human resources and learning requires a new concept and order.

2. Research design

2.1. Respondents data
This study uses a quantitative approach that is analyzed from survey data [9]. A total of 71 class teachers participated in filling out the instruments. Demographic data of respondents (table 1) shows the distribution of data grouped by gender, employment status, age, education level, teaching experience, sector or institutional status.
Table 1. Respondents Data

| Variable      | Category | f  | %    |
|---------------|----------|----|------|
| Gender        | Male     | 56 | 76,71|
|               | Female   | 17 | 23,29|
| Job status    | PNS      | 56 | 76,71|
|               | GTY      | 6  | 8,22 |
|               | GTT      | 8  | 10,96|
|               | Other    | 3  | 4,11 |
| Age           | 21 - 30 Years | 14 | 19,18|
|               | 31 - 40 Years | 14 | 19,18|
|               | 41 - 50 Years | 19 | 26,03|
|               | > 51 Years | 26 | 35,62|
| Levels of Educations | D-III | 1  | 1,37 |
|               | S1 Education | 60 | 82,19|
|               | S1 Applied  | 4  | 5,48 |
|               | S2 Education | 5  | 6,85 |
|               | S2 Applied  | 3  | 4,11 |
| Teaching experience | Less than 1 year | -  | -    |
|               | 1 to 5 years | 18 | 24,66|
|               | 6 to 10 Years | 3  | 4,11 |
|               | 11 to 15 Years | 12 | 16,44|
|               | More than 15 Years | 40 | 54,79|
| Institution/sector | Public school | 62 | 84,93|
|               | Private school | 10 | 15,07|

2.2. Questioner research

Vocational teacher perceptions of learning readiness that are relevant to industry 4.0 were measured using a questionnaire. Four important variables, namely digital transformation (TD), design principles, learning innovations and skills development are developed into 30 closed statement items. The instrument uses a rating scale (Likert scale), namely 1 - 5 indicating the level of perception (never doing - always doing).

2.3. Data analysis

The data collected was analyzed data. The data is grouped and categorized based on the supporting variables for the implementation of vocational teacher learning. Data analysis is based on the mean, standard deviation and percentage as a decision making. The facts found from the perception of vocational teachers are new findings, as a follow-up to research and strengthening future human resources.

3. Result dan Discussion

3.1. Readiness for Vocational Teacher Learning Based on Digital Transformation (DT)

Digital Transformation (DT) is closely related to digital and technology. In learning planning, vocational teachers must integrate the roles of digital and technology in a broad and deep manner. The results of an exploratory study of the readiness of vocational teachers to the elements of digital transformation are as follows: Based on Digital Transformation (DT)

Table 2. Readiness for Vocational Teacher Learning Based on Digital Transformation

| No | Indicators of Digital Transformation | N  | Mean | SD  |
|----|-------------------------------------|----|------|-----|
| 1  | The implementation of learning is more dominant using digital media | 71 | 4,16 | 0,58 |
No | Indicators of Digital Transformation                                                                 |
---|--------------------------------------------------------------------------------------------------------|
2  | Competencies and sub-competencies in subjects are more dominated by the role of technology in accordance with developments in Industry, Business, and the World of Work (IDUKA) |
3  | Cognitive, Psychomotor, and Affective Competencies (KPA) are emphasized on the function and role of technology according to the subject matter |
4  | The selected learning resources are digitization-oriented                                               |
5  | The selected learning media is technology-oriented                                                       |

| Total                                                                 |
|-----------------------------------------------------------------------|
| 71 | 3.99 | 0.49 |

Overall, vocational teachers' learning readiness for digital transformation (DT) was 79.8% (M = 3.99, SD = 0.49). These results provide the perception that vocational teachers are in the “doing good” category during lesson preparation. However, increasing the competency of DT needs to be improved and has a certain level of measurability.

3.2. Readiness for Vocational Teacher Learning based on Application of Industry 4.0

The design principles in DT are measured based on (a) speed, intelligence, agility and agility; (b) communication capacity; (c) visualization in understanding; (d) decentralization; (e) real-time data management; (f) service orientation; and (g) integrated business processes. The results of an exploratory study of the readiness of teachers to implement industry 4.0 which are reviewed based on design principles are presented (Table 3) as follows:

| Table 3. Vocational Teacher Learning Readiness in Industrial Application 4.0 |
|-----------------------------------------------------------------------------|
| No | Indicators of Industry 4.0 Application                                      |
|----|----------------------------------------------------------------------------|
| 1  | Competence or learning outcomes are determined based on work speed          |
| 2  | Competence or learning outcomes are determined based on the method or stage of problem solving |
| 3  | Competence or learning outcomes are determined based on dexterity, speed, or agility in completing work |
| 4  | The learning implementation prioritizes how to communicate with the learning environment |
| 5  | The learning implementation prioritizes how to collaborate in teamwork      |
| 6  | The learning implementation prioritizes how to negotiate                    |
| 7  | Before the learning was carried out, I practiced this competency by means of visualization or demonstration |
| 8  | Implementation of learning focuses on solving real work problems or the environment |
| 9  | Competency achievements are calculated and accumulated based on the duration of time |
| 10 | Competency-oriented determination of work procedures applicable in Industry, Business World, and the World of Work (IDUKA) |

| Total                                                                 |
|-----------------------------------------------------------------------|
| 71 | 3.89 | 0.55 |

Overall, the readiness of vocational teachers in applying design principles based on industry 4.0 was 77.8% (M = 3.89, SD = 0.55). Vocational teachers' perceptions of the application of industry 4.0 in the "doing good enough" category. Thus, the challenges of vocational teachers in learning need to be increased extensively and deeply.

3.3. Readiness for Vocational Teacher Learning in Learning Innovations

The success of digital transformation in the concept of vocational learning is new innovations in the implementation of learning. The innovations explored from this research include design and delivery innovations, approaches, strategies, methods, media, models, management, the role of teachers, and
content that supports the needs of Industry 4.0 skills. The results of the exploratory study (Table 4.) are shown.

Table 4. Vocational Teacher Learning Readiness in Learning Innovations

| No | Indicators of Innovations in Learning                                                                 | N  | Mean | SD  |
|----|------------------------------------------------------------------------------------------------------|----|------|-----|
| 1  | Design and transfer of skills to competencies using various digital technologies                     | 71 | 3,75 | 0,66|
| 2  | The learning approach uses blended learning                                                          | 71 | 3,53 | 0,90|
| 3  | Learning methods have innovations in problem solving, producing products, and the like that are fun  | 71 | 3,81 | 0,84|
| 4  | Learning media using digital multimedia                                                               | 71 | 3,88 | 0,80|
| 5  | Learning management has changed in content or competency adjustments at work at IDUKA                | 71 | 3,78 | 0,75|
| 6  | As a teacher, I have developed my capabilities through various trainings in the past year            | 71 | 3,67 | 0,85|
| 7  | Learning content is developed and simplified based on competency needs at IDUKA                      | 71 | 3,84 | 0,80|
|    | Total                                                                                               | 71 | 3,75 | 0,61|

Based on the analyzed data, it was obtained an average of 75.00% (M = 3.75, SD = 0.61). The data obtained indicates that the readiness of the teacher in carrying out learning innovations is good enough category from all aspects. The important role of digitalization and technology in learning innovation needs to be improved.

3.4. Readiness for Vocational Teacher Learning in Skills Development

The development of skills in the implementation of vocational teacher learning is reviewed based on complex problem solving, critical thinking, creativity, people management, coordinating with others, emotional intelligence, judgment and decision making, service orientation, negotiation, and cognitive flexibility. Vocational teacher readiness for skills development has been presented (Table 5.) in the results of an exploratory study as follows:

Table 5. Vocational Teacher Learning Readiness in Skills Development

| No | Indicator of Skills Development                                                                 | N  | Mean | SD  |
|----|------------------------------------------------------------------------------------------------|----|------|-----|
| 1  | My learning is set based on the needs in the industry, business world, and the world of work    | 71 | 3,89 | 0,79|
| 2  | Implementation of learning emphasizes the stage of analysis, evaluation, and creation (HOTS)     | 71 | 3,88 | 0,69|
| 3  | Achievement of competencies based on opinions from shared thinking                               | 71 | 3,77 | 0,66|
| 4  | The learning implementation focuses on how to manage information from various sources           | 71 | 4,00 | 0,71|
| 5  | The implementation of learning focuses on how to communicate and conclude the opinions of others  | 71 | 3,73 | 0,69|
| 6  | The learning implementation focuses on how to submit reports to others                           | 71 | 3,81 | 0,72|
| 7  | The learning implementation focuses on accountable decisions                                     | 71 | 4,08 | 0,70|
| 8  | In certain problems, students can explain the causes and explain alternative solutions           | 71 | 3,81 | 0,70|
|    | Total                                                                                             | 71 | 3,87 | 0,51|

The data analyzed based on the overall aspect was obtained as much as 77.4%, (M = 3.87, SD = 0.51). The data identification is categorized as good enough. This study only looks at how big the categorization is in the new concept variables of SMK learning. The definition of data is carried out descriptively, namely the extent to which DT and Industry 4.0 have been implemented in learning. Based on theory, vocational learning can follow the flow of globalization if the industrial era 4.0 has been implemented and developed. However, the world of work has changed, so that learning, namely teachers
as actors of education must follow the direction of change and maintain their status as professional
teachers. If this new concept is ignored, of course the competence of students in responding to
opportunities in the world of work will experience new problems.

The new concept of implementing learning lies in the mastery and use of digital and technology [10].
The concept is influenced by design principles, learning innovation, and skills development. The
vocational teachers must be able to provide reinforcement in the implementation of learning [11], [12].
The findings of an exploratory study conducted in Yogyakarta-Indonesia in terms of perceptions of
vocational teachers were 75.00% - 79.8% in the good category.

4. Conclusion
An exploratory study based on perceptions of vocational teacher readiness in facing the industrial
revolution 4 which is reviewed based on the involvement of digitalization transformation in the
implementation of learning by 79.8%, design principles in the implementation of learning by 77.8%,
learning innovations that have been carried out by vocational teachers are 75.00%, and the development
of skills that have been carried out by vocational teachers by 77.4%. All aspects have been developed
by vocational teachers but must be improved massively and deeply.

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