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INCREASING TEACHER COMPETENCE IN THE INDUSTRIAL REVOLUTION INDUSTRI 4.0

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Abstract. In the era of the industrial revolution 4.0, new technologies emerged which resulted in extraordinary changes in all fields, including education. If the teacher's function is only limited to transferring knowledge to students or just teaching in the classroom, then its role will be replaced by technology in this 4.0 industrial revolution era. As agents of change, teachers are required to have pedagogical competence, professional competence, personality competence, and social competence. In the era of industrial revolution 4.0, teachers must be proactive in taking advantage of the changes in science and technology that are currently happening.Technology will make teachers more confident and easier to teach their students so they can turn classrooms into creative, innovative and fun learning spaces. This paper aims to reveal the role of teachers in the era of education 4.0. The method used is literature study with descriptive analysis techniques. The results of the study show that (1) The current problem of education in Indonesia is the low quality of education compared to other countries, (2) Teacher competence (3) Education 4.0 is the answer to the era of the industrial revolution 4.0 in the world of education.

Keywords: teachers; quality of education; industrial revolution 4.0

I. INTRODUCTION

Revolution 4.0 is the fourth phase of the industrial revolution journey. The industrial revolution itself began in the 18th century, when agricultural society had become more advanced and urbanized. The Industrial Revolution 4.0 will build the availability of expanding digital technology as a result of Industry 3.0 **[1]**. The Industrial Revolution 4.0 or what is often referred to as the cyber physical system emerged in the 21st century with the main characteristic being the incorporation of information and communication technology into the industrial sector **[2]**. The 4.0 Revolution changed many things in various sectors. Where at first it required a lot of workers to carry out its operations, now it is being replaced by the use of machines. Industry 4.0 is characterized by the presence of new technologies that merge the physical, digital and biological worlds, manifested in the form of robots, mobile computer devices, artificial intelligence, driverless vehicles, genetic editing, digitization of public services, etc. In industry 4.0 equipment, machines, sensors and humans are designed to be able to communicate with each other using internet technology known as the "Internet of Things (IoT)" (Maria, Shahbodin, Pee **[3]**).

The era of the industrial revolution 4.0 also had an impact on the world of education. The use of digital technology in the learning process, completing various assignments, and increasing teacher competence cannot be separated from the flow of information and technology development **[4]**. Facing these challenges, teachers as the forefront in the world of education are required to be ready to change and adapt. The role of the teacher will not be replaced by any sophisticated machine. This is because teachers are needed to shape the character of the nation's children with manners, tolerance, and good values. Teachers are also able to cultivate social empathy, build imagination and creativity, and strengthen the spirit of national unity and integrity **[5]**. The role of the teacher is increasingly important and strategic now, the role of the teacher is very complex in order to educate the life of the Indonesian nation. Therefore, the teacher has a very starting task. Mangacu in Suharyati **[6]** article 1 paragraph 1 states that teachers are professional educators with the main task of educating, guiding, directing, training, assessing and evaluating students in early childhood education through formal education, basic education, and secondary education. This law explicitly states that professional teachers must shape the character of students according to Pancasila and the 1945 Constitution. In addition, it forms students who are intelligent in their knowledge and breadth. Learners have skills and competencies.

In carrying out the task, the teacher must have the ability and competence in managing education within the class scope, even the school scope. Competence **[7]** is the overall knowledge, attitudes, and skills. Referring to Government Regulation No. 74 of 2008, it states that teachers must have four competencies, namely: 1) Pedagogic Competence; 2) Personality Competence; 3) Professional Competence; and 4) Social Competence.

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The Minister of Education and Culture, Muhadjir Effendy **[8]**, in his written remarks commemorating National Teacher's Day and the 73rd Anniversary of PGRI at the West Java Province level, revealed that teachers need to improve professionalism in terms of mentality, commitment, and quality so that they have competence in accordance with the developments of the Industrial Revolution 4.0 because the Industrial Revolution 4.0 requires teachers to be able to take advantage of super fast advances in information technology to improve the quality of the teaching and learning process and prepare superior human resources. Thus, in the era of the industrial revolution 4.0, if teachers are only limited to transferring knowledge to students in class, the role of the teacher can be replaced by technology, but the role of the teacher cannot be replaced by any sophisticated technology in educating character, morals, and setting an example to students **[9]**.

II. RESEARCH METHODS

In conducting this research, the method used was literature study with descriptive analysis techniques. The data used is qualitative data. This study examines the relevant literature and references. The researcher followed Miles and Huberman **[10]** in analyzing the data. The method used is to reduce data, present data, and conclude and check research results on an ongoing basis in the research process. The aim of literature research is to gain an in-depth understanding of the problem in order to find a theoretical basis for research. The instruments used in this study used secondary data types, namely data andreferences from existing literature for approximately 10 years. The data collection technique used is the identification of data from various libraries or in the form of books, articles, magazines, newspapers or even websites related to the problem to be solved. Analyzing the data, researchers used content analysis techniques (T & Purwoko **[11]** with five steps namely; First, the researcher sets concrete goals to be achieved. The researcher then defines terms that need to be explained in detail. After that, the researcher then determines the unit to be analyzed and looks for relevant data. Next, the researcher establishes rational or conceptual relationships to explain how the data relate to goals. Then, the researcher took the sample. Lastly, the researcher formulates coding categories. After the researcher determines the aspects of the content to be examined in as much detail as possible, the researcher must formulate the relevant categories to be examined (Fraenkel, Wallen & Hyun **[12]**)

III. RESULTS AND DISCUSSION

Education Problems

One of the problems in education in Indonesia is the quality of education which is still of concern. UNESCO data in the 2016 Global Education Monitoring (GEM) Report shows that education in Indonesia is ranked 10th and 14th in developing countries. Meanwhile, an important component in education, namely teachers, ranks 14th out of 14 developing countries in the world.The current problems of education in Indonesia include the quality and competitiveness of Indonesian education which is very low compared to other countries. One of the indicators is the results of the Program for International Student Assessment (PISA) test, which places Indonesian children's abilities in science, reading and mathematics far below those of Singapore, Vietnam, Malaysia and Thailand. Based on the problems above, it is necessary to improve education through improving the quality of teachers because teachers are the spearhead of education. The current condition of teachers in general, the quality and competence of teachers in Indonesia are still not as expected because they are not in accordance with their scientific disciplines, there are also teachers who do not have knowledge in accordance with their fields, there are also teachers who do not understand technological advances, so that is why the current condition of teachers cannot be expected.

The rapid development of technology makes teachers required to be up to date in facing the industrial revolution 4.0. A teacher must be literate about the information technology revolution that is developing in the current era. State-of-the-art conditions like today should be a motivation for teachers to transform the available information into useful knowledge for students. In the era before the industrial revolution, the teacher's role was as a source of learning for students. The teacher is the person who knows most about the learning material. Teachers who best understand each part of the material in learning resources. Package books are the main learning resource used as a learning resource for teachers. Therefore, the teacher's knowledge will be the same as the information contained in the book. It is not impossible, the teacher memorizes the material contained in the textbook.

Vice President Jusuf Kalla has been self-critical of the government's performance, saying that the quality of Indonesia's education internationally is low. Even in the ASEAN environment, Indonesia is in the middle table, now it is under Vietnam, which used to be behind us. Even though our education budget since 2010 has increased sharply and now it has reached 400 trillion. Indonesia's per capita income is10,385 US dollars, while Vietnam was only 5,668 US dollars, but Vietnam's education surprised the World Bank because it earned an above average rating, on par with China. Even though they already have an educator certificate, many teachers have inadequate pedagogical and professional competence. Data from Kemdigbud.go.id shows that the 2015 Teacher Competency Test (UKG) results, UKG results in the pedagogic and professional fields show that the national average for these two fields is 53.02. This figure is still below the national minimum competency standard of 55. Even the pedagogic competence which is the main competency of teachers, the national average is only 48.94. This shows that the competence of teachers in Indonesia is still low.

The same thing was also expressed by Salahuddin Wahid in his article entitled "Not Everyone Can Become a Teacher" which was published on Kompas 16 March 2018. According to him, our main problem is the provision of

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quality education services that are spread across all regions. Salahuddin Wahid also quoted the opinion of Abdul Kadir Baraja who received an honorary doctorate degree from Surabaya State University who said that the main problem with our education is the lack of good teachers. This can be seen from the results of the Teacher Competency Test (UKG) where their competence is only slightly above the minimum passing score for the Teacher Competency Test. Most of the teachers (PNS) who took UKG, with a passing score of 80, there were around 41,000 teachers who failed. In the end, I had to do UKG again, with the passing mark being lowered to 65. Syarifudin Yunus (Detik.com, May 1 2019) said that the causes of low teacher competence in Indonesia are (1) the incompatibility of disciplines with the fields of study being taught. This is due to the uneven distribution of teachers in all regions so that many schools still lack teachers. To cover the shortage of teachers, the school assigns teachers to teach several fields of study so that students can study all fields of study at school. The incompatibility of disciplines with teaching fields results in the teaching and learning process not being optimal. The second cause is (2) teacher qualifications that are not equivalent to a bachelor's degree. According to the Director General of PAUD and DIkmas Ministry of Education and Culture, Harris Iskandar, the number of PAUD teachers in Indonesia has reached 552,894 people and only 47.79% have met undergraduate qualifications (Koran Jakarta.com, 2 May 2019). (3) the teacher's Continuous Professional Development Program (PKB) is still low. This program is designed to improve teacher competence through self-development due to the rapid development of science and technology. However, there are still many teachers who do not want to develop themselves to improve their competence in accordance with the times. If this continues, teachers will not have the competence in accordance with the demands of the Industrial Revolution 4.0 era (4) fourth, the recruitment of teachers has not been effective. Many teachers are recruited without going through the proper recruitment system. For example, when schools lack teachers, teachers are often accepted only on the basis of a bachelor's degree without considering the prospective teacher's ability in quality education and learning activities. Not to mention the teacher recruitment process which prioritizes kinship, not competency selection. This condition makes teacher competence lower and will hinder them in facing the Industrial Revolution 4.0 Syarifudin Yunus (Detik.com, May 1 2019) said that the causes of low teacher competence in Indonesia are (1) the incompatibility of disciplines with the fields of study being taught. This is due to the uneven distribution of teachers in all regions so that many schools still lack teachers. To cover the shortage of teachers, the school assigns teachers to teach several fields of study so that students can study all fields of study at school. The incompatibility of disciplines with teaching fields results in the teaching and learning process not being optimal. The second cause is (2) teacher qualifications that are not equivalent to a bachelor's degree. According to the Director General of PAUD and DIkmas Ministry of Education and Culture, Harris Iskandar, the number of PAUD teachers in Indonesia has reached 552,894 people and only 47.79% have met undergraduate qualifications (Koran Jakarta.com, 2 May 2019). (3) the teacher's Continuous Professional Development Program (PKB) is still low. This program is designed to improve teacher competence through self-development due to the rapid development of science and technology. However, there are still many teachers who do not want to develop themselves to improve their competence in accordance with the times. If this continues, teachers will not have the competence in accordance with the demands of the Industrial Revolution 4.0 era.(4) fourth, the recruitment of teachers has not been effective. Many teachers are recruited without going through the proper recruitment system. For example, when schools lack teachers, teachers are often accepted only on the basis of a bachelor's degree without considering the prospective teacher's ability in quality education and learning activities. Not to mention the teacher recruitment process which prioritizes kinship, not competency selection. This condition makes teacher competence lower and will hinder them in facing the Industrial Revolution 4.0

Technological developments in the Industrial Revolution 4.0 era gave rise to new challenges. The challenges in this era are unemployment as a result of insufficient knowledge and skills, socio-economic inequality due to capital-intensive technology, and threats to environmental sustainability as a result of exploitation of natural resources. The flow of technological disruption that ignores the centrality of formal education has the potential to accelerate the fall of the important meaning of education in the new order of society. As a result, structural poverty has the potential to strengthen and socio-economic disparities between citizens will widen.

Competence

Competence in Indonesian is an absorption of English, competence which means skill and ability. (Echols and Shadily **[13]**). Competence is a collection of knowledge, behavior and skills that must be possessed by teachers to achieve learning and educational goals. Competence is obtained through education, training, and independent learning by utilizing learning resources. The meaning of competence from the term's point of view includes various aspects, not only related to physical and mental, but also spiritual aspects. According to Mulyasa **[14]**, "teacher competence is a combination of personal, scientific, technological, social, and spiritual abilities Teacher competence must collaborate with the development of this revolution. Of course, the competencies possessed must follow the developments in the revolutionary era 4.0 and society 5.0 now too. From a national policy perspective, the government has formulated four teacher competencies, as stated in the elucidation of Government Regulation no. 19 of 2005 concerning National Education Standards, namely: pedagogical, personal, social, and professional competence. Collaborating teacher competencies in the era of the industrial revolution 4.0 and society 5.0, the competencies that must be considered are as follows:

1. Pedagogical Competence

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Pedagogical competence is the ability to manage students. In the era of industrial revolution 4.0 and society 5.0, teacher abilities include: (a) understanding of the basis of technology in education (b) Design of technology-based learning and dialogue for example Google Class Room, Kahoot, Quiper which hone critical thinking and problem solving (c) Technology-based learning media for example flash cards with various themes and the use of ICT in finding learning resources (d) Evaluation using applications for inputting students' values and sharing links to children's anecdotes (e) Development of actualization of students' potential with the STIFIn test and providing opportunities for children to express their potential through technology such as YouTube, blogs and others. Through teachers, the world of education must construct creativity, critical thinking, cooperation, mastery of information and communication technology and digital literacy skills.

2. Personality Competence

Personal competence is the ability to behave (real actions). In the era of the industrial revolution 4.0 and society 5.0, teacher abilities include: (a) having a noble character (b) stable and mature (c) wise and wise (d) being a role model (e) evaluating one's own performance (f) developing oneself and (g) religious. social-behavioral competence, including emotional social skills, openness, persistence, emotional stability, self-regulation skills, courage to decide and interpersonal skills (krjogja.com, 24 October 2019). This means that the teacher's personality competence in using technology is an example for his students and can adapt in responding to his progress.

3. Social Competence

Social competence is the ability of educators as part of society. In the era of industrial revolution 4.0 and society 5.0, the ability of teachers to use social media so that information can be received on time and easily communicate orally and in writing, interact effectively with students, fellow educators, educational staff, parents/guardians of students and get along politely with the surrounding community.

4. Professional Competence

Professional competence, namely the ability to master learning material broadly and deeply. This professional ability is highly demanded because it is one of the determinants of the quality of education. According to Nurholis, M Anwar, and Badawi **[15]**, in improving teacher professionalism in the 4.0 revolution era, teachers must pay attention to the following: (1) Educational competence, educational competence or internet-based learning of things as basic skills. (2) Competence for technological commercialization, having competence in bringing students to have an attitude of technology-based entrepreneurship and students' innovative work. (3) Competence in globalization, a world without partitions, not stuttering about various cultures, hybrid competence and problem solving competence (problem solver competence). (4) Competence in future strategies, the world changes easily and moves quickly, so that you have the competence to predict exactly what will happen in the future along with the strategies. (5) Counselor competence, bearing in mind that in the future the child's problem will not be difficulty understanding teaching material, but more related to psychological problems, stress due to pressure from increasingly complex and severe circumstances, a teacher who is able to act as a counselor/psychologist is needed. Why is it called a teacher because some people think that all areas of the teacher must be mastered even though sometimes we cannot lie to ourselves, if we have to master all fields it is likely that we will not be able to, but there is nothing wrong if these deficiencies must be covered by means of lifelong learning. Such as psychology, the teacher must have it, so that in dealing with student problems the teacher can provide useful enlightenment for students.

Dinar in his article entitled "Increasing Teacher Competence Towards the Era of the Industrial Revolution 4.0" which was published in a brief info journal (puslit.dpr.go.id accessed April 30 2019) stated that efforts to achieve teacher competence in the Industrial Revolution 4.0 era can be done in 6 ways, namely (1) the teacher recruitment system is carried out in a selective and standardized pattern according to the needs of technological developments. (2) a bottom-up pattern of increasing teacher competence so that any problems and constraints faced by teachers in the regions can be accommodated for later joint study. (3) continuous improvement of the teaching profession through the PKB program. (4) lesson study to improve teacher competence. (5) e-literacy.

Education 4.0

Education 4.0 is a term used by education experts to integrate cyber technology in learning. Education 4.0 is a response to the needs of the industrial revolution 4.0 where machines and humans are aligned to find solutions, solve problems and discover new innovation possibilities. Education in the industrial era 4.0 needs to be seen as developing competencies which consist of three major components, namely the competence to think, act and live in the world (Greenstein **[16]**). Thinking components include critical thinking, creative thinking, and problem solving. The acting component includes communication, collaboration, digital literacy, and technology literacy. Component living in the world includes initiative, self-direction, global understanding, and social responsibility.

The praxis of education in schools which relies on the transfer of knowledge from teachers to students is no longer effective in preparing students to enter the industry 4.0 ecosystem which prioritizes the development of 21st Century competencies. Education 4.0 can only be implemented by referring to a new educational paradigm which characterizes students as connectors, creators, and constructivists in the context of the production and application of knowledge and innovation (Brown-Martin **[17]**). The synthesis of views on the characteristics of Education 4.0 leads to the following learning features:

1) Student-centered learning (student-centered), providing opportunities for students to learn according to their respective interests and learning speed;

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2) Learning develops students' ability to explore their own knowledge from information sources by using the internet, as a vehicle for them to learn for life (life-long learning);
3) Utilization of ICT infrastructure and virtual learning tools to provide flexibility for students to find quality learning resources, record data, analyze data, and compile reports and make presentations;
4) Emphasizing hands-on learning through a learning method called "flipped classroom", in which with this method students learn theoretical aspects of knowledge at home and practice in class. This method develops self-learning habits and abilities while providing looser study time for learning in schools for competency development;
5) Develop soft-skills of critical thinking, creativity, and problem solving, especially authentic and non-routine problem solving;
6) Collaboration and in social interaction as the main approach used in competency development, to introduce work culture in the industrial world and the world of work in the 21st Century.
7) Provide flexibility for the learning process in the form of blended learning, which allows students to interact, collaborate and learn from one another in class settings or remotely via the internet.

Teachers in the Era of the Industrial Revolution 4.0

Currently we are facing the era of the Industrial Revolution 4.0. The Industrial Revolution 4.0 era emphasized the digital economy, artificial intelligence, big data and robotics. This requires the world of education to construct creativity, critical thinking, mastery of technology, and digital literacy skills. Thus, changes in the world of education and learning are a necessity. Teachers are required to change the perspective of education, both learning methods and educational concepts in accordance with the demands of the Industrial Revolution 4.0 era. The world is changing very fast. Digitization of education brings big changes. Now, the classroom is not the only place to learn. The virtual world can also be a campus. Also related to that, now in the middle of the Industrial Revolution 4.0 a number of professions replaced by artificial intelligence (artificial intelligence). Because of this rapid change, the teacher's role must be more than teaching, but also managing student learning. Teachers need to be more flexible, creative, interesting, and more fun for students. Unifah Rosyidi in her remarks as general chair of PGRI at the 73rd birthday ceremony of PGRI and the 2018 national teacher's day said that in the era of the industrial revolution 4.0, the national education system was faced with very complex but interesting challenges. The world today is facing disruption phenomena such as the birth of digitalization of the education system through innovative technological applications such as the Massive Open Online Course (MOOC) and Artificial Intelligence. MOOC is an online learning innovation that is designed to be open, share, connect or network with each other. This principle marks the start of the democratization of knowledge that creates opportunities for everyone to make productive use of technology. Meanwhile, Artificial Intelligence is an artificial intelligence machine that is designed to do specific jobs to help people with daily tasks. In the field of education, artificial intelligence helps individual learning, which is able to search for information and present it quickly, accurately and interactively. This is what marks the industrial revolution 4.0, especially in the field of education.

These two things fundamentally change teaching and learning activities. Classrooms have evolved towards digital learning patterns that create more creative, participatory, diverse and comprehensive learning. Teachers play an important role in contextualizing information and guiding students during online discussions. Teachers need to change the way of teaching to make it more fun and interesting. Likewise, the teacher's role changes from being a conduit of knowledge to students, becoming a facilitator, motivator, inspirer, mentor, developer of imagination, creativity, character values, as well as team work, and social empathy because otherwise the teacher's role can be replaced by technology. The Industrial Revolution 4.0, which is full of super-fast technology, will bring significant changes, one of which is the education system in Indonesia. Changes in the education system have an impact on the role of teachers as educators. Teachers are required to have high competence to produce students who are able to answer the challenges of the Industrial Revolution 4.0. Qusthalani mentioned five competencies that must be possessed by teachers in the Industrial Revolution 4.0 era, namely: a) educational competence, competency in educating/learning based on the internet of things as a basic skill.b) competence for technological commercialization, having competence to educate students to have an entrepreneurial attitude (entrepreneurship) based on technology and the results of student innovation ,Next is c) competence in globalization, a world without partitions, not stuttering about various cultures, hybrid competencies and excellence solve problems (problem solver competence). d) competence in future strategies, the world is easy to change and moves quickly so that you have the competence to predict exactly what will happen in the future along with the strategies. e) counselor competence. Bearing in mind that in the future the child's problem will not be difficulty understanding teaching material, but more related to psychological problems, stress due to pressure from increasingly complex and severe circumstances, a teacher who is able to act as a counselor/psychologist is needed (Ministry of Education and Culture, 1 May 2019). So when we are going to improve the quality of education, we have to improve the quality of teachers first.

In the era of disruption, not only students, but teachers and lecturers must also have 21st century skills. Because it is impossible for teachers to train these skills to students if the teachers themselves have not mastered them. Teachers must have strong competence, have soft skills, namely critical thinking, creative, communicative and collaborative. The teacher's role is as a character model, spreading passion and inspiring. This is a role that technology cannot replace. Teachers must be able to build an atmosphere that can meet the psychological needs of students, which include: needs for competence, every student needs to feel able, meaning that

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interaction in learning is able to make students feel able. This can be done by giving awards for student learning outcomes. Needs for Autonomy, every student needs to feel 'autonomous' by getting freedom and trust because every autonomous learner will not depend on the teacher in learning. Needs for relatedness, every student needs to feel himself part of a group, and interact in groups. So the learning process must be able to foster collegiality interactions and mutual support. Sustainable learning, so that students are able to pass through the era of disruption, and enter a new era called the Abundant Era, which is an abundance of information, media and learning resources.

IV. CONCLUSION

The four teacher competencies which include pedagogical, personality, social, and professional competencies must be quasi teachers coupled with the development of the era teachers must improve these four competencies so they can face the era of the industrial revolution 4.0 and society 5.0 in improving the quality of education to educate students. The relevance is very clear that the four teacher competencies collaborate with the era of the industrial revolution 4.0 and society 5.0 d, because the goals of the four teacher competencies also include the goal of integrating education staff who have entered the era of the industrial revolution 4.0 and society 5.0 in every learning process by utilizing technology so that, by increasing the quality of teacher competence as the spearhead of education that keeps up with the times, the quality of education will also increase.

One of the problems with education in Indonesia today is that the quality of education in Indonesia is very low compared to other countries. This is partly due to the low quality of teachers. the causes of the low competence of teachers in Indonesia are (a) the incompatibility of scientific disciplines with the fields of study being taught. (b) teacher qualifications that are not equivalent to a bachelor's degree. (c) the teacher's Continuous Professional Development Program (PKB) is still low. (d) fourth, the recruitment of teachers has not been effective.

Teachers in the era of the industrial revolution 4.0 will not be replaced by technology. The role of the teacher is irreplaceable because the teacher is the shaper of the character of students through education of character, tolerance and good values. However, teachers need to change the way of teaching to make it more fun and interesting. Likewise, the teacher's role changes from being a conduit of knowledge to students, becoming a facilitator, motivator, inspirer, mentor, developer of imagination, creativity, character values, as well as team work, and social empathy because otherwise the teacher's role can be replaced by technology.

Teachers in the Industrial Revolution 4.0 era need to have five competencies that must be possessed by teachers, namely: 1) educational competence. 2) competence for technological commercialization, 3) competence in globalization, a world without partitions, not stuttering about various cultures, hybrid competencies and problem solving competence (problem solver competence). 4) competence in future strategies, the world is easy to change and moves quickly so that you have the competence to predict exactly what will happen in the future along with the strategies. 5) counselor competence.

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