



Essential Skills Challenges for the 21st Century Graduates: Creating A Generation of High-Level Competence in The Industrial Revolution 4.0 Era

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ABSTRACT

This research discusses the challenges and opportunities for Islamic basic education in the post-Industrial Revolution 4.0 era. Strengthening new literacy for Islamic basic education teachers is a key to change, revitalizing literacy-based curricula, and strengthening the role of teachers who have digital competence. The teacher's role is to build a generation with competence, character, new literacy skills, and higher-order thinking skills. Islamic basic education, as a basis for determining intellectual, spiritual, and emotional intelligence in children, must strengthen 21st-century literacy skills. Starting from the creative aspects, critical thinking, communication, and collaboration. Islamic basic education urgently strengthens new literacy and digital-based curriculum revitalization. Curriculum revitalization refers to the five basic values of good students, namely resilience, adaptability, integrity, competence, and continuous improvement. Islamic basic education educators must be digital teachers, computer savvy, and free from academic ills. The goal is to create a generation of high-level competence, character, and literacy to answer the challenges of the Industrial Revolution 4.0 era.

INTRODUCTION

The industrial revolution began in the 18th century and had an influence on the progress of a nation, including Indonesia. To anticipate the Industrial Revolution 4.0, the Indonesian government has created a roadmap that includes activities in the fields of human resources, innovation, and technology. In Industry 4.0, humans must have the ability to predict the future, which is changing very fast. The challenges in the era of the fourth industrial revolution include 1) economic challenges, 2) social challenges, 3) technical challenges, 4) environmental challenges, and 5) political and regulatory challenges. According to the Ministry of Education and Culture (Dirjen, 2018) Learning is an interactive process between students, educators, and learning resources in a learning environment. Education 4.0 is a phenomenon that responds to the need for the emergence of the fourth industrial revolution (4 IRs), where humans and machines are aligned to find solutions, solve problems, and find new innovation possibilities. Learning in the era of the Industrial Revolution 4.0 is expected to produce a superior, innovative generation, produce products, and provide reinforcement to the people's creative economy.

Its success can be measured by evaluating its effect on users (students) (Dedi Lazuardi, 2017). In educational institutions, students are the main users of education. Therefore, the implementation of the educational process must be directed at developing student abilities. Education is the key word in every effort to improve the quality of human life, in which it has a role and aims to humanize humans. That's why the focus of education is directed at the formation of a superior personality by focusing on the process of maturing the qualities of logic, heart, morals, and faith. The pinnacle of education is achieving perfection in the quality of life (Dede, 2009). Entering an era that requires competition, every individual must have skills

The 21st century is like asking questions, requiring creative thinking, critical thinking, decision-making, and problem-solving skills in order to be able to choose between the information they receive, interpret the information, and produce new knowledge. Educating individuals with these skills requires careful planning (Bozer et al., 2019). In order for the development of student abilities to be carried out in a more directed manner and in accordance with the needs and challenges of the times, the development of student abilities must be carried out in a programmed manner through the curriculum that will be studied by students. The curriculum needs to be modified in line with these demands, with the aim of equipping individuals with 21st-century skills (Bell, 2010).

The success of a country in facing the Industrial Revolution 4.0 is also determined by the quality of educators, such as teachers. Teachers are required to v the ability to adapt to new technologies and global challenges. In this situation, every educational institution must prepare a new orientation and literacy in the field of education. Old literacy that relies on reading, writing, and mathematics must be strengthened by preparing for a new literacy, namely data literacy, technology, and human resources. Data literacy is the

ability to read, analyse, and use information from data in the digital world. Then, technological literacy is the ability to understand mechanical and technological systems in the world of work. While human resource literacy is the ability to interact well, not rigid, and with character.

To face the era of the industrial revolution 4.0, education is needed that can form a creative, innovative, and competitive generation. One can achieve this by optimizing the use of technology as an educational tool, which is expected to be able to produce output that can keep up with or change the times for the better. Without exception, Indonesia also needs to improve the quality of graduates according to the world of work and the demands of digital technology. Education 4.0 is a response to the needs of the Industrial Revolution 4.0, where humans and technology are aligned to create new creative and innovative opportunities. (B & Susanti, 2023) explains "that the new vision of learning promotes learners to learn not only the skills and knowledge that are needed but also to identify the source to learn these skills and knowledge."

The quality of the nation's human resources (HR). Quality human resources are one of the main assets in the progress of a nation in the fields of economy, science and technology, politics, culture, and national character (Aoun, 2017). Relating to Resources For better human beings, of course, the role of education is the most important thing, especially teachers as the main spearhead to spark the nation's successors. How can educators change the perspective of students and also adapt to this era of the Industrial Revolution 4.0? The most critical role of educators is that they must be able to maintain the delivery of knowledge and skills to students, but by conveying this longer, these students will lose out on the role of technological developments and changes in learning methods. In such conditions where educators must explore more and create learning that is not boring and can keep up with existing developments, they cannot only continue to be given past methods so that they forget constantly changing or changing developments. Not only teaching knowledge but also skills is a condition for the success of 21st-century learning. Then what skills can be used in the 21st century? and also what needs to be improved and understood about its importance (B & Susanti, 2023)

Skills to be competitive in human resource development? Knowledge will be able to grow by itself and will be increasingly widespread. Same with information and communication technology, which has changed everything in terms of life (education, work, and business) and also social relations. The role of education in a nation is very important and primary, therefore, knowing skills for 21st-century learning will be a requirement to develop the human resources desired by the state. The better the human resources, the better will be the level of welfare of its citizens, the country, and the nation (Purwanto, 2022). This will also create ample job opportunities, and can also reduce the unemployment rate in Indonesia.

21st-century learning is actually an implication of the development of society from time to time. As it is known, society developed from a primitive

society to an agrarian society, then to an industrial society, and now it is shifting towards an information society. The informative society is characterized by the development of digitalization. From the 1960s to the present, the use of computers, the internet, and mobile phones has grown exponentially. Society has changed from an offline community to an online community. For the record, internet users in Indonesia are 88.1 million people and have increased to as many as 196.7 million, or 73.7 percent of the population (Adrian & Agustina, 2019). Like it or not, due to the increasingly rapid development of digitalization in society, learning in schools in Indonesia must keep up with these developments. Therefore, it can be concluded that we must be technologically literate and be able to apply various ICT-based learning methods or models so that we can keep up with current developments in digitalization. The purpose of writing this article is to find out how learning innovations from the 21st century can be applied in Indonesia.

LITERATURE REVIEW

What is Education 4.0?

Technology began to penetrate the educational process in the new millennium, and both students and teachers began to use technology in fundamental ways (otherwise known as Education 2.0). Education 3.0 emerged as technology advanced, especially the widespread adoption of a more user-generated internet, Butt, R., Siddiqui, H., Soomro, R. A., & Asad, M. M. (2020). This enabled students to access their own information sources, the ability to learn electronically and platforms to communicate with teachers and other students. Education became more networkable, with students having their own direct link to a range of different knowledge sources, rather than being concentrated on a back-and-forth between students and teachers. Education 4.0 is a technique of learning that is connected with the fourth industrial revolution and focuses on transforming the future of education through advanced technology and automation, Tangahu, W., Rahmat, A., & Husain, R. (2021). Smart technology, artificial intelligence and robotics are part of this industrial revolution. They are all affecting our daily lives. Universities must prepare their students for a world in which cyber-physical systems are ubiquitous across all industries if they are to continue to produce successful graduates. This entails incorporating technology into the curriculum, altering the learning process entirely, and leveraging technology to enhance the university experience.

The Benefits of Machine Learning in Education

a. Preparing Students for Evolving Industries.

As cyber-physical systems become more integrated into many businesses, the skills needed for employees will undoubtedly change. According to McKinsey Digital research, 60% of all vocations could have at least a third of their tasks automated as a result of the fourth industrial revolution. As a result of technology's ability to keep us linked at all times, employment responsibilities are becoming increasingly flexible and adaptable.

Education 4.0 is all about changing with the changes, and for higher education institutions, that means figuring out what their future graduates will need.

b. Automating Basic Administrative Tasks

Teachers devote a significant amount of time to administrative tasks. The application of artificial intelligence and machine learning in education can aid in the automation of activity grading and assessment. Administrative tasks can be automated, allowing teachers to spend more time with pupils and improving the learning experience.

c. Offering Personalized Education

The goal of using AI and machine learning in education is not to replace instructors but to assist them in better understanding each student's potential and limitations.

d. Providing Constructive Criticism

Teachers can use AI in the classroom to help them enhance the instructions they provide their students as well as make learning more engaging and exciting. Students benefit from immediate feedback, since it enables them to see where they are doing wrong and how they may improve.

e. Offering Access to All Pupils

Learning becomes universally accessible for all pupils when AI and machine learning is used in the classroom. It can help students to overcome geographical hurdles to learning. Universities must integrate their teaching and operations with technology improvements in order to prepare future graduates for work. Education 4.0 is a method of learning that is aligned with the fourth industrial revolution. Involving AI in the field of business and corporate environment is changing the need an employer is searching for in the candidate. With machine learning in education, every job prospect will be different. Adaption of learning incorporating artificial intelligence and machine learning in education will keep the students up to date. It highlights the importance of preparing pupils to face and overcome problems. To stay up with the times, old educational paradigms must be revisited with a futuristic perspective. Students should be able to master the abilities required by rapidly changing technology, they should be guided rather than instructed, and knowledge should be made available rather than fed to them. Both general and vocational education should strive to prepare students to compete in the labor market.

METHODOLOGY

This research uses a descriptive qualitative method. Data collection uses a research approach in the form of a literature study. According to (Hermann et al., 2016), literature study research has the following characteristics: (1) This research deals with text or numerical data, not with the field or eyewitnesses, events, people, or other objects; (2) The data are ready-to-use or deal directly with existing data in the library or other sources; (3) Data in the library generally comes from secondary data sources, meaning that researchers obtain data from second-hand, not from first-hand in the field; (4) The condition of the data in the library is not divided by space and time.

Sources of data in this study were examined from various sources, including books, literature, research reports, scientific essays, theses, dissertations, and articles, both printed and electronic, relating to learning skills in the 21st century and human resource development. The initial stages of this research are carried out by reading data sources or literature from various reliable sources, such as e-books, scientific articles, or websites concerned with the topic of discussion, then analyzing the contents of the data sources related to material about learning skills and developing human resources in the 20th century. 21. After conducting the analysis, I conclude the results of the analysis. This method is carried out so that this article can provide relevant information based on data sources, and provide a clear picture of learning skills in the 21st century as well as the importance of skills as demands in human resource development.

RESULTS AND DISCUSSION

21st-Century Learning and Practice

The industrial revolution 4.0 is also referred to as the industrial revolution," which will change patterns and relationships between humans and machines. Therefore, to face various challenges and demands in the current global century, it is necessary to learn and practice in the 21st century to prepare quality 21st-century generations.

21st-century learning is learning that prepares the 21st-century generation to face various global demands and challenges. In this century, advances in technology and information are developing very rapidly and affecting all areas of human life, one of which is the field of education. Education is part of the effort to improve the welfare of human life while advancing the development of the nation and state. Education in the 21st century has undergone changes marked by the development of new literacy skills, such as digital literacy, information literacy, and media literacy. Learning in the 21st century is oriented towards activities that train skills in students by leading to the learning process. Learning can be interpreted as a teacher's effort to provide stimulus, guidance, direction, and encouragement to students so that the learning process occurs. In this definition, learning is not a process of learning knowledge but rather a process of forming knowledge by students through their cognitive performance (Wilson, 2019, p. 112). Therefore, the learning system in the 21st century is actually no longer teacher-centered but student-centered. This aims to provide students with skills in thinking and learning skills in the 21st century, or what is known as "The 4C Skills" formulated by the Framework Partnership of 21st Century Skills, including (1) communication; (2) collaboration; (3) critical thinking and problem solving; and (4) creativity, innovation, and innovation (Nilasari, 2020, p. 3). In its application, it directly requires students to do activities without being limited by space or time (Kristanto et al., 2017, p. 15). 21st-century learning cannot be separated from the demands of 20th-century learning, namely the integration of technology as a learning medium to develop learning skills. In this case, the field of education in the 21st century demands changes in teaching materials,

learning media, facilities, and learning models provided to students to meet increasingly stringent global demands.

The 21st century is the century of openness or globalization. Therefore, the learning content is expected to be able to fulfil 21st-century skills, namely:

1. learning and innovation skills, including mastery of various knowledge and skills, learning and innovation, critical thinking and problem-solving, communication and collaboration, and creativity and innovation,
2. The skills of digital literacy include information literacy, media literacy, and ICT literacy.
3. Career and life skills include flexibility and adaptability, initiative, social and cultural interaction, productivity and accountability, and leadership and responsibility.

Currently, individuals aged 18 and 23 years known as "Generation Z" (Gen Z) have changed due to technological advances. This generation has learning preferences where they are fully involved in the learning process. They welcome challenges and enjoy group discussions and a highly interactive learning environment. For them, learning is limitless; they can study anywhere and anytime and have unrestricted access to new information. They pay attention to learning that involves active collaboration with team members and learning in places other than the classroom. In addition, the use of digital tools and online forums is becoming more popular; students prefer to be integrated into their learning process. Because Gen Z students love digital tools so much, they expect them to be available whenever they need them with low barriers to access. Gen Z students need to be prepared to thrive in the fourth industrial revolution.

In his speech, the Indonesian Minister of Education and Culture, Muhajir Effendy, at the May 2 Education Celebrates activities at Yogyakarta State University, said that the presence of the industrial revolution 4.0 made the world experience changes that were increasingly fast and competitive. To deal with this, the Minister of Education and Culture considers it necessary to revise the curriculum by adding five competencies. Specifically, students are expected to have the ability to think critically. Second, students are expected to have creativity and innovative abilities. Third, ability and communication skills. Fourth, the ability to work together and collaborate, and finally, students are expected to have self-confidence.

In addition to vocational education programs, the curriculum must adapt to the increasingly competitive business and industrial climate. Students are prepared with a curriculum that contains artificial intelligence, the Internet of Things (IoT), wearables (augmented reality and virtual reality), advanced robotics, and 3D printing. In short, the curriculum must link and match schools with the world of business and industry.

The World Economic Forum (Prayogo, 2016) has predicted the 10 best skills for the future. Creativity will be one of the three skills required by workers. With the massive movement of new products, new technologies, and new ways of working, workers must become more creative to benefit from

these changes. Although robots can help to reach the desired places and destinations more quickly, they cannot be as creative as humans. Negotiation skills (making deals) and intelligence in thinking and acting (cognitive flexibility) are downgraded and replaced by data-based decision-making (big data).

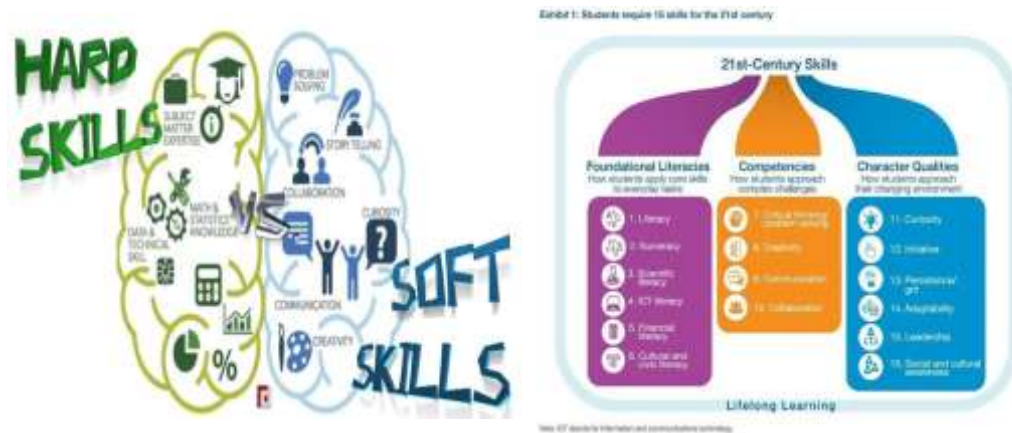


Figure 1: Skills in 2015 & 2020 (Alex Gray, 2016)

A survey conducted by the World Economic Forum's Global Agenda Council on the Future of Software and Society shows that people expect artificial intelligence machines to be part of company boards of directors by 2026. Likewise, active listening, which is considered a core skill today, will disappear completely from the top 10. Emotional intelligence, which is not in the top 10 today, will be one of the top skills required by all.

Learning Principle of 21st Century

In (Syahputra, 2019), it is explained that there are 4 main principles of 21st century learning, which are explained and developed as follows:

1. Instruction should be student-centered. Where the development of learning should use a student-centred learning approach, students are placed as learning subjects who actively develop their interests and potential. Students are no longer required to listen to and memorize subject matter given by the teacher but try to construct their knowledge and skills according to their capacity and level of thinking development while being invited to contribute to solving real problems that occur in society (Andriani et al., 2022).
2. Education should be collaborative. In this case, it must be taught to be able to collaborate with others. Collaborate with people who have different backgrounds and values. In exploring whether their values differ from yours and constructing meaning, students need to be encouraged to be able to collaborate with their classmates. In working on a project, students need to be taught how to appreciate each person's strengths and talents and how to take on roles and adapt appropriately to them.
3. Learning should have context. It was explained that learning would not have much meaning if it did not have an impact on students' lives outside of school. Therefore, the subject matter needs to be

related to the daily lives of students. Teachers develop learning methods that allow students to connect with the real world. The teacher helps students find value, meaning, and belief in what they are learning and apply it in their daily lives. The teacher conducts student performance assessments that are associated with the real world.

4. Schools should be integrated with society. In an effort to prepare students to become responsible citizens, schools should be able to facilitate students' involvement in their social environment. For example, holding community service activities where students can learn to take on roles and carry out certain activities in a social environment. Students can be involved in various development programs in the community, such as health, education, environmental programs, and so on. Apart from that, students also need to be invited to visit orphanages to train their empathy and social awareness.



Figure 2. Essential Skill 21st century (Hughes and Acedo (2014))

Implementing curriculum in 21st century

In all existing societies in the world, children are initiated into certain modes of acquiring experiences, a set of norms, knowledge, and skills needed for their survival in the future. In most societies, almost all the time, one of the symptoms-or maybe conditions-of pluralism is conflict and arguments about what should be contained in the curriculum. Today, however, the conflicts and arguments run even deeper and undermine rational discussions about what should be included in the curriculum. Much discussion in the professional field of the curriculum today focuses on the basic question of what is curriculum (Egan, 2003). The curriculum is "social fact" in the sense used by the French sociologist and Professor

In pedagogy, Emile Durkheim's meaning is that curriculum as a 'social fact' can never be reduced to individual actions, beliefs, or motivations (Young, 2014). A curriculum is a structure that limits not only the activities of those involved, especially teachers and students but also those who design the curriculum or seek to achieve certain goals (Yeo, 2021). Etymologically, the term curriculum comes from the Greek, namely *curir* which means "runner" and

curere which means "place to race". In French, the term curriculum comes from the word *courier*, which means to run (to run). Furthermore, the curriculum can be interpreted as a distance that must be traveled by a runner from the start line to the finish line to get a medal or award (Anaelka, 2018). Then, in meaning, the curriculum is defined as "a plan of learning", namely a set of learning plans (Taba, 1962). In the traditional view, the curriculum is formulated as a number of subjects that must be taken by students to obtain a diploma (Dedi Lazuardi, 2017). Another opinion defines the curriculum "as a constraint on what students can learn," which is related to what students can learn (Yazid, 2018).

In Law Number 20 of 2003 concerning the National Education System, it is explained that the curriculum is a set of plans and arrangements regarding objectives, content, and implementation of learning activities to achieve certain educational goals. So, the curriculum is a learning plan that contains objectives, content, and implementation of learning activities to achieve educational goals. A curriculum is basically specific knowledge that is organized to be transmitted from one generation to another. The curriculum is also defined as everything that can be taught and learned by students at various stages and different ages (Wijayanti, 2017).

Alignment of learning at the practical level with curriculum constructs is the first focus of completing 'homework in the field of education'. Curriculum policies must elaborate on students' abilities on pedagogic dimensions, life skills, the ability to live together (collaboration) (Sung, 2018), and the ability to think critically and creatively. Prioritizing 'soft skills' (Subekt et al., 2017) and 'transversal skills', life skills, and skills that are virtually unrelated to certain fields of work and academics (Setiyorini et al., 2017). situations are widely used in many work situations such as critical and innovative thinking skills, interpersonal skills, global citizenship, and media and information literacy.

Teacher Competence and Skills in the Revolutionary Era 4.0 Revolution

Currently, digital developments are so advanced that teachers are not the only source of information for learning. Therefore, teachers must be able to become facilitators and motivators for their students to find and utilize learning resources through digital progress. This is also an inspiration for students to be more active in learning and find sources of information through developing technology. Relevant to Research from (Wijaya et al., 2016) using the literature review method shows that there is a TPACK (Technological Pedagogical Content Knowledge) framework model, which is a new type of knowledge that educators must master in order to be able to integrate technology into learning. Likewise, research conducted (Wiedarti, 2018) with a qualitative approach shows that teachers must have 4C skills, and be able to utilize technology through these skills. The following are the characteristics of the 21st-century teacher:

1. The teacher's interest in reading must be high.
2. The teacher must have the ability to write scientific papers Besides the teacher's high interest in reading, teachers are also required to have the ability to write scientific papers. Because the teacher, in the course of his duties, will always give various assignments to his

students. Some of the assignments required by teachers for their students include reviewing books, and journal articles, writing short essays, and others (Widiyanto, 2016). This all requires teachers to be proficient in writing.

3. Teachers must be creative and innovative in practicing learning models. The demands of 21st-century learning require creative and innovative teachers to practice learning models that can construct their students' knowledge. The combination of learning models and the use of digital technology will lead to student creativity and innovation (Wibawa, 2018).
4. Teachers are able to transform culturally. The "teacher-centered" view of the previous learning culture must be able to transform towards "student-centered". Make students learn subjects that can develop and construct their knowledge to the fullest (Trilling & Fadel, 2009).

In addition, there are also characteristics of students in the 21st century, namely:

1. Think critically, have the will and ability to solve problems and communicate, and be creative, collaborative, and innovative. Have the will and ability to be digitally literate, in new media and ICT. Flexible and adaptive initiatives. Friendly with Technology The world is always changing and developing to a higher level, one of the changes marked by technological advances. Everyone will not be able to fight against technological advances, therefore, in order not to be crushed by it, teachers must have the will to learn continuously. Changes in the world due to technological advances do not need to be used as a threat but are faced positively, learn and adapt, and are willing to share with colleagues or colleagues both successes and failures (Schwab, 2017).
2. Cooperation (Collaboration) Maximum results will be difficult to achieve if done individually without cooperation or collaboration with others. Therefore, teachers must have a strong will to collaborate and learn with and or from others. This attitude is needed now and in the future. Doing so is not too difficult, because the world is interconnected, so there is no reason not to collaborate with others.
3. Creative and Taking Risks Creativity is one of the skills needed in the Top 10 Skills 2020, creativity will produce a structure, approach, or method to solve problems and answer needs. Teachers need to model this creativity and work smarter on how this creativity is integrated into their daily tasks. Educators also don't need to be too afraid of being wrong but are always ready to face the risks that arise (Redhana, 2019). Mistakes are the first step in learning, and they don't need to be a stopping factor in moving forward, mistakes are meant to be corrected.
4. Have a good sense of humor. Humorous teachers are usually the teachers most often remembered by students. Laughter and humor can be important skills to help build relationships and relaxation in

life. This will reduce stress and frustration, as well as give other people a chance to see life from another side.

Teaching as a Whole (Holistic) In various learning and teaching theories, we recognize individual and group learning. And, lately, learning styles and learning that is individual are increasing. Therefore, today's teachers need to recognize students individually, including their families and the way they learn (know them as a whole, including the constraints they experience both personally and within their families).

CONCLUSION

The era of the Industrial Revolution 4.0 has changed the way we think about education. The changes made are not only in the way of teaching but far more critical is the change in the perspective of the concept of education itself. Therefore, current and future curriculum development must complement students' abilities in pedagogic dimensions, life skills, and the ability to live together (collaboration) and think critically and creatively. Develop soft skills and transversal skills, as well as invisible skills that are not related to certain work or academic fields. However, it is useful in many work situations, such as interpersonal skills, living together, the ability to be a global-minded citizen, and media and information literacy. Curriculum development must be able to direct and shape students who are ready to face the industrial revolution era with an emphasis on science, technology, engineering, and mathematics (STEM), as well as character. Curriculum reorientation that refers to ICT-based learning, the internet of things, big data, and computerization, as well as entrepreneurship and apprenticeships, needs to become a mandatory curriculum to produce skilled graduates in the fields of information literacy, technology literacy, and human literacy. Things that need to be considered by schools and teachers in deciding how education and learning are organized, namely student-centered learning, collaboration (collaborative learning), meaning, and integration with the community. To support the intended education and learning process, methods such as (1) flipped classroom, (2) integrating social media, (3) Khan Academy, (4) project-based learning, (5) Moodle, and (6) schoology, can be integrated into the learning process.

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