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Deep Learning: a Theoretical Review

Pembelajaran Mendalam: Tinjauan Teoretis

Endang Fauziati
Universitas Muhammadiyah Surakarta, Sukoharjo, Jawa Tengah, Indonesia
e-mail: endang.fauziati@ums.ac.id

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Abstract
The term Deep Learning has become the current issue in educational field all around the globe. Deep learning is true learning, in the sense, that it is enduring, as opposed to shallow or surface learning that tends to be momentary. This term was proposed by Fullan et al. to refer to the process of acquiring the global competencies known as the 6Cs: character, citizenship, collaboration, communication, creativity, and critical thinking. These competencies are suitable to prepare students to be confident in encountering globalization challenges. Deep learning is designed based on a new pedagogical model, a learning partnership between and among students and teachers to master of content knowledge, create and use new knowledge in the real world. The focus of teaching is to develop students' ability to manage their own learning and to do things with their learning. In Indonesian context, Deep Learning is implemented based on a framework consisting of four main components: learning framework, learning experience, learning principle, and graduate profile dimension framework. The learning experience framework includes three aspects: understanding, applying and reflecting. In practice, Deep learning is based on three main learning approaches mindful learning, meaningful learning, and joyful learning.
Keywords: *compassionate learning; deep learning; meaningful learning; mindful learning; new pedagogy*

Introduction

Deep learning has become the current issue in educational field and claimed good attentions from educators and policy makers all around the globe. Deep learning is true learning, in the sense, that it is enduring, as opposed to shallow or surface learning that tends to be momentary. One definition of deep learning comes from Pellegrino & Hilton (2012) who proposed the term "deeper learning" to refer to the process through which learners become capable of taking what was learned in one situation and applying transferring it to new situations. Through deeper learning learners can develop their expertise in a particular domain of knowledge. The product of deeper learning is transferable knowledge, including content knowledge of how, why, and when to apply this knowledge to answer questions and solve problems. While shallow learning may allow learners to recall facts, concepts, or procedures, deeper learning allows them to transfer what was learned to solve problems

Corresponding to Pellegrino & Hilton (2012), Fullan et al. (2017) proposed the term *deep learning*. It refers to the process of acquiring the six global competencies also known as the 6Cs: character, citizenship, collaboration, communication, creativity, and critical thinking. It includes the acquisition of knowledge and understanding of global and intercultural issues, the ability to learn from and live with people from diverse

backgrounds, and the attitudes and values necessary to interact respectfully with others. Through deep learning, learners really understand and engage in something that is important to them or valuable to the world. They transform their reality through learning, both individually and with others. This can be done through project–based learning and internship project–based learning in order to create connections among what students learn in different disciplines and them to develop collaboration skills. It uses the changing world as the platform for continuous transformation.

The core learning outcomes of deep learning (6Cs)

Deep learning with 6Cs elements is seen as suitable to prepare students to be confident in encountering globalization challenges. The explicit aim is to master the six deep learning competencies through deep learning experiences, but engaging, relevant, and authentic. Fullan et al. (2014; 2018) identify the deep learning outcomes or the 6Cs of global competencies that include character, citizenship, collaboration, communication, creativity, and critical thinking. These six deep learning competencies are used to design and to assess learning, measuring the growth in these competencies.

Character relates to individuals' qualities that are essential for being effective in a complex world, such as perseverance, resilience, responsibility, honesty, compassion and integrity in action. *Citizenship* deals with a global perspective, sensitivity to and respect for diverse values and worldviews, having interest in human and environmental sustainability, and solving complex problems in the real world to benefit citizens. Education that promotes citizenship inspires students to help humanity, find their voice and agency to affect change. *Collaboration* means being able to work in teams, learn from others and contribute to the learning of others, and make social networking. *Communication* means being able to communicate effectively orally and in written form with a variety of digital tools. *Creativity* is about having an imagination for economic and social entrepreneurialism, generating novel ideas, and demonstrating leadership to pursue the ideas into practice. *Critical thinking* relates to students' ability to think critically to design projects, solve problems, and make effective decisions using a variety of digital tools and resources. The most important attribute of critical thinking is curiosity, the desire to stay well informed.

Rationale for deep learning

A fundamental rationale for deep learning in the constantly changing world. Today's world is revolutionary that the changes and challenges are happening very swiftly and are global in their impact. The challenge becomes greater when dealing with job employment. In recent years, companies demand employees with Higher Order Thinking Skills to solve company problems, rather than just with manual skills. For this to happen, students should be equipped with competences to deal with these challenges and to be lifelong learners. They should be able to apply (transfer) what they have learnt to new real situations. Students need to acquire core competencies known as 21st Century Skills or Deep Learning Skills prepare them for their life and their future work. These competencies include *ways of working* (communication and collaboration, *ways of thinking* (critical thinking, problem solving, creativity and innovation), *tools for working* (ICT literacy), *and ways of living in the world* (global citizenship and civic responsibility). (Fullan, 2012)

An additional rationale for deep learning is that in the traditional schooling the students are less engaging. As it was reported by Gallup Poll (2016) that at least a third of students are "actively disengaged"; they are substantially less connected to learning. The students' engagement in learning is decreasing, especially when they get older. About 47% of school students were engaged at school, 29% were not, and 24% were "actively disengaged". The main reason for lacking in engagement is because they do not have an opportunity to lean topics suitable with interest and this is due to the limited access to

interesting elective courses. The Gallup polling found that students feel that their schools take a "one size fits all" teaching approach and do not consider the students' uniqueness in learning style.

Theoretical foundation: new pedagogy

Fullan et al. (2014) state that deep learning is designed based on a new pedagogical model. A new pedagogical model is not simply adding ICT tools on the traditional curriculum, neither a "flipped" classroom where instructional material is delivered online (Richardson, 2012). A new pedagogy is substantially more complex. A new pedagogy can be defined as a new model of learning partnerships between and among students and teachers. Its learning objective is to achieve deep learning that is facilitated by advanced digital access (Fullan et al., 2014). Deep learning goes beyond the mastery of content knowledge; it creates and uses new knowledge in the world. The focus of teaching is no longer to master the content, but to the learning process that develop students' ability to manage their own learning and to do things with their learning (Fullan & Langworthy, 2014).

In the new pedagogy, students are required to create new knowledge and connect the knowledge to the world by using the power of digital tools. It transforms students' learning by building knowledge about deep learning competencies, the 6Cs—collaboration, communication, critical thinking, creativity, character, and citizenship—in order that they can succeed now and in the future. A new pedagogy is not just an instructional strategy. It main aim is to achieve two outcomes, that is, to foster deep learning and to gain the competencies that prepare students to be creative, connected, collaborative, life-long problem solvers, and to be healthy, holistic human beings in this interdependent world.

Actually, most instructional elements of the new pedagogy are not new teaching strategies, such as the discovery learning and the inquiry based learning that have been advocated for at least a century by John Dewey, Jean Piaget, Montessori, and Vygotsky. What is considered new in the new pedagogy among others include the followings. (1) It aims to achieve deep learning goals (6Cs), involving the use of new knowledge in the real world. (2) It realizes in the new learning partnerships between and among students and teachers. (3) The learning process manifests in the mutual discovery, the creation and use of knowledge. (4) It is accelerated by digital technology inside and outside of schools. In conclusion, the new pedagogy integrate the digital technology and the inquiry based learning into the classroom to support students' interests and engagement. This to prepare students for their life after school and promotes a life-long learning mindset. (Fullan & Langworthy, 2014)

In the old pedagogical model, the quality of the teachers is assessed primarily based on their ability to deliver content in their field; their pedagogical competence is secondary. Their teaching strategies are to direct their instruction. By contrast, in *the new pedagogical model*, the foundation of the teachers' quality is their pedagogical competence. Their teaching strategies are to form partnerships with students in mastering the learning process. The digital technology is used to discover and master the content knowledge. *In the old pedagogy*, the term *applying knowledge* means working on tasks or problems to demonstrate mastery of concepts within the boundaries of textbooks, classrooms, and schools. The technology is used to facilitate the delivery of knowledge. *In the new pedagogy*, applying knowledge means using digital technology to enable students to apply their solutions to real-world problems with authentic audiences beyond their school boundaries. The technology is not just to facilitate the delivery and consumption of knowledge, but to enable students to use their knowledge in the world. (Fullan & Langworthy, 2014)

In the new pedagogy, the integration of digital technology is to create three core components of the deep learning outcomes: the new learning partnerships, the deep learning tasks, and the digital learning tools and resources.

The New Learning Partnerships: The relationship between students and teachers and

their roles change. Students today want to be actively engaged, determine their own learning path and monitor their own learning journeys. They do not want to accept the role of as passive receivers of knowledge. As they can access digitally to huge amount of information, they become skeptical to have teachers who deliver content knowledge using traditional instructional approaches. However, the teachers cannot simply let them go by themselves; instead, teachers should manage the learning partnerships between and among students and teachers. Through such partnership, teachers become learners themselves who view learning through the eyes of their students. (Fullan & Langworthy, 2014)

The Deep Learning Tasks: These tasks should enable students to engage and practice the learning process learning through discovering and mastering the knowledge and skills then create and practice them in the real world. In deep learning tasks, students are expected to become leaders in their own learning, determining and pursuing their own learning goals using the available resources and ICT tools. This is called a learning leadership. Through deep learning tasks, students re-structure their learning in more engaging ways using ICT tools and resources, from the focus on content mastery to the development of students' capability to learn, create and implement what they have learnt. The students have real experiences to create and practice the new knowledge in the world beyond the classroom. They can develop their key future skills, the 6 Cs. In deep learning tasks, students may collaborate with teachers in designing the structure of the tasks. (Fullan & Langworthy, 2014)

The digital learning tools and resources: Fullan & Langworthy (2014) do not give explicit description of the digital technology in the new pedagogies. He only highlights that the integration of ICT tools in the new pedagogies is to ignite powerful learning. The technology and powerful teaching strategies (deep learning tasks) would result in in deep learning. The technology is used to accelerate learning and the other core component, i.e., the learning partnerships between and among students and teachers. In summary, the ICT tools and resources enable learners to discover and master the content knowledge, to collaborate in learning, and to use the new knowledge for real purposes.

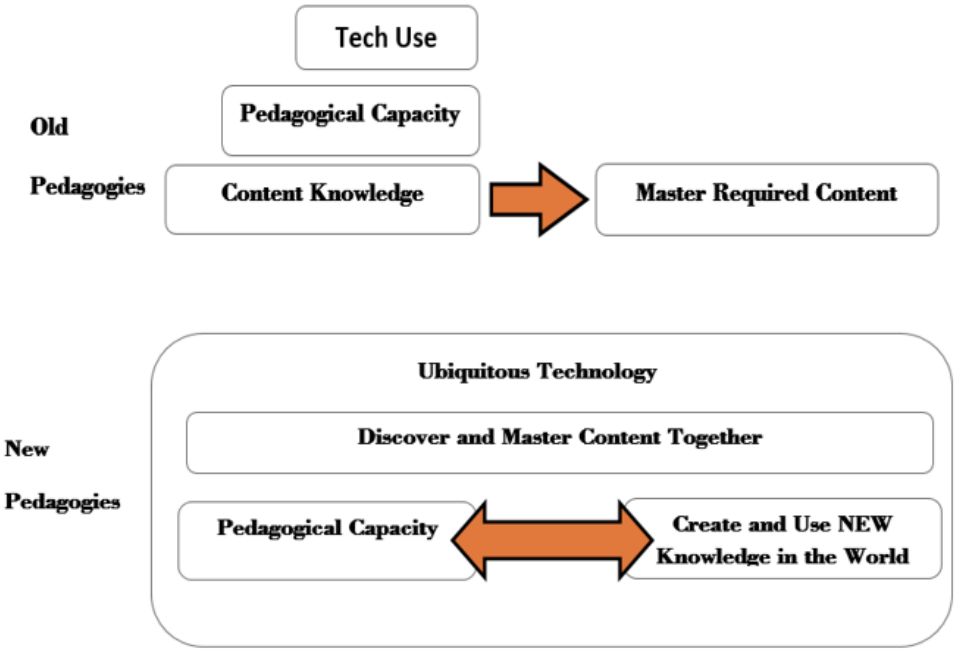

Figure 1 Old and New Pedagogy adopted from Fullan & Langworthy (2014)

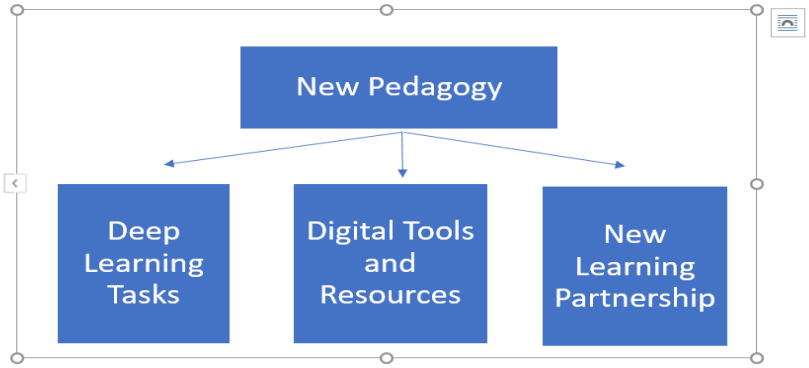

Figure 2 New Pedagogy adopted from Fullan, Quinn, & McEachen (2018)

Four elements of learning design

Fullan, Quinn, and McEachen (2018) discuss four elements to create the new pedagogy that promote deep learning. These elements are used as guide lines for teachers to design instruction that allows the development of students' six Global competencies. The four elements includes Learning Partnership, Learning Environment, Leveraging Digital, and Pedagogical Practices.

Learning Partnership: It deals with the way students and teachers collaborate with one another. Partnership also include the collaboration with parents, experts, and the community. The learning experience allows students to be connected to the real opportunities in the local, national, and global context. Therefore, learning moves beyond the classroom walls and builds on the students' interests and talents.

Learning Environment: It deals with two interrelated aspects. The first is the cultivation of a learning culture of learning that promotes the students' potentials and the second deals with the design of physical and virtual setting that optimizes the development of students' competencies (Fullan, Quinn & McEachen, 2018). In order for Deep Learning to occur, an intentional consideration of learning environments is essential. Teachers must consider that these environments extend beyond the classrooms. For example, there are places that provide multidimensional spaces for group collaboration, quiet places for reflection, and active areas for investigation and documentation (Quinn et al, 2020). In order that these physical and virtual spaces could maximize learning, the culture of learning should be promoted within these spaces, such as students asking questions, questions valued above answers, various learning models, explicit connections to real-world application, collaboration, transparent and authentic assessment (Fullan, Quinn, McEachen, 2018).

Leveraging Digital: It allows students to communicate freely, to enhance students' capacity to be autonomous learners who can take control of their own learning, and to make learning more relevant and authentic. Teachers play the role as activators who ensure that students can use digital applications to facilitate learning and to create new knowledge. They have to be skillful in selecting the most appropriate apps for their students. They also play the role as their students' partners in learning that is accelerated by through the technology (Fullan & Langworth, 2013). There are so many ICT tools to choose from, and they have to choose the ones that could enhance learning. Not all ICT tools are good for pedagogy and great pedagogy can exist without technology. Therefore, pedagogy must be the foundation to consider before and above the ICT tools.

Pedagogical Practice: It deals with the use of teaching strategies that engage all students and provide them with the opportunities for success. Teachers should be able to select the teaching strategies that scaffold students' learning experiences that is

suitable with the students' needs and interests of the students that can make learning authentic and meaningful (Fullan, Quinn, & McEachen, 2018). Teachers may use a wide repertoire of strategies such as inquiry-based learning, problem-based learning, and project-based learning.

Deep learning in Indonesian context

In 2025, the Minister of Primary and Secondary Education Abdul Mu'ti launched the Deep Learning as a new approach that must be applied in primary and secondary schools. The Curriculum and Learning Center (PUSKUJAR) defines Deep Learning as an approach that emphasizes the creation of a learning atmosphere through a conscious learning process (mindful), meaningful learning, and joyful learning in order to develop the learners' intellectuality, ethics, aesthetics, and kinesthetic in a holistic and integrated manner (PUSKUJAR, 2025). Through Deep Learning, it is expected that students can understand the material in deeply. Learning focuses on deep, pervasive, and long-lasting understanding, not just memorizing information. As the opposite is Surface Learning in which students focus on external goals, such as getting grades, certain awards, pleasing others. Students only do what is needed and focus on the ability to repeat what they have learned.

In practice, Deep Learning is implemented based on a framework consisting of four main components, namely learning framework, learning experience framework, learning principle framework, and graduate profile dimension framework.

The learning framework includes four aspects, namely Pedagogical Practice, Learning Environment, Utilization of Digital Technology, and Learning Partnerships. Pedagogical Practice is a teaching strategy or method chosen by teachers to achieve learning objectives, namely realizing the eight dimensions of the graduate profile. The Learning Environment emphasizes the integration between physical space, virtual space, and learning culture to support deep learning. Utilization of Digital Technology as a catalyst to create more interactive, collaborative, contextual learning, with various teaching resources. Learning Partnerships form a dynamic working relationship between teachers, students, parents, communities, and professional partners.

The learning experience framework includes three aspects of learning, namely understanding, applying and reflecting. *The first aspect is understanding.* It refers to learning activities where students actively construct knowledge in order to deeply understand concepts or materials from various sources and contexts. Knowledge consists of essential knowledge (foundational knowledge), applied knowledge (applied knowledge), and knowledge of values and characters (humanistic knowledge). *The second aspect is application*. In learning application activities, students are expected to be able to apply the knowledge they have acquired in real life contextually. Knowledge is obtained through deepening knowledge (extending knowledge) and through reflection (evaluating and interpreting the process and results of real practices that have been carried out. *The third aspect is reflection*. Reflection learning activities are expected to involve students in self-regulation activities. Students are able to manage their learning process independently, including planning, implementing, supervising, and evaluating their learning methods. *The fourth framework is the principle of learning*. In classroom practice, Deep learning is based on three main learning approaches, namely mindful learning, meaningful learning, and joyful learning.

Mindful learning

With regard to Mindful Learning, Langer (2010) states that mindfulness is a state as being fully present at the moment, without judging or evaluating it, without reflecting back on memories of the past, without looking ahead to anticipate the future. Mindfulness is not just about meditation; it is a way of living with awareness. It enlightens us to come to a deeper understanding and lead us to new ways of living in this world. It guides us to reflect on

our own life and learn from it. Mindfulness does not happen automatically. This process takes effort. Mindfulness may be simple, but it is not easy. Mindful learning, therefore, refers to learning strategy used to raise the awareness of learning, sensitivity of context and novelty. It is very effective because it drives the students to new perspective, open minded learning, contextual, and aware of the self (Langer, 2010).

Therefore, in Mindful learning, learning i**s** approached with an open, curious, and non-judgmental attitude. It emphasizes calmness, sensitivity, and openness in thinking. Individuals are situated in the present and deeply immersed in learning, actively draw distinctions and notice new things, and see the familiar in the novel and the novel in the familiar. Just the opposite, *Mindless learning is* habitual, automatic thought and behavior. Learners just rely on established categories made in the past. They see things from a single perspective, become rigid and certain. They fail to consider context, are entangled in a single and inflexible perspective, and are unaware of other possible ways of knowing (Langer, 2010).

Meaningful learning

Meaningful Learning is a concept proposed by David Ausubel **(**1963**).** Ausubel's theory was influenced by Piaget's theory of cognitive structure. He concerned how individuals learn large amounts of material from verbal/textual presentations in a school setting. Learning is an active process, not simply responding to an environment. Knowledge construction begins with observation of events and objects through concepts that is already known. Learners seek to make sense of their surroundings by integrating new knowledge with what they have already learned.

Ausubel (1963) believed that the acquisition of large amount of knowledge is possible only through meaningful learning. To learn meaningfully, learners must relate new knowledge to relevant concepts they already know or mental schemas. They need to have a solid background knowledge and skills related to the topic in order to construct the new knowledge. Meaningful learning involves two processes: the reception process employed in meaningful verbal learning and the discovery process employed in formation of concept and problem solving. The reception process becomes meaningful by appropriate use of various teaching techniques (Ausubel, 1963).

There are three key elements for meaningful learning to occur. The first key element is that the topic discussed in the classroom should be relevant to the learners' need, experience, or interest. The second element is that learning activities process should provide relevant context and meaningful experience. The third element is that learning should provide a clear benefit for the learners (Ausubel, 1963).

In addition, Shuell (1992) mentions five principles of meaningful learning process that include active, constructive, cumulative, self-regulated, and goal-oriented. Active: The learner must cognitively engage with the presented information using an appropriate learning style. Constructive: The new information is incorporated into a cognitive structure and it is recreated as a new form showing the learners own understanding. Cumulative: New information builds upon old information rather than being replaced or stored independently. Self-regulated: Meaningful learning is an independent process. The learner must conduct and regulate their own learning process as well as make decisions on how to organize the mental model. Goal-Oriented: An outcome or expectation should be worked by the learner. Moreover, the goal must be devised individually.

Joyful learning or compassionate learning

In pedagogy literature, we find the term Compassionate Learning or Compassionate Pedagogy (Jacobs & Alcock, 2019) and not the term Joyful Learning. In this paper, the term Compassionate Learning rather than Joyful Learning is preferable. So, what is compassion? According to the Oxford English Dictionary, the word *compassion* comes from Latin *compati*, meaning to suffer with. Aristotle (in Gibbs, 2017) considered

compassion is a moral virtue aroused in the form of a painful feeling towards others' undeserved suffering. There is a broad consensus among scholars in the field that compassion involves feeling towards others who are suffering and being motivated to help them (Smith & Haakonssen, 2002; Goetz et al., 2010). Jacobs & Alcock (2019) state that compassion is a concern for others' well-being with a desire to help. In sum, compassion is not only about feeling touched by others' suffering, but also about wanting to help them.

The concept of Compassionate Pedagogy comes from Hao's (2011) study on critical compassionate pedagogy based on Freire's (1970) concept of critical pedagogy, The Pedagogy of the Oppressed. The ultimate aim of education is to liberate individuals from the oppressive systems and promote a more equitable society. Education has power to break the chains of the oppressive systems and it empowers people to become agents of a social change. Then, in Pedagogy of Hope, Freire (2004) revisits Pedagogy of the Oppressed and evolves his ideas on education for political reasons, called critical education for a post-conflict state. His view on education goes beyond that of the cultural productive function of the school; it offers a more humanist approach to education. Vandeyar & Swart (2016) state that Freire's humanist aspect of pedagogy lends educators to create a useful construct for a pedagogy of compassion. The exploration of the human experience is the key to a liberal education. Human experience involves suffering and teaching is an act of compassion, and compassion is the act of suffering together.

Hao (2011) defines compassionate pedagogy as a pedagogical commitment that allows educators to criticize institutional and classroom practices that ideologically place underserved students at disadvantaged positions, while at the same time be self-reflexive of their actions through compassion as a daily commitment. In the same vein, Lipka (2019) states that a pedagogy of compassion allows us to put our hearts into education; when we can do it in our teaching, we can teach to the whole person. Compassion pedagogy is the foundation of good teaching.

Compassionate Teacher: In every way, Freire's (1998) critical pedagogy can be referred to as a pedagogy of love. For Freire, love here is not a romanticized love, but a fighting love that strives to announce commitment to humanity. Passionate teachers are committed to a shared humanity with love; without love, they are just empty vessels, having nothing to teach and lack the moral for critical pedagogy. Passionate teachers have the enthusiasm and passion for teaching and facilitate empowering pedagogy. They are committed to the support the marginalized students by countering the oppressive pedagogy and creating a classroom environment that is conducive to learning for all students. They educate the whole person by tapping into the students' cognitive, emotional, physical, and spiritual development (Laucella, 2019).

Laucella (2019) presents some examples of compassionate teaching practices as a launching point for teachers to consider. First, provide detailed syllabi as students like to know what to expect, to see the flow of the course. Second, build in flexibility to accommodate various assignments and reduce stress by setting a clear expectation about the extent to which the instructor would accommodate. Another idea for flexibility is to allow students to retake quizzes or substitute grades when appropriate (Schacter et al., 2021). Third, model empathy and grace as students learn a lot from watching the teachers. Therefore, it is important that they model the virtues for students to develop. Fourth, cultivate communication as it is the most important part of compassionate pedagogy. Teachers can initiate relationships with their students by showing up to class early or reaching out to anyone who are (Schacter et al., 2021).

Conclusion

Deep learning is true learning and it is enduring, as opposed to shallow or surface learning that tends to be momentary. Fullan et al. proposed the term *deep learning* to refer to the process of acquiring the six global competencies also known as the 6Cs:

character, citizenship, collaboration, communication, creativity, and critical thinking. Through deep learning, learners really understand and engage in something that is important to them or valuable to the world. The fundamental rationale for deep learning in the constantly changing world. Students need to acquire core competencies known as 21st Century Skills or Deep Learning Skills prepare them for their life and their future work. These competencies include *ways of working* (communication and collaboration, *ways of thinking* (critical thinking, problem solving, creativity and innovation), *tools for working* (ICT literacy), *and ways of living in the world* (global citizenship and civic responsibility). In addition, deep learning is make students more engaged in the classroom.

Deep learning is designed based on a new pedagogical model, that is, a model of learning partnerships between and among students and teachers. Its learning objective is to achieve deep learning that is facilitated by advanced digital access. Students are required to create new knowledge and connect the knowledge to the world by using the power of digital tools to build their deep learning competencies (the 6Cs). There are four elements in the new pedagogy that promotes deep learning, including Learning Partnership, Learning Environment, Leveraging Digital, and Pedagogical Practices.

In Indonesian context, Deep Learning must be applied in primary and secondary schools. Deep Learning emphasizes the creation of a learning atmosphere through a conscious learning process (mindful), meaningful learning, and joyful learning in order to develop the learners' intellectuality, ethics, aesthetics, and kinesthetic. In practice, Deep Learning is implemented based on a framework consisting of four main components, namely learning framework, learning experience framework, learning principle framework, and graduate profile dimension framework. About the principle of learning, the classroom practice is based on three main learning approaches, namely mindful learning, meaningful learning, and joyful learning.

Mindful Learning is learning strategy used to raise the awareness of learning, sensitivity of context and novelty. It is very effective because it drives the students to new perspective; open minded learning, contextual, and aware of the self. Meaningful Learning is where learners must relate new knowledge to relevant concepts they already know or mental schemas. It goes through two processes: the reception process and the discovery process. Compassionate Learning is a pedagogical commitment that allows educators to criticize institutional and classroom practices that ideologically place underserved students at disadvantaged positions, while at the same time be self-reflexive of their actions through compassion as a daily commitment. It is a pedagogy of love, a fighting love that strives to announce commitment to humanity.

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