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Exploring the Direction of Teaching and Learning in the Post-Humanism Era

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ABSTRACT

Post-humanism is a perspective within the humanities and social science that is concerned with how rapid changes in science and technology and the 4th Industrial Revolution affect individuals and wider society. The purpose of this study is to examine how education should change in the post-humanist era. The content of this study is as follows: Four perspectives of post-humanism in the postmodern era are identified and described. First, post-anthropocentrism claims that humans are no longer the best. Second, neo-materialism criticizes the limits of the human-centered perspective and suggests that the relationships between humans and tools and material and society should be re-established. Third, actor–network theory identifies behavior as not just a characteristic of humans, but a characteristic of a coalition of actors. Fourth is post-phenomenology. Next, the question of how education should change according to these four perspectives is addressed. The direction of education should first accept that humans are not the best through transcendental education. This means that education should reflect the fundamental characteristics of human beings, existence, and relationship with others, while including intellect and sensibility. Second, learning tools should have intrinsic meaning rather than only being a means of learning. Third, it is necessary to find the intersection between technology and ethics through participatory communication as a network of actors for technology. Post-phenomenology presents a perspective on learning in a different dimension from the existing humanistic view of knowledge and learning.

KEYWORDS

Post-humanism, post-anthropocentrism, new-materialism, actor–network theory, post-phenomenology

1. INTRODUCTION

A paradigm is the standard that sets the direction of politics, society, economy, and education in a given era. The 21st century paradigm called as the post-human age (Jang, Shin, & Park, 2019). The 4th industrial revolution has dramatically changed our lives through the introduction of artificial intelligence (AI), the Internet of Things (IoT), drones, self-driving cars, 3D printing, nanotechnology, and bioindustry as we transition into a post-human era (Bostrom, 2003). "Post-humans" can be described as beings whose health and longevity are greatly improved through cutting-edge science enhancement technology, with intellectual abilities and emotional control that is superior to those of current humans (Bostrom, 2005). With the emergence of post-humans created by the technological environment of the future, it is necessary to explore what kind of coexistent relationship can be maintained between all material and non-material entities on Earth, including the present human beings, and to consider what kind of efforts should be made in the field of education. Knowledge acquired mechanically and memorized in the past cannot act as an absolute law in the changing environment of the post-human era and the 4th Industrial Revolution.

The social influence of digital technologies based on big data, AI, the IoT, virtual reality, and augmented reality is growing. In the field of education, efforts to combine technologies such as data, networks, AI, the cloud, virtual reality, and augmented reality are becoming essential elements. In line with these changes, there is an increase in demand for major changes in the learning content, methods, and environment in education (Kim, 2023; Lee, 2021). "Edutech," a concept that technology has emerged to help promote educational activities, is attracting attention as a new direction of educational practice as a result of its potential to overcome various limitations in schools and education fields, provide new and diverse learning experiences, and provide customized education (Ha, & Lee, 2021). This use of edutech is basically a human-centered educational method. Therefore, in the post-human era, the need for a different educational approach is required that promotes individual thinking ability. While the current educational approach has focused on socialization, there is a limit to applying traditional educational methods in the post-human age. If the characteristics of the post-human age

are to overcome the limits of human memory, dismantle the order of the past, and create new values, what human abilities should be cultivated? Accordingly, various studies have been conducted on the direction of education in the post-human era are being conducted (Ha, & Lee, 2021; Jang, Shin, & Park, 2019; Lee, 2021; Oh, & Cho, 2020).

The postmodern era is experiencing a variety of changes and challenges, such as an explosive increase in knowledge and information, rapidly changing technology and society, and a multicultural and diverse population. These changes are also affecting the fields of education and teaching and learning. Accordingly, the reasons for exploring new teaching and learning directions are as follows. The way students learn has changed. In the era of postmodernism, the way students learn has diversified. Previously, teacher-centered lecture formats were dominant, but now emphasis is placed on student-centered, participatory learning. Students learn based on their individual interests and experiences, and build knowledge through interactions. As a result, a new direction of teaching and learning is needed.

First, there is an explosive increase in knowledge and information. In the era of postmodernism, the explosive growth of knowledge and information requires changes and updates in educational content. We need to change the direction of teaching and learning so that students are equipped with the competencies needed for the future through the introduction of new knowledge and technology. Second, technology and society are rapidly changing. In the era of postmodernism, technology and society are changing rapidly. As a result, the competencies required by students are also changing. Changes in technology and society must also be reflected in the fields of education and teaching and learning. Accordingly, it is necessary to explore new teaching and learning directions (Yu, 2023). Third, it is a multicultural and diverse population composition. In the postmodern era, multicultural and diverse demographics are emerging in most countries. Accordingly, teachers and educators need the ability to understand and respect the diverse cultural backgrounds of students. In this respect, a new direction of teaching and learning is also needed. Fourth, it is necessary to understand nonlinear knowledge and complexity. In the postmodern era, nonlinear knowledge and complexity became more important. This knowledge and complexity is difficult to handle in traditional teaching and learning methods. Therefore, teaching and learning methods must change so that students can understand and deal with nonlinear knowledge and complexity based on exploring new teaching and learning directions. Fifth, it is necessary to understand nonlinear knowledge and complexity. In the postmodern era, nonlinear knowledge and complexity became more important. This knowledge and complexity is difficult to handle in traditional teaching and learning methods. Therefore, teaching and learning methods must change so that students can understand and deal with nonlinear knowledge and complexity based on exploring new teaching and learning directions.

The purpose of this study is to examine how education should change in the post-humanist era. First, the four perspectives of post-humanism are described, and then how changes in education should be made according to each of the four perspectives.

2. METHOD

To explore the direction of teaching and learning in the post-human era, post-human academic sources (domestic: KCI, DBPIA, RISS, KISS, international: Education Resource, Science Direct, ERIC) were examined, from which 70 theses and 15 books were derived. The search keyword is teaching and learning in the post-human era. Of these, 32 papers and 10 books were subsequently used in this study. As shown in [Table 1].

[Table 1] Papers and Books Used

Division	Number of Searches	Number of Uses
Paper	70	32 (45.7%)
Book	15	10 (67%)

3. The Four Perspectives of Posthumanism

Post-humanism is a perspective within the humanities and social science that is concerned with how rapid changes in science and technology and the 4th Industrial Revolution affect individuals and wider society. Post-humanism reinterprets the meaning and role of human nature and existence in an advanced science and technology-centered society of the future beyond a humanistic perspective. Post-humanism began with the critical notion that it is difficult to understand human nature and human existence from the existing humanistic perspective due to the rapid development of science and technology. It is part of an effort to recognize human beings anew by breaking away from the anthropocentric viewpoint of the human status and role in the future social, cultural, and environmental conditions brought about by a scientific and technological civilization (Park, 2019). Further, post-humanism is an ideology that either denies or transcends humanism and regards humans as the center. It is a philosophy and socio-cultural theory that criticizes various moral values pursued by existing humanist ideas. Post-humanism criticizes existing humanistic ideas from four perspectives. Their contents are summarized in [Table 2].

[Table 2] Criticism of Humanistic Ideas in Post-Humanism

humanistic thought	post-humanist thought
anthropocentric worldview	aiming for post-anthropocentrism
humanistic thought	new materialism
humans are the only active subject	actor–network theory
phenomenology	post-phenomenology

The first aim is for post-anthropocentrism, which concerns the independence of each object, including humans, and from where the reality of humans is derived; even questioning whether humans themselves are real. Following ancient Greek philosophy, anthropocentrism based on the Bible emerged from the Middle Ages. Since then, the attempts of Copernicus and Galileo to escape from an anthropocentric way of thinking based on the Bible through science is the beginning of post-anthropocentrism in the anthropocentric worldview. De-anthropocentrism, (another name for post-humanism), refers to a worldview that deviates from the original ideas of anthropocentrism. In the existing humanistic world view, humans are considered superior, but in post-humanism, there is an ontological reinterpretation of the human status in the natural ecosystem. According to post-humanism, there is a symbiotic ecology of humans and non-humans in which nothing holds privilege in the process of change and creation of the natural and social world. Thus, according to post-humanism, only humans are no longer superior.

The second approach is new materialism. New materialism and new materialism (new materialism) are used together. In this study, it focuses on materiality such as science technology, tools, and machines. New materialism is a humanistic dualism, a modern human-centered worldview from the 1990s that explains how the dualisms of nature/culture and human/materials can be overcome. New materialism was prominent among constructivists and essentialists during the early 20th century, who considered the interaction between matter and forces by paying attention to microscopic actions and experiences of agents. According to new materialism, the content of the material world is in a state of constant flux, and nature, culture, matter, and society, as continuous elements of materiality, are mutually influential in an ever-changing world. New materialism advocates an ontology rather than an epistemology, a flat monism that rejects the difference between nature and culture, especially spirit and matter (Coole, & Frost, 2010).

The key features of the new materialism are: First, it is relational materiality. The material world and its contents are not fixed or stable entities, but relational, uneven, and always fluid. Relational materiality is that things and material goods gain value and meaning through their relationships with people and other things. This perspective emphasizes the importance of social, cultural, and historical context in shaping the value and importance of material goods, and material things can only be understood in relation to the network of relationships to which they belong. Relational materiality emphasizes that material goods are not simply physical objects, but are always intertwined with human meanings, values, and social relationships. Second, it is a monistic ontology. Nature and culture should not be treated as separate areas, but as parts of a continuum with materiality.Monistic ontology is a philosophical view that asserts that there is only one basic entity or principle that constitutes reality, as opposed to dualistic ontology, which posits the existence of two distinct and separate entities or principles. The specific nature of this one entity can vary according to various monisms, including material matter (material monism), mind or consciousness (ideal monism), and ultimate, undifferentiated reality (neutral monism). Monistic ontology is contrasted with dualistic and pluralistic ontology, which postulates the existence of multiple entities or principles. Third, non-human agency is Bennett. Agency extends beyond human agents to non-humans and inanimate objects. Non-human agency refers to the ability of a non-human entity, such as an animal, machine, or natural phenomenon, to act and affect the world in ways not solely determined by human intention or control. This concept challenges traditional notions of agency as entirely human attributes and demonstrates that many non-human entities have the ability to create effects, make choices, and shape the environment in ways that cannot be reduced to human influence or control. it means. Fourth, material objects and technologies are not passive or neutral, but actively influence and shape human behavior and social norms. This perspective shifts the focus from examining only the cultural, social, and psychological dimensions of human experience and instead recognizes the active role of material objects in shaping our lives and societies. New materialism recognizes that technology and material culture do not simply reflect society, but shape society, forming a mutually constructive relationship between humans and the material world. New materialism is a philosophical view that views matter and physical processes as active and influential agents shaping the world rather than passive objects. The implications of new materialism in education challenge the traditional anthropocentric view of education and emphasize the role of material, physical, and technological factors in shaping knowledge and learning experiences. This perspective emphasizes the importance of considering the material conditions and physical environment that influence how knowledge is created, transmitted and applied. It also suggests the need for a more integrated and interdisciplinary approach to education that integrates research on physical and material processes with technological literacy development.

The researcher has recently undergone laser-assisted in situ keratomileusis **(**LASIK) eye surgery. Such revision surgery does not fix eyesight problems, but rather requires the recipient to wear glasses or contact lenses. After a surgical procedure to correct deterioration of visual acuity due to a refractive error, is it now the researcher's eyes looking at the computer screen, or the glasses or contact lenses placed over the eyes? It is not possible to see the screen properly with only your eyes. You cannot see even with only the contact lenses of the glasses engraved on your eyes. Without interaction with my eyes, the contact lenses imprinted on my eyes cannot see independently. Therefore, it is more accurate to say that the researcher's eyes and the contact lenses of the glasses placed over the eyes are looking at the manuscript on the computer screen together. There are theoretical perspectives such as post-humanism, new materialism, and social materialism that lie behind criticism of the anthropocentric worldview (Barad, 2007; Fenwick, & Edwards, 2011; Gamble, Hanan, & Nail, 2019). New materialism requires a new perspective. New materialism has criticized the limits of the human-centered perspective and identified a need to redefine the relationship between humans and tools, materials and society. New materialism is a trend that seeks to renew the relationship between objects, animals, nature, tools, and technology, which have been considered passive beings, rather than dividing them into dichotomies such as human and object, nature and society, and thought and material(Kim, Chang, & Lee, 2021).

The third perspective is actor–network theory. Bruno Latour and Steve Woolgar are the pioneers of this theory, which posits that to properly understand society, science, and technology, the network of relationships between human and non-human elements should be well formed and stabilized in order for science, technology, and society to develop. Importantly, both humans and non-humans are active agents in the hybrid relationship network. For example, trains can run only with railroads, but cannot run in fields without railroads. It changes when a human holds a gun, but a gun can change when held by a human. Actor network theory rejects both the social constructivist and technological determinist perspectives. Technological determinism is that technology has its own vitality and develops society regardless of human will. Social constructivism is when different people come together to discuss and agree with each other to create some knowledge. Actor network theory considers the network between actors (human and non-human) important. This new point of view overturns the fact that "human beings are the only active subjects with the power of action," which has been taken for granted when analyzing social phenomena. In other words, actor–network theory together with new materialism theory emphasizes breaking away from the anthropocentric worldview. Actor–network theory denies the dichotomy of human and nature, subject and object, mind and matter. In actor–network theory, an actor is an entity in which a broad set of humans and non-humans intertwine. The actor means all thing that has the power to act through a network of relationships (a mutual relationship with others). Thus, the agency of an agent is always an association of the elements that compose it and is expressed as a result of a network of relationships. The agent is not a characteristic of only humans, but a characteristic of the association of actants.

Agents have agency, which means that non-humans can change our human behavior just as we can change other people's behavior. For example, the author is currently writing a thesis, and the keyboard, mouse, body, screen, and print are all actors. The mere existence of the keyboard itself is not an actor. Reality is not determined by existence itself, but is manifested in relationships with other actors. To become an agent, there must be a new performance of the agent, a trial. Actors are defined by trials that result in new performances in emergent states. For example, in order for the keyboard itself to become an actor, the keyboard becomes an actor in the process of the author performing the keyboard. The keyboard has the ability to write papers. Not only for writing papers, but also when the keyboard itself meets other actors and is used as a pedestal, it becomes an actor with the ability to act. Even if it is used to drive nails with a keyboard, it becomes an actor. In this way, not only humans but also non-humans have the ability to exert various influences on all actors. The keyboard does not have an intention or a will. It means that the keyboard affects my writing behavior, just as my friends and family can change my behavior. If you have a car, you change the way you walk to the act of riding a car. Science and technology are human practices that transform or tame these non-human actors into meaningful ones for humans.

An actant refers to a series of active roles played by people, organisms, machines, animals, and objects. For example, the act of flying comprises a network of non-human actants such as airports, airplanes, runways, and check-in counters as well as human actants (pilots, flight attendants, and passengers). In this case, the actant means a mediator (intermediary), which is a connecting entity that enables the formation of relationships between actors and various human and non-human actors constituting a network. Basically, mediator and actor can be said to be synonymous, but it is differentiated that "mediation" and "connection" are emphasized among actors. Intermediaries can be classified as text, technical artifacts, knowledge and skills, and money (monetary value). A network of relationships means a map-like drawing of how actors determine each other's roles and discover and mobilize other actors. All power of action appears as a result of the union of a network of heterogeneous and hybrid actors.

According to actor–network theory, translation appears as the central concept. Translation is the process by

which one actor associates with other actors to form a network of relationships, and a specific actor within a network recruits and persuades another actor so that the other party can accept their understanding or intention, just like translating Korean into English. The success of translation is important in embracing other actors in the network of relationships by accepting them according to their will and intention. According to actor–network theory, a nodule is what makes a complex association of actors appear as a simplified network of relationships. If actors form a network of relationships well to realize their own interests, a new network of relationships can be recreated. For other examples, when an author writes a thesis, the actor is connected to me, the keyboard, the screen, the computer body, and the printer. I dose not write a thesis without a keyboard actor other than me. When writing a thesis, there is me, a ballpoint pen, and a notebook. Without the agent of a ballpoint pen, writing cannot be written on paper. In this way, humans and all other non-human agents are connected. Even in the case of writing, the word itself and the sentence itself can be actors. When you write a word or a sentence, that word or sentence becomes an actor and can influence the writing of the next one.

In the view of Bruno Latour, the humanistic perspective ignored the active role of these non-human actors (airports, airplanes, runways) and the hybrid characteristics of humans and non-humans through interaction. The actor-relational network theory originated in the fields of philosophy of science and philosophy of technology. However, the rejection of the dichotomy claimed by modern humanism and the concept of non-human actants in the equal position of humans and non-humans are being actively studied in various academic fields such as education, geography, and history (Lee, Kim, 2019). The focus of actor-relational network analysis is to uncover how a phenomenon arises by discovering and analyzing the networks built by all human and non-human actors, material and non-material entities related to a particular phenomenon. Within the network, all actants have equal status, except for human superiority. Bruno Latour was concerned not only with society constituting science, but also with science constituting society, noting human actors as well as non-human actors, such as machines, materials, electronics, sensors, and records. He focused on the point that actors from the two groups form a network by endowing the ability of actors not only with the actions of scientists but also with various instruments and records in the laboratory (Latour, 2018). After all, actor network theory does not distinguish or discriminate between humans and non-humans. Doesn't differentiate between science and technology. It does not separate subject and object. Doesn't differentiate between macro and micro. It has no boundaries and crosses boundaries. Therefore, it was seen that human capabilities be quite different depending on the networks (humans and non-humans) they have built.

The fourth perspective is post-phenomenology. Modern phenomenology, which is derived from the phenomenology of Hegel, is generally associated with the German philosopher Husserl and is recognized as subjective idealism in philosophy. The important feature of phenomenology is the orientation of consciousness. Paradoxically, phenomenology does not examine a phenomenon as it appears on the outside but looks at what lies behind it. To understand phenomenon correctly, we need to examine the real aspect beneath. To do so, it is important to study mental phenomena such as individual consciousness, attitude, and values. Phenomenology attempts to describe our experience as it is, as a report on experienced space and time, the relationship between the subject and the world, and the world, without considering the psychological occurrences and causal explanations that historians, scientists, and sociologists can provide. Merleau-Ponty addresses the issue of somatization as a point of connection between the body and the external environment to overcome the dichotomy. The body is essential to understanding things. If you have been driving on a road you have often travel on, you can pass it without comparing the width to the car even if you enter the narrow road, you often use. According to post-phenomenology, macroscopic perception is a perception that forms an interpretive relationship as a social, cultural, and historical dimension acquired while interacting with the body, the world, others, and objects. Post-phenomenology attempts an epistemological reinterpretation of human experience, cognition, and knowledge (Bogost, 2013; Simonsen, 2013). Post-phenomenology is a new discipline developed by introducing phenomenology in a descriptive philosophical context (Lee, 2016).. Moreover, it is based on a neutral ontology that treats humans and other objects equally, rather than a dualistic phenomenology that distinguishes between human beings, (the subject of Husserl), and objects, the objects of cognition(Neimanis, 2017).

4. Direction of Teaching and Learning in the Post-human Era

Teaching and learning in the era of humanism presents the direction of education through the theories of behaviorism, cognitivism, and constructivism. However, these theories have limitations in explaining the direction of teaching and learning in the post-humanist era. Because behaviorist, cognitivist, and constructivist theories all focus on human/animal action, the post-humanist era is limited in terms of application due to the development of cyborgs and mechanical men. Accordingly, actor–network theory emerged as a way of addressing this limitation. In [Table 3], behaviorism, cognitivism, and constructivism theories are presented to suggest the direction of teaching and learning in the humanistic era together with actor–network theories pertinent to the post-humanism era.

[Table 3] Behaviorism, Cognitivism, Constructivism, and Actor–network Theory

Compare	Behaviorism (Behavioral science)	Cognitivism (Traditional cognitive science)	Constructivism (Constructive cognitive science)	Network of Actors theory
representative scholar	Pavlov, Thorndike, Skinner	Bruner, Ausubel	Piaget, Vygotsky	French scientists and engineers: Bruno Latour, Michel Callon British Scientist: John Law
philosophical background	objectivism: externally mediated reality	objectivism	subjectivism: internally constructed reality	posthumanism
paradigm	teaching instruction	teaching learning	learning	network of actors
definition of learning	changes in overt behavior	changes in cognitive structure existing perception of new information	creation of personal meaning based on subjective experience	learning is achievement through building various networks Learning is not the composition of the subject on the object, but the process of exerting influence on the object and the object. It is a structured structure that is structured
occurrence of learning	stimulus and response, both sides connect and strengthen	obtaining, organizing, storing information; emphasis on withdrawal activity	based on personal experience creation of meaning for the world	network of actors
Influencing factors of learning	maximizing the learning effect overt stimuli and systematic arrangement of reactions and determination of stimulus timing	learners who can promote information processing activities emphasis on mental activity	situational context, human learning activity as the subject of learning, of knowledge to be learned dynamic interaction	human, Interactions among new materials, actors, actants, and networks. taming various non-humans and forming networks with them
teaching and learning strategies	explicit teaching strategies	learner's internal thinking strategies	creating a learning environment and situational context and authenticity provide assignments	harmonious connection between man and machine, machine and machine, machine and nature, and man and nature

Behaviorism, cognitivism, constructivism, and actor network theories are all important theories in terms of teaching and learning. These theories help understand how students learn and help educators develop effective

teaching methods. Each of these theories has its own approach and characteristics, but the common goal is to improve students' learning experience. Behaviorism focuses on student behavior from a teaching-learning perspective. When students do something, they are rewarded or punished for it, and these rewards and punishments act as moderators of learning. Teachers or educators encourage learning by rewarding students for desirable behavior and punishing students for undesirable behavior. Therefore, teachers or educators focus on changing students' behavior.

Cognitivism focuses on students' thinking processes and cognitive abilities from a teaching-learning perspective. Students acquire new knowledge by building on previous knowledge and experiences, solving problems and advancing their learning in the process. Therefore, teachers or educators focus on understanding students' cognitive processes and using appropriate teaching methods to develop students' problem-solving skills. Constructivism focuses on constructing new knowledge based on students' experiences and knowledge in the process of acquiring knowledge from the perspective of teaching and learning. In the process of acquiring new knowledge, students use their previous experience and knowledge to build understanding and build new knowledge. Therefore, constructivism values interaction, problem solving, and self-directed learning in the process of constructing knowledge independently by students. In theory, knowledge is not accepted as an objective fact, but viewed as subjectively constructed and interpreted by individuals, which gives students a deeper understanding of knowledge.Teachers or educators focus on respecting and actively supporting these students' independent learning processes, and providing an environment for problem solving and self-directed learning.

From the perspective of teaching and learning, Actor-Network Theory places importance on the interaction of various elements in the learning environment to affect student learning. The theory understands that all factors involved in learning are connected as a network, and that all factors, such as students, teachers, textbooks, assignments, and facilities, interact with each other and affect learning. Thus, the teacher or educator focuses on structuring the learning environment and supporting student learning. While each of these theories has its own approach and characteristics, they all help improve students' learning experiences and help educators develop effective teaching methods. Help. Educators can understand these theories and use them appropriately to support student learning.

4-1. Post-anthropocentrism and Teaching and Learning

First, there should be education about transcendence that humans are not the best. Transcendence is never in the concept of one-sided spirituality oriented towards religious education or pious education. Transcendence education means education that reflects on existence and relationships with others, which are the fundamental characteristics of human beings, while including intellect and sensibility to a greater extent. Beyond the anthropocentric worldview, beyond the boundaries between nature and the environment, the material world and technology, which are all living things, even nature, ecosystems, and technologies that have been conquered are in the discourse of education. In this respect, it is necessary to include discussion and education on the categories and norms of transcendence in a post-humanism society (Park, 2019). If social justice (emphasized in existing humanistic education) highlights issues of racial discrimination, economic inequality, feminism, and various powers and privileges, then post-human social justice should expand the object of interest to all non-human beings(Kuby & Rowsell, 2017). For example, new interests and perspectives on climate change, space creation, and AI are needed.

Second, learning theories should be developed not for animals or humans, but for cyborgs or post-humans who emerge as a synthesis of humans and machines. The post-humanist era of education changes the nature of knowledge, learners, and teachers. Education and learning in the era of post-humanism cannot depend on behaviorism, cognitivism, and constructivism, which comprise teaching and learning based on human psychological characteristics against the background of independent and autonomous existence of existing human learners. This is because humans in the post-human era are part of a network that can survive only by having close relationships with all things (Braidotti, 2016). In this respect, future learning should be quite different from humanistic learning methods.

4-2. Neo-materialism and Teaching and Learning

First, a learning tool should find its meaning as a learning tool itself, not as a means of learning. Within the existing education system, learning tools were regarded as aids in education, but did not acquire an ontological status corresponding to the teacher’s role. However, in the new materialistic worldview, educational tools and machines are not subordinated to humans. In this respect, new efforts to understand the relationship between overlooked technologies should examine the use of learning tools in an educational context from a different perspective than before. The attempt from a new materialist perspective to newly establish the relationship between humans and scientific and technological development requires research on the use of learning tools in educational situations from various perspectives. In the field of early childhood education (that considers play tools important in cognitive development) and in the field of education the use of various digital tools, there has

been an increase in studies based on the theory of new materialism (Toohey, 2022). Learning in these fields as well as in various learning fields is necessary to study the meaning of use of a tool itself, not as a means.

Second, digital literacy education is essential. The seven representative technologies of the 4th Industrial Revolution are: AI, the IoT, 3D printing, self-driving cars, big data, intelligent robots, and cloud computing. Biomimetic technology (represented by copying technology), artificial organs, neuromorphics, brain-machine interface (represented by connection technology), augmented humans, genetic scissors technology (represented by transformation technology in connection), and synthetic biology (represented by combination technology) all have super intelligence The universalization of these technologies is already changing our lives toward the post-human condition. Technology is moving from the level of resembling life to the direction of substituting life. With the development of science and technology, the illusion of human's unique thinking ability is disappearing, and analog knowledge or human learning about it may no longer be effective(Quinn, 2018). The digital environment is erasing the boundaries between humans and machines, online and offline, real and virtual, authentic and replica, while the concept of uniqueness and ownership of knowledge is also changing. Knowledge is not delivered through textbooks or reference books, but can be accessed anytime, anywhere through various educational materials provided by internet-based web documents, YouTube, online lectures, and various learning platforms, as well as through the use of smartphones. Therefore, it is necessary to utilize digital educational tools in various ways. It is necessary to think of various apps such as Pedlet, Kahoot, and Socrative and the use of the Metaverse platform as a subjective tool, not as a substitute for teachers.

4-3. Actor–network Theory and Teaching and Learning

Actor–network theory was developed by the French philosophers/sociologists Bruno Latour, Michel Callon, and Madeleine Akrich, together with British social scientist John Law. The theory tries to explain social phenomena by the use of only the network created by actors (both human actors and non-human actors such as cars, watches, mobile phones) and their relationships without assuming structures or social forces. According to this theory, these non-human agents have agency, even though it was previously stated that only human beings have agency. Whereas it was previously thought that only humans have will or intention, actor–network theory posits that non-humans also have agency. This does not mean that objects have intention or will, but just as people around me can change my behavior, non-humans can also influence me and change my behavior. For example, owning a cell phone means that I can change my behavior by recording readings on my cell phone instead of writing them in a note. In this sense, society is an aggregate in which humans and non-humans are intertwined. There is a limit to understanding human beings by analyzing only human beings. Therefore, science and technology are understood to be human practices that transform or tame non-humans (such as machines, nature, animals) into something meaningful for humans. Thus, according to actor–network theory, science and technology are combined and called "technoscience."

At the junction of technology and ethics, a cyborg is a hybrid of machine and living organism, and although it is extreme in that it does not have a traditional physical personality, it shows the possibility of overcoming the traditional dichotomies of mind and body, nature and culture, and woman and man. Thus, future men and women may become cyborgs [15]. From the actor–network theory point of view, teaching and learning theory must first find the junction between technology and ethics through participatory communication as an actor–network for technology.

Another field in this respect is molecular biology. During the 1950s and 1960s, medicine merged with molecular biology. Molecular biology identified human diseases at the level of DNA, and by manipulating DNA, cloned specific DNA to create new life forms. Bioethics has come to discuss artificial insemination, new organisms created in the laboratory, DNA recombination, gene therapy, embryo research, gene patents, human cloning, custom babies, xenotransplantation, genetic enhancement, and new biotechnology such as neurophysiology. With the success of the human genome project in 2001, a reductive anthropology that regards humans as the totality of genetic information has emerged. The communicative actor–network theory in the era of biotechnology will help us to establish the value that humans are whole personal beings beyond genetic beings through communication between people. There is a realization that joining ethics and technology is a new survival strategy for humans through communication.

It is also necessary to learn that the network is a complex network in which all beings, including humans and non-humans, interact in the educational field. The actor–network theory raises non-human beings, such as schools, playgrounds, textbooks, and seating arrangements, which are regarded as external elements of educational activities, as key actants with the same status as teachers. Fenwick and Edwards believed that education policy research mainly establishes policies with human-centered thinking, and that it is necessary to effectively examine the network formation of human and non-human elements, which had been neglected in existing policy research (Fenwick, & Edwards, 2011). They argue that when educational policies are established and implemented, human and non-human elements do not remain as environments or contexts only; rather, they induce non-human-related behaviors as active actants. Analysis of the use of digital media by 12 British

university graduate students for a period of 6 months found that various physical objects (tools related to computers, smartphones, tablet PCs, and facilities related to education field, such as classrooms, playgrounds, schools, houses, libraries) are changing their intermediary role(Gourlay, 2015). The performance of actants, such as computer performance, image reader performance, various machine performance, and AI performance, are also important factors. In this respect, whether it is a traditional teaching method or a teaching method the use of digital tools, learners are not simply objects to be used, but each non-human medium is the subject of action that constitutes teaching and learning. As such, actor–network theory highlights the role of non-human actors in the field of education that has been overlooked by previous studies focusing on the motives, intentions, and relationships of human beings such as teachers and students. From the perspective of actor networks, the influx of new technologies such as translators, Kahoot, Socrative, and AI into the teaching and learning space goes beyond demonstrating instrumental usefulness and transforms the network of existing actors to create new meanings, suggesting that it can create an ecosystem (Kim, Chang, & Lee, 2021).

Learners are beings who do not acquire knowledge or perform learning for instrumental purposes but experience the process of "becoming together" with knowledge and objects, machines, materials, and the world (Postma, 2016). Cutting-edge research in neuroscience, cognitive science, brain science, AI, and evolutionary neuroscience is based on neo-materialist theories, and studies on the essential similarity of thinking and learning between humans and animals or between humans and machines are the main focus. In the case of self-directed learning, the cognitive process based on the subjectivity and autonomy of the learner is not emphasized, but the analysis and feedback process of the data (learning content) that emerges from the multiple connections between the learner and the learning content, the knowledge, and the network, the educational medium. to analyze the effect of learning. In this environment, education can be a process of data processing to fine-tune the structure or relationships of neural networks or to optimize the performance of brain systems, rather than a process of realizing the potential of individuals (Busso & Pollack, 2015).

4-4. Post Phenomenology Teaching and Learning

Phenomenology is a philosophical trend of the 20th century in which the primary goal is to directly describe and study phenomena experienced by consciousness causally or without assuming any premise. This phenomenology is based on the logic of Bernhard Bolzano and the psychology of Franz Brentano. Phenomenology is not an epistemology but provides a strict distinction between phenomena and reality. What is visible is phenomena, and what is not visible is reality. The use of the metaphor of an iceberg, what is revealed is the phenomenon, and what is not revealed is the reality. Therefore, it is not only phenomena that exist. Phenomena can be superficial, and actual phenomena can be invisible. We are interested in individual perception (consciousness) that gives meaning to a phenomenon or object. This is because most of the phenomena or objects that exist in reality are experienced only when their meaning is formed through the individual's perception. Therefore, in phenomenology, we want to explore the object as a human "recognition phenomenon," not as the actual characteristics of the object. In this respect, phenomenology is not seeing phenomena as phenomena.

Post-phenomenology presents a different perspective on learning from the existing humanistic view of knowledge and learning. Just like the creation of beings such as cyborgs and robots, the way of learning will fundamentally change to a combination of AI technology, new media communication, and the cyber environment. Through the Internet, new media outlets such as YouTube, Facebook, Instagram, and blogs are influencing learning subjects. For students accustomed to new media, the traditional classroom culture of one-sided knowledge transfer, distinction between information producers and consumers, and authoritative knowledge in textbooks no longer works.

Phenomenology and post-phenomenology are two major schools of thought that emerged in the development of phenomenology, one of the philosophical disciplines. These two schools differ from each other in some respects, but overall, post-phenomenology can be seen as a reinterpretation of phenomenology from a modern perspective.

Classical phenomenology is represented by philosophers such as Hegel, Heidegger, and Hughes. These philosophers explored the perception of the essence and truth of things, focusing on human cognitive abilities. Traditional phenomenology explores existence itself and emphasizes the perception of the essence and truth of existence.On the other hand, post-phenomenology is a phenomenological approach that emerged in late modern philosophy. This school focuses on the experience and perception of humans or objects rather than exploring the phenomenon itself. Rather than theoretical or conceptual analysis, it focuses on exploring subtle differences or subtle changes in experience. Post-phenomenology focuses on experience and perception, and is concerned with the process of experience and perception rather than the nature of phenomena. Thus, traditional phenomenology and post-phenomenology are different philosophical schools. While traditional phenomenology emphasizes the exploration of existence and essence, post-phenomenology emphasizes the process of experience and perception. According to the post-phenomenological point of view, the communication method of new media

does not distinguish between the learner, who is the subject of experience, and the learning content, which is the experience itself, and there is no distinction between knowledge producers and receivers. focus on information Therefore, education and learning should be a process in which all beings involved in our lives form relationships without special distinction between the subject and object of education, and continuously become something new and meaningful.

Post-phenomenology provides a philosophical foundation upon which to form an educational worldview. The idea of the purpose or method of education requires philosophical discussion. Post-phenomenology can help educators think more deeply about and understand the nature of education. Second, post-phenomenology presents a new methodology that can be applied to educational practice. Educational scholars must consider the experiences of students when designing curricula and teaching methods. Post-phenomenological methodologies can help to design curricula and develop teaching methods around students' experiences. Finally, post-phenomenology provides insight into sensitive issues related to education. Problems related to education are often complex and difficult to solve because of the multiplicity of factors at play. Post phenomenology offers a variety of perspectives on these issues and helps scholars gain a better understanding of these issues. Therefore, post-phenomenology is one of the important schools in the field of education and can play a major role in providing a new perspective to educational philosophy and methodology.

5. ACKNOWLEDGEMENTS

As the post-human era arrives, education should strive to strengthen educational competitiveness according to the needs of the times and society. In conclusion, the direction of future education is to predict the future environmental changes and create an environment to develop the capabilities and knowledge suitable for them for nurture talents who can adapt and be needed in the post-human era. In this respect, this study looked at the characteristics of the post-human era from four perspectives and looked at how education should change according to those characteristics. The present age is an era in which the combination of virtual and real, machine and human is possible thanks to the development of science technology and information communication.

Post-humanism is a philosophical stance that criticizes anthropocentric perceptions and attitudes and approaches in a way that understands and treats all beings and the world, including humans, as one. This philosophical position is also exerting an important influence in the field of education. Education in the era of post-humanism must change from the existing education method to one that accepts and embraces various perspectives. To this end, the following directions can be suggested. First, we need an education method that respects diversity. Post-humanism is a philosophy that criticizes anthropocentric perception and approaches in a way that understands and treats all beings and the world as one. Therefore, education should proceed in a way that accommodates this philosophical position and respects various perceptions and perspectives. Second, a learner-centered education method is required. Post-humanism is a philosophy that criticizes anthropocentric perception and approaches in a way that understands and treats all beings and the world as one. This philosophical stance means that education must be developed in a way that values learners' perspectives and experiences. Therefore, education must adopt a learner-centered approach to education, respecting the perspectives and experiences of students and focusing on their development. Third, we need an educational method that respects creativity and autonomy. Post-humanism is a philosophy that criticizes anthropocentric perception and approaches in a way that understands and treats all beings and the world as one. This philosophical position implies that education should be developed in a way that respects creativity and autonomy. Therefore, education should provide an educational method that unfolds education in a way that respects creativity and autonomy. This requires adopting an educational approach that provides opportunities for students to present and discuss their ideas and strengthens students' ability to solve problems on their own. Fourth, we need an educational method that strengthens problem-solving skills. Post-humanism is a philosophy that criticizes anthropocentric perception and approaches in a way that understands and treats all beings and the world as one. This philosophical stance implies that education should be developed in a way that enhances problem-solving skills. Therefore, education must provide learning methods that enable students to develop their ability to solve problems, thereby strengthening students' ability to solve problems in the real world. Lastly, we need an educational method that encourages active social participation. Post-humanism is a philosophy that criticizes anthropocentric perception and approaches in a way that understands and treats all beings and the world as one. This philosophical position implies that education should be developed in a way of learning that actively encourages participation in society. Therefore, education should provide educational methods that strengthen students' ability to express their thoughts and opinions and propose solutions to social problems, so that students can actively pursue democratic thinking and participation.

From this point of view, the following are the necessary competencies for educators. First, systematic thinking is needed to connect various networks. In schools, teachers now have to play the role of guides to establish learning strategies that connect various networks rather than imparting knowledge and information. Second, it

should play a role in organically connecting various learners with devices related to learning materials and learning tools in various network systems. Third, teachers need to adapt to and critically understand new media literacy, techno literacy, and digital literacy. Fourth, based on the principle of cybernetics learning, teachers should promote interaction between machines, technology, and students, and should enable effective learning programs to be stably operated on this basis. We posit that the role performance described in this paper is necessary for teachers in the post-human age. The limitation of this study is the literature review. It is expected that there will be qualitative research and field research related to the direction of teaching and learning in the post-human era in future additional research.

REFERENCES

Barad, K. (2007). Meeting the universe halfway: Quantum physics and the entanglement of matter and meaning. Duke University Press.

Bogost, I. (2013). Alien phenomenology, or, what it's like to be a thing. Twin Cities, MN: University of Minnesota Press.

Bostrom, N. (2003). The Transhumanist FAQ: A General Introduction (Version 2.1). World Transhumanist Association.

Bostrom, N. (2005). In defense of posthuman dignity. Bioethics, 19(3), 202-214. DOI: 10.1111/j.1467-8519.2005.00437.x

Braidotti, R. (2016). Posthuman, all too human: Towards a new process ontology. Theory, culture & society, 23(7), 197-208. DOI: 10.1177/0263

Busso, D. S. & Pollack, C. (2015). No brain left behind: Consequences of neuroscience discourse for education. Learning, Media and Technology, 40(2), 168-186. URL:http://dx.doi.org/10.1080/17439884.2014.908908

Coole, D. H. & S. Frost, S. eds (2010). New Materialisms: Ontology, Agency, and Politics. Duke U. P.

Fenwick, T. & Edwards, R. (2011). Considering materiality in educational policy: messy objects and multiple reals. Educational Theory, 61(6), 709-726. DOI:10.1111/j.1741-5446.2011.00429.x

Gamble, C. N. Hanan, J. S. & Nail, T. (2019). What is new materialism? Angelaki, 24(6), 111-134. DOI:10.1080/0969725X.2019.1684704

Gourlay, L. (2015). Posthuman texts: Nonhuman actors, mediators, and the digital university. Social Semiotics, 25(4), 484-500. DOI:10.1080/10350330.2015.1059578

Ha, H. S. & Lee, J. R.(2021). A Study on the Types of Private EduTech Content for establishment of integrated platform of K-EDU(In conjunction with future teaching-learning methods and learning types), Education Green Environment Research, 20(3), 11-24. artiId: ART002763431.

Jang, H. J. Shin, S. Y. & Park, C. U. (2019). Education toward 'The Human' in the Posthuman Era, The Convergent Research Society Among Humanities, Sociology, Science, and Technology, 9(12), 269-279. DOI : 10.35873/ajmahs.2019.9.12.026.

Kuby C. R. & Rowsell, J. (2017). Early literacy and the posthuman: Pedagogies and methodologies. Journal of Early Childhood Literacy, 7(3), 285-296. DOI:10.1177/1468798417715720.

Kim, B. H. (2023) "A Study on the Perception of Artificial Intelligence Education and the Artificial Intelligence Teaching Efficacy in Secondary School Technology Teacher," Asia-pacific Journal of Convergent Research Interchange, KCTRS, 9(4), pp. 517-527, http://dx.doi.org/10.47116/apjcri.2023.04.41

Kim, S. Y. Chang, I. C. & Lee, J. A. (2021). Machine translation in language education: A new materialist perspective, Multimedia-Assisted Language Learning, 24(4), 163-188. http://eduphil.jams.or.kr

Latour, B. (2018). Translated by S. W. Hong, Human-Thing Alliance: Actor–network Theory and Techno Science, MN: University of Minnesota Press.

Lee, D. H. (2021). Strategies to Establish Inclusive Governance according to the Digital Transformation of Education, Journal of Democracy and Human Rights, 21(4), 145-186. https://www.dbpia.co.kr/journal/articleDetail?nodeId=NODE10896081.

Lee, J. S. Kim, Y. C. (2019). Material Turn of Social Theories: New Materialism, Actor-Network Theory, and Object-Oriented Ontology, Society and Theory, 35, 7-53. DOI : 10.17209/st.2019.11.35.7.

Lee, H. G. (2021). A Study on the Direction of Literature Education for Post-Human Age, The Journal of Korea

elementary education, 31, 93-104. DOI : 10.20972/kjee.31..202101.93

Lee, J. H. (2016). Feed-Forward: 21st-Century Media, Whitehead, Post-Phenomenology, Cyber Communication Journal, 33(3), 201-237. uci: G704-001789.2016.33.3.004.

Neimanis, A. (2017). Bodies of water: Posthuman feminist phenomenology. New York: Bloomsbury Publishing.

Oh, Y. K. & Cho, J. R. (2020). The status and Direction of Liberal Arts Education in the Posthuman Era-Focusing on Korea

University's common liberal arts class, Free•Justice•Truth, Center for Literature and Language Education, 33(0), 7-28. DOI : 10.24008/klle.2020..33.001.

Park, H. Y. (2019). The Transformations of Schooling and the Direction of Teacher Professionality in the Posthuman Era, The Korean Journal of Philosophy of Education, 41(2), 47-80. DOI : 10.15754/jkpe.2019.41.2.003.

Postma, D. (2016). The ethics of becoming in a pedagogy for social justice. A posthumanist perspective. South African Journal of Higher Education, 30(3), 310-328. DOI:10.20853/30-3-651.

Quinn, T. P. (2018). The behavior and ecology of Pacific salmon and trout. Seattle, WA: University of Washington Press.

Simonsen, K. (2013). In quest of a new humanism: Embodiment, experience and phenomenology as critical geography. Progress in Human Geography, 37(1), 10-26. DOI:10.1177/030913251246757.

Toohey, K. (2022). The onto-epistemologies of new materialism: Implications for applied linguistics pedagogies and research. Applied Linguistics, 40(6), 937-956. URL:http://dx.doi.org/10.1093/applin/amy046276406069232.

Yu, S. H. (2023), The Effects of Flipped Learning Teaching Methods Using Application of the Action Research Models, Asia-pacific Journal of Convergent Research Interchange, KCTRS, 9(4), 529-538, http://dx.doi.org/10.47116/apjcri.2023.04.42.